



Job Order Contract Technical Specifications

CSI Divisions 01-46 February 2026

San Bernardino County



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23 81 00 00	Variable-Refrigerant-Flow HVAC Systems
23 81 13 11	Packaged Terminal Air-Conditioners, Through-Wall Units
23 81 13 12	Packaged Terminal Air-Conditioners, Freestanding Units
23 81 13 13	Packaged Terminal Air-Conditioners, Outdoor, Wall-Mounted Units
23 81 23 00	Small Capacity Computer-Room Air-Conditioners Floor-Mounted Units
23 81 23 00a	Computer-Room Air-Conditioners, Console Units
23 81 23 00b	Computer-Room, Rack-Cooling Equipment
23 81 23 12	Large Capacity (7 Tons (25 kW) and Larger), Computer-Room Air-Conditioners, Floor-Mounted Units
23 81 23 13	Computer-Room Air-Conditioners, Ceiling-Mounted Units
23 81 26 00	Split-System Air-Conditioners
23 81 46 00	Water-Source Unitary Heat Pumps
23 81 46 00a	Water-To-Air Heat Pumps
23 82 00 00	Chilled Beams
23 82 16 11	Hydronic Air Coils
23 82 16 12	Steam Air Coils
23 82 16 13	Refrigerant Air Coils
23 82 16 14	Electric-Resistance Air Coils
23 82 19 00	Fan Coil Units
23 82 29 00	Radiators
23 82 33 00	Convectors
23 82 36 00	Finned-Tube Radiation Heaters
23 82 39 13	Cabinet Unit Heaters
23 82 39 16	Propeller Unit Heaters
23 82 39 19	Wall and Ceiling Unit Heaters
23 83 13 00	Radiant-Heating Electric Cables
23 84 13 00	Heat Exchanger Humidifiers
23 84 13 16	Wetted-Element Humidifiers
23 84 13 23	Direct-Steam-Injection Humidifiers
23 84 13 29	Self-Contained Steam Humidifiers
23 84 16 16	Indoor, Mechanical Dehumidification Units

26 Electrical

26 01 00 00	Supplemental Requirements for Electrical
26 05 00 00	Sleeves and Sleeve Seals for Electrical Raceways and Cabling
26 05 13 00	Medium-Voltage Cables

26 05 19 00	Low-Voltage Electrical Power Conductors and Cables
26 05 23 00	Control-Voltage Electrical Power Cables
26 05 26 00	Grounding and Bonding for Electrical Systems
26 05 29 00	Hangers And Supports For Electrical Systems
26 05 29 00a	Vibration And Seismic Controls For Electrical Systems
26 05 33 13	Conduits for Electrical Systems
26 05 33 16	Boxes and Covers for Electrical Systems
26 05 33 23	Surface Raceways for Electrical Systems
26 05 36 00	Cable Trays for Electrical Systems
26 05 39 00	Underfloor Raceways For Electrical Systems
26 05 43 00	Underground Ducts and Utility Structures
26 05 46 00	Poles for Electrical Systems
26 05 53 00	Identification for Electrical Systems
26 09 00 00	Addressable Luminaire Lighting Controls
26 09 00 00a	Relay-Based Lighting Controls
26 09 13 00	Electrical Power Monitoring
26 09 23 00	Lighting Control Devices
26 09 23 00a	Modular Dimming Controls
26 11 16 00	Secondary Unit Substations with Switchboard Secondary
26 11 16 00a	Secondary Unit Substations with Motor Control Center Secondary
26 11 16 11	Secondary Unit Substations with Switchgear Secondary
26 12 13 00	Liquid-Filled, Medium-Voltage Transformers
26 12 16 00	Dry-Type, Medium-Voltage Transformers
26 12 19 00	Pad-Mounted, Liquid-Filled, Medium-Voltage Transformers
26 12 19 00a	Low-Voltage Switchgear
26 13 29 00	Medium-Voltage Compartmentalized Switchgear
26 21 16 00	Paralleling Low-Voltage Switchgear
26 22 13 00	Low-Voltage Distribution Transformers
26 24 13 00	Switchboards
26 24 16 00	Panelboards
26 24 16 00a	Electronically Operated Circuit-Breaker Panelboards
26 24 19 00	Motor-Control Centers
26 25 00 00	Low-Voltage Enclosed Bus Assemblies
26 27 13 00	Electricity Metering
26 27 16 00	Electrical Cabinets and Enclosures
26 27 19 00	Multi-Outlet Assemblies
26 27 26 00	Wiring Devices
26 27 26 00a	General-Use Switches, Dimmer Switches, and Fan-Speed Controller Switches
26 27 26 00b	General-Grade Single Straight-Blade Receptacles
26 27 26 00c	General-Grade Duplex Straight-Blade Receptacles
26 27 26 00d	Hospital-Grade Straight-Blade Receptacles
26 27 26 00e	Receptacles with Arc-Fault and Ground-Fault Protective Devices
26 27 26 00f	Locking Receptacles
26 27 26 00g	Pin-and-Sleeve Receptacles
26 27 26 00h	Special-Purpose Power Outlet Assemblies
26 27 26 00i	Connectors, Cords, and Plugs
26 27 33 00	Power Distribution Units
26 28 13 00	Fuses
26 28 16 00	Enclosed Switches And Circuit Breakers
26 29 13 00	Manual and Magnetic Motor Controllers
26 29 13 00a	Soft-Start Motor Controllers
26 29 23 00	Variable-Frequency Motor Controllers
26 31 00 00	Photovoltaic Collectors
26 32 13 13	Diesel-Engine-Driven Generator Sets
26 32 13 19	Bi-Fuel-Engine-Driven Generator Sets
26 33 43 00	Battery Chargers
26 33 43 00a	Public Address Systems
26 33 53 00	Static Uninterruptible Power Supply
26 35 33 00	Power Factor Correction Equipment
26 36 00 00	Transfer Switches
26 43 13 00	Surge Protective Devices for Low-Voltage Electrical Power Circuits
26 50 00 00	Lighting
26 55 61 00	Theatrical Lighting
26 55 68 00	Athletic Field Lighting

27 Communications

27 11 00 00	Communications Equipment Room Fittings

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27 13 13 00	Communications Copper Backbone Cabling
27 13 23 00	Communications Optical Fiber Backbone Cabling
27 15 13 00	Communications Copper Horizontal Cabling
27 15 23 00	Communications Optical Fiber Horizontal Cabling
27 15 33 00	Communications Coaxial Horizontal Cabling
27 16 00 00	Communications Hybrid Cabling
27 41 23 00	Educational Intercommunications and Program Systems
27 41 33 00	Master Antenna Television System
27 51 19 00	Sound Masking Systems
27 52 23 00	Nurse Call Code Blue Systems
27 53 13 00	Clock Systems

28 Electronic Safety and Security

28 08 00 00	Access Control Software and Database Management
28 10 00 00	Access Control
28 10 00 00a	Access Control System Hardware
28 15 00 00	Integrated Access Control Hardware Devices
28 15 00 00a	Access Control Credentials
28 15 00 00b	Electrified Locking Devices and Accessories
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28 15 00 00d	Telephone Entry Systems
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28 15 11 00	Integrated Credential Readers and Entry Management
28 16 11 00	Area and Perimeter Intrusion Detection
28 20 00 00	Video Surveillance
28 31 00 00	Intrusion Detection
28 40 00 00	Emergency Responder Communications Enhancement System ERCES
28 46 00 00	Fire Detection and Alarm
28 47 00 00	Mass Notification

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31 10 00 00	Site Clearing
31 20 00 00	Earth Moving
31 23 19 00	Dewatering
31 24 13 00	Levee Closure
31 31 16 00	Termite Control
31 32 19 16	Pond and Reservoir Liners
31 41 13 00	Drilled Concrete Piers and Shafts
31 50 00 00	Excavation Support and Protection
31 62 13 00	Concrete Piles
31 62 16 00	Steel Piles
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32 Exterior Improvements

32 12 16 00	Asphalt Paving
32 12 16 00a	Imprinted Asphalt
32 13 13 00	Concrete Paving
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32 13 73 00	Concrete Paving Joint Sealants
32 14 00 00	Unit Paving
32 14 16 00	Vitrified Brick Pavement Replacement
32 14 33 13	Porous Unit Paving
32 17 13 00	Parking Bumpers
32 17 16 00	Manufactured Traffic-Calming Devices

32 17 23 00	Pavement Markings
32 17 26 00	Tactile Warning Surfacing
32 18 16 13	Playground Protective Surfacing
32 18 23 13	Synthetic Grass Surfacing
32 31 13 00	Chain Link Fences And Gates
32 31 13 13	High-Security Chain Link Fences and Gates
32 31 16 00	Welded Wire Fences and Gates
32 31 19 00	Decorative Metal Fences and Gates
32 32 23 00	Segmental Retaining Walls
32 33 00 00	Site Furnishings
32 84 00 00	Planting Irrigation
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32 91 19 13	Facility Septic Tanks
32 92 00 00	Turf and Grasses
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33 Utilities

33 01 30 41	Cleaning of Sewers
33 05 00 00	Common Work Results For Utilities
33 11 13 00	Rehabilitation of Water Supply Wells
33 11 13 00a	Potable Water Supply Wells
33 14 00 00	Site Water Distribution Piping
33 14 13 23	Ground-Loop Heat-Pump Piping
33 31 00 00	Site Sanitary Sewerage Piping
33 32 00 00	Site Packaged Sewage Pumping Stations
33 42 00 00	Stormwater Conveyance
33 44 36 00	Oil Water Separator
33 46 00 00	Subdrainage
33 71 00 00	Overhead Medium-Voltage Wiring

34 Transportation

34 01 23 33	Welded Track Rails
34 01 23 33a	Thermite Welded Track Rail
34 01 23 33b	Direct Fixation Track
34 01 23 33c	Ballasted Track Rail
34 01 23 33d	Concrete Track Cross Ties
34 01 23 33e	Timber Track Cross Ties
34 01 23 33f	Resilient Track Cross Ties
34 01 23 33g	Direct-Fixation Fasteners
34 01 23 33h	Traction Power
34 01 23 33i	Roadway Crossing Control Equipment
34 11 00 00	Rail Tracks
34 11 93 00	Track Appurtenances and Accessories
34 71 13 00	Active Vehicle Barriers
34 71 13 26	Vehicle Guide Rails

35 Waterway and Marine Construction

35 22 26 00	Sluice Gates
35 24 00 00	Dredging

41 Material Processing and Handling Equipment

41 22 23 00	Hoists
41 22 23 00a	Specialty Hoists

41 22 23 00b	Monorails With Electric Powered Hoists
41 22 23 00c	Monorails With Manual Hoist



SECTION 01 00 00 00 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 BRACKETED OPTIONS

- A. Within these Technical Specifications there are bracketed options. For example **[6ft] [12ft] [24ft]**. The final selection will be made by the Owner and set forth in the Detailed Scope of Work.

1.2 WARRANTY

- A. Within these Technical Specifications there are warranty periods listed. The warranty periods listed cover both material and labor for that period. If a manufacture will warranty a material for a longer period than what is listed, the material is covered as a replacement by the manufacture for the extra period. The labor to replace will be at the installation price for the contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 00 00 00



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SECTION 01 10 00 00 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work performed by Owner.
5. Multiple Work Packages.
6. Work under Owner's separate contracts.
7. Future work not part of this Project.
8. Owner's product purchase contracts.
9. Owner-furnished/Contractor-installed (OFCI) products.
10. Owner-furnished/Owner-installed (OFOI) products.
11. Contractor-furnished/Owner-installed (CFOI) products.
12. Contractor's use of site and premises.
13. Coordination with occupants.
14. Work restrictions.
15. Specification and Drawing conventions.
16. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
2. Section 017300 "Execution" for coordination of Owner-installed products.

1.2 DEFINITIONS

- A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

1.3 PROJECT INFORMATION

- A. Project Identification: **<Insert Project identifier, such as Project name and number>.**

1. Project Location: **<Insert Project location (street address, city, and state)>.**

- B. Owner: **<Insert name and address of Owner>.**

1. Owner's Representative: **<Insert name and contact information for Owner's representative>.**

- C. Architect: **<Insert name and contact information for Architect>.**

1. Architect's Representative: **<Insert name and contact information for Architect's representative>.**



- D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:
1. **<Insert title of design discipline>: <Insert name of Architect's consultant firm>.**
 - a. **<Insert title of design discipline> Representative: <Insert name and contact information for Architect's consultant representative>.**
- E. Other Owner Consultants: Owner has retained the following design professionals who have prepared designated portions of the Contract Documents:
1. **<Insert title of design discipline>: <Insert name for consultant firm> has prepared the following portions of the Contract Documents:**
 - a. **<Insert title of design discipline> Representative: <Insert name and contact information of Owner consultant representative>.**
 - b. **Scope of Service: <Insert description of scope of service for Owner consultant>.**
- F. Contractor: **<Insert name of Contractor firm>** has been engaged as Contractor for this Project.
1. **Contractor Representative: <Insert name and contact information for Contractor representative>.**
- G. Construction Manager: **<Insert name of Construction Manager firm>.**
1. **Construction Manager Representative: <Insert name and contact information for Construction Manager representative>.**
 2. Construction Manager has been engaged for this Project to serve as an advisor to Owner and to provide assistance in administering the Contract for construction between Owner and **[each]** Contractor, according to a separate contract between Owner and Construction Manager.
 - a. Construction Manager also serves as Project coordinator, as defined in Section 011200 "Multiple Contract Summary."
 3. Construction Manager for this Project is Project's constructor. The terms "Construction Manager" and "Contractor" are synonymous.
- H. Design-Builder: **<Insert name of design-builder firm>.**
1. **Design-Builder Representative: <Insert name and contact information for design-builder representative>.**
 2. Design-builder has been engaged for this Project to provide architectural and engineering services and to serve as Project's constructor. The terms "design-builder" and "Contractor" are synonymous.
- I. Project Coordinator for Multiple Contracts: **<Insert name and contact information of Project coordinator>** has been engaged by Owner to serve as Project coordinator.
- J. Project Coordinator for Multiple Contracts: Owner shall serve as Project coordinator.
- K. Project Mechanical/Electrical Coordinator for Multiple Contracts:
1. **<Insert name and contact information of mechanical/electrical Project coordinator>** has been engaged by Owner to serve as Project coordinator.

2. **[HVAC Contractor][Electrical Contractor][Plumbing Contractor][Construction Manager]<Insert entity>** shall act as mechanical/electrical coordinator.

- L. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage.
 1. See Section 013100 "Project Management and Coordination" for requirements for using web-based Project software.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:
 1. **<Insert a brief description of Project indicating the size, code classification for occupancy and construction type, and general description of major building assemblies>** and other Work indicated in the Contract Documents.
- B. Type of Contract:
 1. Project will be constructed under a single prime contract.
 2. Project will be constructed under coordinated, concurrent multiple contracts. See Section 011200 "Multiple Contract Summary" for a list of multiple contracts, a description of work included under each of the multiple contracts, and the responsibilities of Project coordinator.

1.5 PHASED CONSTRUCTION

- A. Construct the Work in phases, with each phase substantially complete as indicated **[on Drawings][below]**.
 1. Phase **<Insert designation>**: **<Briefly describe work of this phase>**.
 - a. Commencement of Construction:
 - 1) Notice to Proceed: Work of this phase shall commence within **<Insert number of days>** after the Notice to Proceed.
 - 2) Start Date: Work of this phase shall commence by **<Insert date>**.
 - b. Substantial Completion:
 - 1) Within **<Insert number of days>** after **[commencement of construction of this phase][after the Notice to Proceed]**.
 - 2) By **<Insert date>**.
 2. Phase **<Insert designation>**: Perform the remaining Work. The remaining Work shall be substantially complete at time of Substantial Completion of the Work.
- B. Before commencing Work of each phase, submit an updated copy of Contractor's construction schedule, showing the sequence, commencement and completion dates**[, and move-out and -in dates of Owner's personnel]** for all phases of the Work.



1.6 WORK PERFORMED BY OWNER

- A. Cooperate fully with Owner, so work may be carried out smoothly, without interfering with or delaying Work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.
- B. Preceding Work: Owner will perform the following construction operations at Project site. Those operations are scheduled to be substantially complete before Work under this Contract begins.
 - 1. **<Insert a brief description of work performed by Owner>.**
- C. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be conducted simultaneously with Work under this Contract.
 - 1. **<Insert a brief description of work performed by Owner>.**
- D. Subsequent Work: Owner will perform the following additional work at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory Work under this Contract.
 - 1. **<Insert a brief description of work performed by Owner>.**

1.7 MULTIPLE WORK PACKAGES

- A. Construction Documents for this Project will be issued in a series of Work Packages, each defining the Work under individual Contracts. Coordinate the Work under this Contract with separate contracts defined by other work packages. **[Work Packages consist of the following:]**
 - 1. **[Early Site Package]<Insert Work Package title>: <Insert description of Work>. To be issued <Insert date of anticipated issue>.**
 - 2. **[Foundations and Structure Package]<Insert Work Package title>: <Insert description of Work>. To be issued <Insert date of anticipated issue>.**
 - 3. **[General Building Package]<Insert Work Package title>: <Insert description of Work>. To be issued <Insert date of anticipated issue>.**
 - 4. **[Interior Upfit Package]<Insert Work Package title>: <Insert description of Work>. To be issued <Insert date of anticipated issue>.**

1.8 WORK UNDER OWNER'S SEPARATE CONTRACTS

- A. Work with Separate Contractors: Cooperate fully with Owner's separate contractors, so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under Owner's separate contracts.
- B. Preceding Work: Owner **[has awarded][or][will award]** separate contract(s) for the following construction operations at Project site. Those operations **[are scheduled to be substantially complete before Work under this Contract begins][may be substantially complete or may be partially conducted simultaneously with Work under this Contract]**.
 - 1. **<Insert name of the Contract>: To <Insert name of Owner's separate Contractor>[to][for]<Insert a brief description of work performed under Owner's separate contract>.**

- C. Concurrent Work: Owner **[has awarded][will award][and will assign to Contractor]** separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with Work under this Contract.
1. **<Insert name of the Contract>**: To **<Insert name of Owner's separate Contractor>****[to][for]****<Insert a brief description of work performed under Owner's separate contract>**.
- D. Subsequent Work: Owner **[has awarded][will award]** separate contract(s) for the following additional work to be performed at site following Substantial Completion. Completion of that work will depend on successful completion of preparatory Work under this Contract.
1. **<Insert name of the Contract>**: To **<Insert name of Owner's separate Contractor>****[to][for]****<Insert a brief description of work performed under Owner's separate contract>**.
- E. Future Work Not Part of this Contract: The Contract Documents include requirements that will allow Owner to carry out future work following completion of this Project; provide for the following future work:
1. **<Insert description of future work requiring consideration during construction of the Work of this Contract>**.

1.9 OWNER'S PRODUCT PURCHASE CONTRACTS

- A. Owner has negotiated Product Purchase contracts with suppliers of material and equipment to be incorporated into the Work. Owner will assign these Product Purchase contracts to Contractor. Include costs for purchasing, receiving, handling, storage if required, and installation of material and equipment in the Contract Sum unless otherwise indicated.
1. Contractor's responsibilities are same as if Contractor had negotiated Product Purchase contracts, including responsibility to renegotiate purchase and to execute final purchasing agreements.
- B. Owner's Product Purchase Contracts Information:
1. **<Insert product name>**: See Section **<Insert Section number>** "**<Insert Section title>**."
 - a. Purchase Contract Firm and Representative: **<Insert name and contact information of Product Purchase contract firm and representative>**.
 - b. Product Purchase Contract Scope: **[Furnishing material][Material and installation labor]****<Insert description of contract>**.
 - c. Product Purchase Status: **[Price negotiated by Owner, to be incorporated into the Contract Sum by Contractor; see Section 012100 "Allowances" for cash allowance for Product Purchase contract][Price negotiated and incorporated into the Contract Sum by Contractor][Product reserved by Owner][Order placed and deposit paid by Owner][Order to be placed by Contractor]****<Insert description of status of Product Purchase contract>**.
 - d. Quantity: **<Insert quantity ordered>**.
 - e. Other Requirements: **<Insert special requirements>**.

1.10 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

- A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:



1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
2. Provide for delivery of Owner-furnished products to Project site.
3. Upon delivery, inspect, with Contractor present, delivered items.
 - a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
4. Obtain manufacturer's inspections, service, and warranties.
5. Inform Contractor of earliest available delivery date for Owner-furnished products.

B. Contractor's Responsibilities: The Work includes the following, as applicable:

1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
3. Receive, unload, handle, store, protect, and install Owner-furnished products.
4. Make building services connections for Owner-furnished products.
5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
6. Repair or replace Owner-furnished products damaged following receipt.

C. Owner-Furnished/Contractor-Installed (OFCI) Products:

1. **<Insert description, in separate subparagraphs, for each Owner-furnished/Contractor-installed product>.**

1.11 OWNER-FURNISHED/OWNER-INSTALLED (OFOI) PRODUCTS

- A. The Owner will furnish and install products indicated.
- B. Owner-Furnished/Owner-Installed (OFOI) Products:
1. **<Insert description, in separate subparagraphs, for each Owner-furnished/Owner-installed product>.**

1.12 CONTRACTOR-FURNISHED/OWNER-INSTALLED (CFOI) PRODUCTS

- A. Contractor shall furnish products indicated. The Work includes unloading, handling, storing, and protecting Contractor-furnished products as directed and turning them over to Owner at Project closeout.
- B. Contractor-Furnished/Owner-Installed (CFOI) Products:
1. **<Insert description, in separate subparagraphs, for each Contractor-furnished/Owner-installed product>.**

1.13 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Unrestricted Use of Site: **[Each]** Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

- B. **Restricted Use of Site:** **[Each]** Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- C. **Limits on Use of Site:** Limit use of Project site to **[Work in areas]****[areas within the Contract limits]** indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. **Limits on Use of Site:** Confine construction operations to **<Insert description of areas where work is permitted>**.
 - 2. **Limits:** Limit site disturbance, including earthwork and clearing of vegetation, to **40 feet (12.2 m)** beyond building perimeter; **10 feet (3 m)** beyond surface walkways, patios, surface parking, and utilities less than **12 inches (300 mm)** in diameter; **15 feet (4.5 m)** beyond primary roadway curbs and main utility branch trenches; and **25 feet (7.6 m)** beyond constructed areas with permeable surfaces (such as pervious paving areas, stormwater detention facilities, and playing fields) that require additional staging areas in order to limit compaction in the constructed area.
 - 3. **Limits:** Limit site disturbance, including earthwork and clearing of vegetation, to **40 feet (12.2 m)** beyond building perimeter; **15 feet (4.6 m)** beyond surface walkways, patios, surface parking, and utilities; and **25 feet (7.6 m)** beyond constructed areas with permeable surfaces that require additional staging areas to limit compaction in the constructed areas.
 - 4. **Driveways, Walkways and Entrances:** Keep driveways**[parking garage,]****[loading areas,]** and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- D. **Condition of Existing Building:** Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- E. **Condition of Existing Grounds:** Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.14 COORDINATION WITH OCCUPANTS

- A. **Full Owner Occupancy:** Owner will occupy Project site and **[existing]****[adjacent]** building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
 - 2. Notify Owner not less than **[72]****<Insert number>** hours in advance of activities that will affect Owner's operations.
- B. **Partial Owner Occupancy:** Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written

2. permission from Owner and authorities having jurisdiction.
Provide not less than [72]<Insert number> hours' notice to Owner of activities that will affect Owner's operations.

C. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.15 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to between <Insert time> a.m. to <Insert time> p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.

1. Weekend Hours: <Insert restrictions on times permitted for weekend work>.
2. Early Morning Hours: <Insert restrictions or references to regulations by authorities having jurisdiction for restrictions on noisy work>.
3. Work in Existing Building: <Insert restrictions on times permitted and other Owner's restrictions>.
4. Hours for Utility Shutdowns: <Insert Owner's restrictions>.
5. Hours for [Core Drilling]<Insert noisy activity>: <Insert Owner's restrictions>.

C. On-Site Work Day Restrictions: Do not perform work [resulting in utility shutdowns][or][resulting in noisy activity] on-site during work black-out days indicated in Document 003113 "Preliminary Schedules."

D. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging for temporary utility services according to requirements indicated:

1. Notify [Architect][Construction Manager][Owner] not less than [two]<Insert number> days in advance of proposed utility interruptions.
2. Obtain [Architect's][Construction Manager's][Owner's] written permission before proceeding with utility interruptions.

E. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.

1. Notify **[Architect][Construction Manager][Owner]** not less than **[two]<Insert number>** days in advance of proposed disruptive operations.
 2. Obtain **[Architect's][Construction Manager's][Owner's]** written permission before proceeding with disruptive operations.
- F. Nonsmoking Building: Smoking is not permitted within the building or within **25 feet (8 m)** of entrances, operable windows, or outdoor-air intakes.
- G. Smoking and Controlled Substance Restrictions: Use of tobacco products [, **alcoholic beverages,**] and other controlled substances **[within the existing building][on Project site][on Owner's property]** is not permitted.
- H. Employee Identification: **[Provide][Owner will provide]** identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- I. Employee Screening: Comply with Owner's requirements for **[drug][and][background]** screening of Contractor personnel working on Project site.
1. Maintain list of approved screened personnel with Owner's representative.

1.16 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
 3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
 4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 2. Abbreviations: Materials and products are identified by abbreviations **[scheduled on Drawings][and][published as part of the U.S. National CAD Standard]**.
 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.



01 - General Requirements

1.17 MISCELLANEOUS PROVISIONS

A. <Insert miscellaneous provisions>.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00 00



01 - General Requirements

Task	Specification	Specification Description
01 10 00 00	01 00 00 00	General Requirements
01 11 00 00	01 00 00 00	General Requirements
01 11 00 00	01 10 00 00	Summary



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SECTION 01 11 13 00 - WORK COVERED BY CONTRACT DOCUMENTS

1.1 GENERAL

- A. If any conflicts arise in the Specifications; the Owner's Standard Plans and Specifications supersede the Gordian Technical Specifications. Specification conflicts shall be resolved as directed by the Owner.
- B. Contractor is to provide a competent person to ensure operations are completed per plans, specifications, local laws and regulations which pertain.
- C. Specification Format
 - 1. The specification format shall be based on the Construction Specifications Institute (CSI) Section Format.

1.2 PRODUCTS - (Not Used)

1.3 EXECUTION - (Not Used)

END OF SECTION 01 11 13 00



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01 - General Requirements

Task	Specification	Specification Description
01 11 13 00	01 00 00 00	General Requirements
01 11 13 00	01 10 00 00	Summary



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SECTION 01 11 19 00 - NO SPECIFICATION REQUIRED

1.1 GENERAL

- A. A separate specification is not required for this item. The description given in the line item of the Construction Task Catalog completely defines the item.

1.2 PRODUCTS - (Not Used)

1.3 EXECUTION - (Not Used)

END OF SECTION 01 11 19 00



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01 - General Requirements

Task	Specification	Specification Description
01 11 19 00	01 10 00 00	Summary
01 20 00 00	01 00 00 00	General Requirements



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SECTION 01 22 00 00 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Section 012100 "Allowances" for procedures for using unit prices to adjust quantity allowances.
 - 2. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 3. Section 014000 "Quality Requirements" for field testing by an independent testing agency.

1.2 DEFINITIONS

- A. Unit price is[**an amount incorporated into the Agreement, applicable during the duration of the Work as**] a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, [**applicable taxes,**]overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the Part 3 "Schedule of Unit Prices" Article contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

- A. Unit Price No. 1: Removal of unsatisfactory soil and replacement with satisfactory soil material.
 - 1. Description: Unsatisfactory soil excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, in accordance with Section 312000 "Earth Moving."

2. Unit of Measurement: **<Insert cubic yard>** of soil excavated, based on in-place surveys of volume before and after removal.
3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

B. Unit Price No. 2: Mass rock excavation and replacement with satisfactory soil material.

1. Description: Classified mass rock excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, in accordance with Section 312000 "Earth Moving."
2. Unit of Measurement: **<Insert cubic yard>** of rock excavated, based on in-place surveys of volume before and after removal.
3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

C. Unit Price No. 3: Trench rock excavation and replacement with satisfactory soil material.

1. Description: Classified trench rock excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, in accordance with Section 312000 "Earth Moving."
2. Unit of Measurement: **<Insert cubic yard>** of rock excavated, based on survey of in-place surveys volume of before and after removal.
3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

D. Unit Price No. 4: Cutting and patching of concrete slabs-on-grade.

1. Description: Cutting of new or existing concrete slabs-on-grade up to **[6 inches]<Insert dimension>** thick, removal and excavation as required, and subsequent backfill, compaction, and patching of concrete in accordance with Section 017300 "Execution." not otherwise indicated in the Contract Documents.
2. Unit of Measurement: **<Insert square feet>** of concrete removed.

E. Unit Price No. 5: Miscellaneous and structural steel.

1. Description: Miscellaneous lintels and other supports not otherwise indicated in the Contract Documents, in accordance with Section 051200 "Structural Steel Framing" and Section 055000 "Metal Fabrications."
2. Unit of Measurement: Cost in place of **<Insert pounds>** of fabricated steel, as indicated on itemized invoice of steel supplier.

F. Unit Price No. 6: Elevator jack hole rock.

1. Description: Subsurface soil conditions that refuse conventional auger excavation of the elevator jack hole, in accordance with Section 142400 "Hydraulic Elevators."
2. Unit of Measurement: Depth in **<Insert feet>** of drilling required, as indicated on the elevator Installer's invoice.
3. Assigned Unit Cost: Owner will pay **[\$250.00]<Insert dollar amount>** per unit **<Insert feet>** of rock drilling required.

G. Unit Price No. **<Insert unit-price number>** - **<Insert unit-price item>**:

1. Description: **<Insert unit-price item description>** in accordance with Section **<Insert Section number>** "**<Insert Section title>**."
2. Unit of Measurement: **<Insert unit of measurement>**.



3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

END OF SECTION 01 22 00 00



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01 - General Requirements

Task	Specification	Specification Description
01 22 00 00	01 00 00 00	General Requirements
01 22 00 00	01 11 19 00	No Specification Required
01 22 16 00	01 00 00 00	General Requirements
01 22 16 00	01 11 19 00	No Specification Required
01 22 16 00	01 22 00 00	Unit Prices
01 22 20 00	01 00 00 00	General Requirements
01 22 20 00	01 11 19 00	No Specification Required
01 22 20 00	01 22 00 00	Unit Prices
01 22 23 00	01 00 00 00	General Requirements
01 22 23 00	01 11 19 00	No Specification Required
01 22 23 00	01 22 00 00	Unit Prices
01 30 00 00	01 00 00 00	General Requirements
01 35 00 00	01 00 00 00	General Requirements
01 35 29 00	01 00 00 00	General Requirements
01 35 33 00	01 00 00 00	General Requirements



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SECTION 01 40 00 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, **Commissioning Authority**, **Construction Manager**, or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Requirements:
 - 1. Section 012100 "Allowances" for testing and inspection allowances.

1.2 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of **[five]** previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
 - 1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).
- D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.
 - 1. Mockups are used for one or more of the following:
 - a. Verify selections made under Sample submittals.
 - b. Demonstrate aesthetic effects.
 - c. Demonstrate the qualities of products and workmanship.



- d. Demonstrate successful installation of interfaces between components and systems.
- e. Perform preconstruction testing to determine system performance.

- 2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
- 3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

- E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.
- F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) in accordance with 29 CFR 1910.7, by a testing agency accredited in accordance with NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."
- I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect[or **Construction Manager**].

1.3 DELEGATED DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.4 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting

requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

- A. Mockup Shop Drawings:
 - 1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
 - 2. Indicate manufacturer and model number of individual components.
 - 3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
 - 2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- F. Reports: Prepare and submit certified written reports and documents as specified.
- G. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses,



certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within **[10]** days of **[Notice of Award]****[Notice to Proceed]**, and not less than **[five]** days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 - 1. Project quality-control manager **[may also serve as Project superintendent]****[does not have other Project responsibilities]**.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
 - 2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
 - 3. Owner-performed tests and inspections indicated in the Contract Documents[, **including tests and inspections indicated to be performed by Commissioning Authority**].
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.

2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement of whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement of whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.9 QUALITY ASSURANCE

- A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.



- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.
 - 1. Requirements of authorities having jurisdiction supersede requirements for specialists.
- G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor's Responsibilities:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
 - e. When testing is complete, remove test specimens and test assemblies[, and mockups]; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect[**and Commissioning Authority**][, through **Construction Manager**], with copy to Contractor. Interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
- K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups of size indicated.

2. Build mockups in location indicated or, if not indicated, as directed by Architect[**or Construction Manager**].
 3. Notify Architect[**and Construction Manager**][**seven**] days in advance of dates and times when mockups will be constructed.
 4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
 5. Demonstrate the proposed range of aesthetic effects and workmanship.
 6. Obtain Architect's[**and Construction Manager's**] approval of mockups before starting corresponding Work, fabrication, or construction.
 - a. Allow [**seven**] days for initial review and each re-review of each mockup.
 7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
 8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 10. Demolish and remove mockups when directed unless otherwise indicated.
- L. Specialty Mockups: See Section 014339 "Mockups" for additional construction requirements for [**integrated exterior mockups**][**preconstruction laboratory mockups**][**and**][**room mockups**].

1.10 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
 2. Payment for these services will be made from testing and inspection allowances specified in Section 012100 "Allowances," as authorized by Change Orders.
 3. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor[, **and the Contract Sum will be adjusted by Change Order**].
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 2. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least [**24**] hours in advance of time when Work that requires testing or inspection will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect[, **Commissioning Authority**][, **Construction Manager**,] and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 1. Notify Architect[, **Commissioning Authority**,][, **Construction Manager**,] and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform duties of Contractor.
- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspection equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents[**as a component of Contractor's quality-control plan**].

Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.

1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
2. Distribution: Distribute schedule to Owner, Architect, [**Commissioning Authority**,] [**Construction Manager**,] testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified [**testing agency**] [**special inspector**] to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner[, **as indicated in the Statement of Special Inspections attached to this Section**], and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Architect[, **Commissioning Authority**,] [**Construction Manager**,] and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect[**and Commissioning Authority**], [**through Construction Manager**,] with copy to Contractor and to authorities having jurisdiction.
 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
 6. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's[, **Commissioning Authority's**,] [**and Construction Manager's**] [**and**] [**authorities' having jurisdiction**] reference during normal working hours.
1. Submit log at Project closeout as part of Project Record Documents.



3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00 00



01 - General Requirements

Task	Specification	Specification Description
01 40 00 00	01 00 00 00	General Requirements
01 41 00 00	01 00 00 00	General Requirements
01 41 00 00	01 40 00 00	Quality Requirements
01 41 26 00	01 00 00 00	General Requirements
01 41 26 00	01 40 00 00	Quality Requirements



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SECTION 01 42 00 00 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms, including "requested," "authorized," "selected," "required," and "permitted," have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms, including "shown," "noted," "scheduled," and "specified," have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
 - 1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Industry Organizations, List: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list.
[Abbreviations and acronyms not included in this list are to mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."]The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; (see FGIA).
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; www.concrete.org.
9. ACP - American Clean Power; (Formerly: American Wind Energy Association); www.cleanpower.org.
10. ACPA - American Concrete Pipe Association; www.concretepipe.org.
11. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
12. AF&PA - American Forest & Paper Association; www.afandpa.org.
13. AGA - American Gas Association; www.aga.org.
14. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
15. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
16. AI - Asphalt Institute; www.asphaltinstitute.org.
17. AIA - American Institute of Architects (The); www.aia.org.
18. AISC - American Institute of Steel Construction; www.aisc.org.
19. AISI - American Iron and Steel Institute; www.steel.org.
20. AITC - American Institute of Timber Construction; (see PLIB).
21. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
22. AMPP - Association for Materials Protection and Performance; www.ampp.org.
23. ANSI - American National Standards Institute; www.ansi.org.
24. AOSA/SCST - Association of Official Seed Analysts (The)/Society of Commercial Seed Technologists (The); www.analyze-seeds.com.
25. APA - APA - The Engineered Wood Association; www.apawood.org.
26. APA - Architectural Precast Association; www.archprecast.org.
27. API - American Petroleum Institute; www.api.org.
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASA - Acoustical Society of America; www.acousticalsociety.org.
30. ASCE - American Society of Civil Engineers; www.asce.org.
31. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (see ASCE).
32. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.

33. ASME - ASME International; [**American Society of Mechanical Engineers (The)**]; www.asme.org.
34. ASSE - ASSE International; (American Society of Sanitary Engineering); www.asse-plumbing.org.
35. ASSP - American Society of Safety Professionals; www.assp.org.
36. ASTM - ASTM International; www.astm.org.
37. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
38. AVIXA - Audiovisual and Integrated Experience Association; www.avixa.org.
39. AWI - Architectural Woodwork Institute; www.awinet.org.
40. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
41. AWP - American Wood Protection Association; www.awpa.com.
42. AWS - American Welding Society; www.aws.org.
43. AWWA - American Water Works Association; www.awwa.org.
44. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
45. BIA - Brick Industry Association (The); www.gobrick.com.
46. BICSI - BICSI, Inc.; www.bicsi.org.
47. BIFMA - Business and Institutional Furniture Manufacturer's Association; www.bifma.org.
48. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
49. BSI - British Standards Institution; www.bsigroup.com.
50. BWF - Badminton World Federation; www.bwfbadminton.com.
51. CARB - California Air Resources Board; www.arb.ca.gov.
52. CDA - Copper Development Association Inc.; www.copper.org.
53. CE - Conformite Europeenne (European Commission); www.ec.europa.eu/growth/single-market/ce-marking.
54. CEA - Canadian Electricity Association; www.electricity.ca.
55. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
56. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
57. CGA - Compressed Gas Association; www.cganet.com.
58. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
59. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
60. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
61. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
62. CMHA - Concrete Masonry & Hardscape Association; (Formerly: National Concrete Masonry Association); www.masonryandhardscapes.org.
63. CPA - Composite Panel Association; www.compositepanel.org.
64. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
65. CRRC - Cool Roof Rating Council; www.coolroofs.org.
66. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
67. CSA - CSA Group; www.csagroup.org.
68. CSI - Cast Stone Institute; www.caststone.org.
69. CSI - Construction Specifications Institute (The); www.csiresources.org.
70. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
71. CTA - Consumer Technology Association; www.cta.tech.
72. CTI - Cooling Technology Institute; www.coolingtechnology.org.
73. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
74. DHA - Decorative Hardwoods Association; www.decorativehardwoods.org.
75. DHI - Door and Hardware Institute; www.dhi.org.
76. ECIA - Electronic Components Industry Association; www.ecianow.org.
77. EIMA - EIFS Industry Members Association; www.eima.com.
78. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
79. EOS/ESD - EOS/ESD Association, Inc.; Electrostatic Discharge Association; www.esda.org.
80. ESTA - Entertainment Services and Technology Association; www.esta.org.
81. EVO - Efficiency Valuation Organization; www.evo-world.org.
82. FCI - Fluid Controls Institute; www.fluidcontrolsintstitute.org.
83. FGIA - Fenestration and Glazing Industry Alliance; <https://fgiaonline.org>.
84. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.

85. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
86. FM Approvals - FM Approvals LLC; www.fmaprovals.com.
87. FM Global - FM Global; www.fmglobal.com.
88. FRSA - Florida Roofing and Sheet Metal Contractors Association, Inc.; www.floridarroof.com.
89. FSA - Fluid Sealing Association; www.fluidsealing.com.
90. FSC - Forest Stewardship Council U.S.; www.fscus.org.
91. GA - Gypsum Association; www.gypsum.org.
92. GS - Green Seal; www.greenseal.org.
93. HI - Hydraulic Institute; www.pumps.org.
94. HMMA - Hollow Metal Manufacturers Association; (see NAAMM).
95. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
96. IAS - International Accreditation Service; www.iasonline.org.
97. ICC - International Code Council; www.iccsafe.org.
98. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
99. ICPA - International Cast Polymer Association (The); www.theicpa.com.
100. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
101. IEC - International Electrotechnical Commission; www.iec.ch.
102. IEEE SA - IEEE Standards Association; <https://standards.ieee.org>.
103. IES - Illuminating Engineering Society; www.ies.org.
104. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
105. IGMA - Insulating Glass Manufacturers Alliance; (see FGIA).
106. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.org.
107. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
108. Intertek - Intertek Group; www.intertek.com.
109. ISA - International Society of Automation (The); www.isa.org.
110. ISFA - International Surface Fabricators Association; www.isfanow.org.
111. ISO - International Organization for Standardization; www.iso.org.
112. ITU - International Telecommunication Union; www.itu.int.
113. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
114. LPI - Lightning Protection Institute; www.lightning.org.
115. MBMA - Metal Building Manufacturers Association; www.mbma.com.
116. MCA - Metal Construction Association; www.metalconstruction.org.
117. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
118. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
119. MHI - Material Handling Industry; www.mhi.org.
120. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
121. MPI - Master Painters Institute; www.paintinfo.com.
122. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry, Inc.; www.msshq.org.
123. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
124. NACE - NACE International; (National Association of Corrosion Engineers International); (see AMPP).
125. NADCA - National Air Duct Cleaners Association; www.nadca.com.
126. NAIMA - North American Insulation Manufacturers Association; www.insulationinstitute.org.
127. NALP - National Association of Landscape Professionals; www.landscap professionals.org.
128. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
129. NBI - New Buildings Institute; www.newbuildings.org.
130. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
131. NCMA - National Concrete Masonry Association; (see CMHA).
132. NEBB - National Environmental Balancing Bureau; www.nebb.org.
133. NECA - National Electrical Contractors Association; www.necanet.org.
134. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
135. NEMA - National Electrical Manufacturers Association; www.nema.org.
136. NETA - InterNational Electrical Testing Association; www.netaworld.org.

137. NFHS - National Federation of State High School Associations; www.nfhs.org.
138. NFPA - National Fire Protection Association; www.nfpa.org.
139. NFPA - NFPA International; (see NFPA).
140. NFRC - National Fenestration Rating Council; www.nfrc.org.
141. NGA - National Glass Association; www.glass.org.
142. NHLA - National Hardwood Lumber Association; www.nhla.com.
143. NLGA - National Lumber Grades Authority; www.nlga.org.
144. NOFMA - National Oak Flooring Manufacturers Association; (see NWFA).
145. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
146. NRCA - National Roofing Contractors Association; www.nrca.net.
147. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
148. NSF - NSF International; www.nsf.org.
149. NSI - Natural Stone Institute; www.naturalstoneinstitute.org.
150. NSPE - National Society of Professional Engineers; www.nspe.org.
151. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
152. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
153. NWFA - National Wood Flooring Association; www.nwfa.org.
154. NWRA - National Waste & Recycling Association; www.wasterecycling.org.
155. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
156. PDI - Plumbing & Drainage Institute; www.pdionline.org.
157. PLASA - PLASA; www.plasa.org.
158. PLIB - Pacific Lumber Inspection Bureau; www.plib.org.
159. PVCPA - Uni-Bell PVC Pipe Association; www.uni-bell.org.
160. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
161. RFCI - Resilient Floor Covering Institute; www.rfci.com.
162. RIS - Redwood Inspection Service; (see WWSA).
163. SAE - SAE International; www.sae.org.
164. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
165. SDI - Steel Deck Institute; www.sdi.org.
166. SDI - Steel Door Institute; www.steeldoor.org.
167. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
168. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (see ASCE).
169. SIA - Security Industry Association; www.securityindustry.org.
170. SJI - Steel Joist Institute; www.steeljoist.org.
171. SMA - Screen Manufacturers Association; www.smainfo.org.
172. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
173. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
174. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
175. SPIB - Southern Pine Inspection Bureau; www.spib.org.
176. SPRI - Single Ply Roofing Industry; www.spri.org.
177. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
178. SSINA - Specialty Steel Industry of North America; www.ssina.com.
179. SSPC - SSPC: The Society for Protective Coatings; (see AMPP).
180. STI/SPFA - Steel Tank Institute/Steel Plate Fabricators Association; www.steeltank.com.
181. SWI - Steel Window Institute; www.steelwindows.com.
182. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
183. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
184. TCNA - Tile Council of North America, Inc.; www.tcnatile.com.
185. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.kbcdco.tema.org.
186. TIA - Telecommunications Industry Association; www.tiaonline.org.
187. TMS - The Masonry Society; www.masonrysociety.org.
188. TPI - Truss Plate Institute; www.tpinst.org.
189. TPI - Turfgrass Producers International; www.turfgrasssod.org.
190. TRI - Tile Roofing Industry Alliance; www.tilerroofing.org.
191. ULSE - UL Standards & Engagement Inc.; www.ulse.org.

192. UL - UL Solutions Inc.; www.ul.com.
193. USAV - USA Volleyball; www.usavolleyball.org.
194. USGBC - U.S. Green Building Council; www.usgbc.org.
195. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
196. WA - Wallcoverings Association; www.wallcoverings.org.
197. WCLIB - West Coast Lumber Inspection Bureau; (see PLIB).
198. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
199. WDMA - Window & Door Manufacturers Association; www.wdma.com.
200. WI - Woodwork Institute; www.woodworkinstitute.com.
201. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
202. WWPA - Western Wood Products Association; www.wwpa.org.

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut für Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. CPSC - U.S. Consumer Product Safety Commission; www.cpsc.gov.
2. DOC - U.S. Department of Commerce; www.commerce.gov.
3. DOD - U.S. Department of Defense; www.defense.gov.
4. DOE - U.S. Department of Energy; www.energy.gov.
5. DOJ - U.S. Department of Justice; www.ojp.usdoj.gov.
6. DOS - U.S. Department of State; www.state.gov.
7. EPA - United States Environmental Protection Agency; www.epa.gov.
8. FAA - Federal Aviation Administration; www.faa.gov.
9. GPO - U.S. Government Publishing Office; www.gpo.gov.
10. GSA - U.S. General Services Administration; www.gsa.gov.
11. HUD - U.S. Department of Housing and Urban Development; www.hud.gov.
12. LBNL - Lawrence Berkeley National Laboratory; Energy Technologies Area; www.lbl.gov/.
13. NIST - National Institute of Standards and Technology; www.nist.gov.
14. OSHA - Occupational Safety & Health Administration; www.osha.gov.
15. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
16. USACE - U.S. Army Corps of Engineers; www.usace.army.mil.
17. USDA - U.S. Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
18. USDA - U.S. Department of Agriculture; Rural Utilities Service; www.usda.gov.
19. USP - U.S. Pharmacopeial Convention; www.usp.org.
20. USPS - United States Postal Service; www.usps.com.

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from U.S. Government Publishing Office; www.govinfo.gov.

2. DOD - U.S. Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.
 3. DSCC - Defense Supply Center Columbus; (see FS).
 4. FED-STD - Federal Standard; (see FS).
 5. FS - Federal Specification; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from U.S. General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.
 6. MILSPEC - Military Specifications and Standards; (see DOD).
 7. USAB - United States Access Board; www.access-board.gov.
 8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (see USAB).
- F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. BEARHFTI; California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; (see BHGS).
 2. BHGS; State of California Bureau of Household Goods and Services; (Formerly: California Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation); www.bhgs.dca.ca.gov.
 3. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.oal.ca.gov/publications/ccr/.
 4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/Main-Page.aspx.
 5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
 6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
 7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; <https://tfsweb.tamu.edu/>.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00 00



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Task	Specification	Specification Description
01 42 00 00	01 00 00 00	General Requirements
01 42 00 00	01 40 00 00	Quality Requirements
01 42 13 00	01 00 00 00	General Requirements
01 42 13 00	01 40 00 00	Quality Requirements
01 42 13 00	01 42 00 00	References
01 42 16 00	01 00 00 00	General Requirements
01 42 16 00	01 40 00 00	Quality Requirements
01 42 16 00	01 42 00 00	References
01 42 19 00	01 00 00 00	General Requirements
01 42 19 00	01 40 00 00	Quality Requirements
01 42 19 00	01 42 00 00	References
01 42 21 00	01 00 00 00	General Requirements
01 42 21 00	01 40 00 00	Quality Requirements
01 42 21 00	01 42 00 00	References
01 45 00 00	01 00 00 00	General Requirements
01 45 00 00	01 40 00 00	Quality Requirements
01 45 23 00	01 00 00 00	General Requirements
01 45 23 00	01 11 19 00	No Specification Required
01 45 23 00	01 40 00 00	Quality Requirements
01 45 29 00	01 00 00 00	General Requirements
01 45 29 00	01 11 19 00	No Specification Required
01 45 29 00	01 40 00 00	Quality Requirements



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SECTION 01 50 00 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.
 - 2. Section 011200 "Multiple Contract Summary" for responsibilities for temporary facilities and controls for projects utilizing multiple contracts.
 - 3. Section 012100 "Allowances" for allowance for metered use of temporary utilities.

1.2 USE CHARGES

- A. Installation, removal, and use charges for temporary facilities to be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, [**Owner's construction forces,**] Architect, [**occupants of Project,**] testing agencies, and authorities having jurisdiction.
- B. Sewer Service: [Pay][**Owner will pay**] sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: [Pay][**Owner will pay**] water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: [Pay][**Owner will pay**] electric-power-service use charges for electricity used by all entities for construction operations.
- E. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use [with metering][**without metering and without payment of use charges**]. Provide connections and extensions of services [and metering] as required for construction operations.
- F. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use [with metering][**without metering and without payment of use charges**]. Provide connections and extensions of services [and metering] as required for construction operations.
- G. Sewer, Water, and Electric Power Service: Use charges are specified in Section 011200 "Multiple Contract Summary."

1.3 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.
- B. Implementation and Termination Schedule: Within [15] days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility, as

directed by the Owner.

- C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.
- D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
 - 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
 - 2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
 - 3. Indicate methods to be used to avoid trapping water in finished work.
- F. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:
 - 1. Locations of dust-control partitions at each phase of work.
 - 2. HVAC system isolation schematic drawing.
 - 3. Location of proposed air-filtration system discharge.
 - 4. Waste-handling procedures.
 - 5. Other dust-control measures.
- G. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by Owner. Include the following:
 - 1. Methods used to meet the goals and requirements of Owner.
 - 2. Concrete cutting method(s) to be used.
 - 3. Location of construction devices on the site.
 - 4. Show compliance with the use and maintenance of quieted construction devices for the duration of the Project.
 - 5. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with Owner.
 - 6. Indicate locations of sensitive **[research][patient][equipment]** areas or other areas requiring special attention as identified by Owner. Indicate means for complying with Owner's requirements.

1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in **[the DOJ's "2010 ADA Standards**

for Accessible Design"] [and] [ICC A117.1].

1.5 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Chain-Link Fencing: Minimum **2-inch, 0.148-inch-** thick, galvanized-steel, chain-link fabric fencing; minimum **6 feet** high with galvanized-steel pipe posts; minimum **2-3/8-inch-** OD line posts and **2-7/8-inch-** OD corner and pull posts[, **with 1-5/8-inch- OD top rails**][, **with galvanized barbed-wire top strand**].
- B. Portable Chain-Link Fencing: Minimum **2-inch, 0.148-inch-** thick, galvanized-steel, chain-link fabric fencing; minimum **6 feet** high with galvanized-steel pipe posts; minimum **2-3/8-inch-** OD line posts and **2-7/8-inch-** OD corner and pull posts, with **1-5/8-inch-** OD top and bottom rails. Provide **[concrete][galvanized-steel]** bases for supporting posts.
- C. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain-link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.
- D. Wood Enclosure Fence: Plywood, **[6 feet][8 feet]** high, framed with four **2-by-4-inch** rails, with preservative-treated wood posts spaced not more than **8 feet** apart.
- E. Polyethylene Sheet: Reinforced, fire-resistive sheet, **10-mil** minimum thickness, with flame-spread rating of 15 or less in accordance with ASTM E84 and passing NFPA 701 Test Method 2.
- F. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum **36 by 60 inches**.
- G. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

- A. Field Offices:
 - 1. Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
 - 2. Owner will provide conditioned interior space for field offices **[for duration of Project][upon completion of demolition and enclosure]**.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect[, **Construction Manager**], and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site documents, including file cabinets, plan tables, plan racks, and bookcases.



2. Conference room of sufficient size to accommodate meetings of **[10]** individuals, as directed by the Owner. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and **4-foot-** square tack and marker boards.
3. Drinking water and private toilet.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of **68 to 72 deg F**.
5. Lighting fixtures capable of maintaining average illumination of **20 fc** at desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no

longer needed or are replaced by authorized use of completed permanent facilities.

- C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
1. Prior to commencing work, isolate the HVAC system in area where work is to be performed[**in accordance with coordination drawings**].
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area, using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
1. Connect temporary sewers to **[municipal system][private system indicated]** as directed by authorities having jurisdiction.
- C. Water Service:
1. Install water service and distribution piping in sizes and pressures adequate for construction.
 2. Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities **[is not permitted][will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use]**.
- E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.



- F. Electric Power Service:
1. Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
 2. Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - a. Install electric power service **[overhead][underground]** unless otherwise indicated.
 - b. Connect temporary service to Owner's existing power source, as directed by Owner.
- G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- H. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install **[WiFi cell phone access equipment][and][one]** land-based telephone line(s) for each field office, as directed by the Owner.
1. Provide additional telephone lines for the following:
 - a. Provide **[one]** telephone line(s) for Owner's use, as directed by the Owner.
 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Contractor's emergency after-hours telephone number.
 - e. Architect's office.
 - f. **[Construction Manager's home office]**.
 - g. Engineers' offices.
 - h. Owner's office.
 - i. Principal subcontractors' field and home offices.
- I. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.
- J. Project Computer: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:
1. Processor: Intel Core i5 or i7.
 2. Memory: **[16]** gigabyte.
 3. Disk Storage: **[1]** -terabyte hard-disk drive and combination DVD-RW/CD-RW drive.
 4. Display: **24-inch** LCD monitor with 256-Mb dedicated video RAM.
 5. Full-size keyboard and mouse.
 6. Network Connectivity: **[10/100BaseT Ethernet][Gigabit]**.
 7. Operating System: Microsoft Windows 10 Professional.
 8. Productivity Software:
 - a. Microsoft Office Professional, 2013 or higher, including Word, Excel, and Outlook.
 - b. Adobe Reader DC.
 - c. WinZip 10.0 or higher.

9. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
10. Internet Service: Broadband modem, router, and ISP, equipped with hardware firewall, providing minimum **[10.0]** -Mbps upload and **[15]** -Mbps download speeds at each computer, as directed by the Owner.
11. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
12. Backup: External hard drive, minimum **[2]** terrabytes, with automated backup software providing daily backups, as directed by the Owner.

3.4 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

1. Provide construction for temporary field offices, shops, and sheds located within construction area or within **30 feet** of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
2. Utilize designated area within existing building for temporary field offices.
3. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas **[as indicated][within construction limits indicated]** on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas in accordance with Section 312000 "Earth Moving."
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course in accordance with Section 321216 "Asphalt Paving."

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Parking: **[Provide temporary offsite][Use designated areas of Owner's existing]** parking areas for construction personnel.

F. Storage and Staging: **[Provide temporary offsite area][Use designated areas of Project site]** for storage and staging needs.



- G. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 - 2. Remove snow and ice as required to minimize accumulations.
- H. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
 - 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 - 3. Maintain and touch up signs, so they are legible at all times.
- I. Waste Disposal Facilities:
 - 1. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
 - 2. Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
- J. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- K. Temporary Elevator Use: **[Use of elevators is not permitted][See Division 14 elevator Section for temporary use of new elevators].**
- L. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
 - 1. Do not load elevators beyond their rated weight capacity.
 - 2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work, so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
- M. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- N. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
 - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas, so no evidence remains of correction work.

- O. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
 - 1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 - 1. Comply with work restrictions specified in Section 011000 "Summary."
- C. Temporary Erosion and Sedimentation Control:
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection:
 - 1. Comply with requirements specified in Section 015639 "Temporary Tree and Plant Protection."
 - 2. Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.
- G. Site Enclosure Fence: **[Before construction operations begin][Prior to commencing earthwork]**, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
 - 1. Extent of Fence: **[As required to enclose entire Project site or portion determined sufficient to accommodate construction operations][As indicated on Drawings]**.
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.**[Furnish one set of keys to Owner.]**
- H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.
- I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- J. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.



- K. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction[**and requirements indicated on Drawings**].
1. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
 2. Paint and maintain appearance of walkway for duration of the Work.
- L. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- M. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by **[Owner][and][tenants]** from fumes and noise.
1. Construct dustproof partitions with gypsum wallboard, with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
 2. Construct dustproof partitions with two layers of **6-mil** polyethylene sheet on each side. Cover floor with two layers of **6-mil** polyethylene sheet, extending sheets **18 inches** up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
 - a. Construct vestibule and airlock at each entrance through temporary partition with not less than **48 inches** between doors. Maintain water-dampened foot mats in vestibule.
 3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
 4. Insulate partitions to control noise transmission to occupied areas.
 5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 6. Protect air-handling equipment.
 7. Provide walk-off mats at each entrance through temporary partition.
- N. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

- A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture

and Mold Protection Plan.

- B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
 2. Protect stored and installed material from flowing or standing water.
 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 4. Remove standing water from decks.
 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard and replace stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for **[48]** hours are considered defective and require replacing.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for **[48]** hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within **[48]** hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.



- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 - 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 - 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 01 50 00 00



01 - General Requirements

Task	Specification	Specification Description
01 50 00 00	01 00 00 00	General Requirements
01 51 00 00	01 00 00 00	General Requirements



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SECTION 01 51 13 00 - TEMPORARY ELECTRICITY

1.1 DESCRIPTION OF WORK

- A. This specification covers the furnishing and installation of materials for electrical renovation. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 GENERAL

- A. Quality Assurance
1. Regulatory Requirements: Comply with following:
 - a. Electrical: National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code (NEC).
 - b. Accessibility:
 - 1) Architectural Barriers Act of 1968 as amended (42 USC 4151-4157) and HUD implementing regulations (24 CFR Part 40).
 - a) Uniform Federal Accessibility Standards (UFAS).
 - 2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
 - 3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
 - 4) Americans with Disabilities Act of 1990 (ADA) (42 USC §§ 12101, et seq.) and implementing regulations (28 CFR Part 35).
- B. Project Conditions
1. Existing Conditions: Buildings will be occupied during construction. See Division 1 Section "Summary of Work." Do not interfere with use of occupied portions of building. Maintain free and safe passage to and from occupied areas.
- C. Scheduling And Sequencing
1. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.
- D. Alterations, Cutting And Protection
1. Protection: Protect existing finishes, equipment, utilities and adjacent work, which is scheduled to remain, from damage.
 2. Existing Operating Facilities: Confine operations to immediate vicinity of new work and do not interfere with or obstruct ingress or egress to and from adjacent facilities.

1.3 PRODUCTS

- A. Materials
1. Electrical Materials and Devices: Comply with NFPA 70 (NEC):
 - a. Boxes: Galvanized steel, not less than 1.6 mm (0.0625 inch) thickness (NEC 370-20) grounded in accordance with NEC, Article 250, suitable for recess mounting.
 - 1) Provide boxes of appropriate shape and size for intended purpose.
 - b. Devices:
 - 1) Duplex Receptacles: 15 A or 20 A 115 V, UL Listed with screw side connections and corrugated bearing pads.
 - a) GFCI Outlets: 115 V, 60 Hz, 15/20 A rating, UL Listed.
 - 2) Switches: 15 A, 115 V, single pole, single throw switch, UL Listed, with side screw connections and corrugated bearing pads.

- a) Garbage Disposal: Heavy duty, 120/277 VAC, 60 Hz, single pole, single throw, 20 A rate, UL listed and CSA certified.
- 3) Cover Plates: Smooth plastic in color to match existing.
- c. Wiring: Insulated wire, Type NM 600 V with ground wire, sized as appropriate for intended purpose and in accordance with NEC.
 - 1) Aluminum Wire: Not allowed unless existing wiring is aluminum.
 - 2) Provide necessary fittings in accordance with NEC.

1.4 EXECUTION

A. Examination

- 1. Units, Spaces and Areas to be Renovated: Inspect to become familiar with existing conditions and to take measurements which are necessary for renovation work to be completed in accordance with contract requirements.
 - a. Carefully inspect condition of existing spaces including, but not limited to walls, floors, plumbing, electrical, etc. as essential to successful completion of renovation work.
 - b. Survey each space and verify dimensions for work.

B. Preparation

- 1. Building Occupation: Carry out renovation work to cause as little inconvenience to occupants as possible. See Division 1 Section "Summary of Work."
- 2. Protection: Protect and be responsible for existing buildings, facilities, utilities, and improvements within areas of construction operations.
 - a. Tenant's Property: Be responsible for any damage or loss to residents' property and to other work. Replace any material, which, in opinion of the Owner, has become damaged to extent that it could not be restored to its original condition.
 - b. Take precautions to protect residents and public from injury from construction operations.

C. Laying Out Work

- 1. Discrepancies: Verify dimensions and elevations indicated in layout of existing work.
 - a. Prior to commencing work, carefully compare and check Drawings (if any), for discrepancies in locations or elevations of work to be executed.
 - b. Refer discrepancies among Drawings (if any), Specifications and existing conditions to the Owner for adjustment before work affected is performed.
 - 1) Failure to make such notification shall place responsibility on Contractor to carry out work in satisfactory, workmanlike manner.
- 2. Contractor: Responsible for location and elevation of construction contemplated by Construction Documents.

D. Location Of Equipment And Piping

- 1. Drawings (if any) indicating location of equipment, piping, ductwork, etc. are diagrammatic and job conditions shall not always permit their installation in location shown. When this situation occurs, bring condition to the Owner's attention immediately. Relocation will be determined in joint conference.
- 2. Contractor: Do not relocate any items without first obtaining the Owner's acceptance. Remove and relocate such relocated items at own expense if so directed.

E. Electrical Work

- 1. General: Install boxes, wiring, and devices as indicated and required to connect and control electrical devices in accordance with NFPA 70 (NEC).
 - a. Boxes: Solidly anchor to framing or blocking.
- 2. Removing Electrical Switch or Duplex Outlet (Non-Hazardous Locations):
 - a. Box to Remain:
 - 1) Remove electrical device; cap hot and neutral with set-screw wire connectors.

- 2) Attach ground wire to remaining box with solid screw attachment.
 - 3) Provide and install natural finish aluminum blank cover plate with screw fasteners integral to match size of box remaining.
 - b. Box to be removed:
 - 1) Remove electrical device and box and pull wire out of wall back to first circuit panel, disconnecting from circuit panel.
 - 2) Patch and repair hole in partition to match existing.
 3. Garbage Disposal Electrical Hook-up: See Section "Plumbing." Comply with NFPA 70 (NEC):
 - a. Wiring: Install from disposal through concealed spaces to house panel, anchoring wire, and providing necessary fittings.
 - b. Switch: Install above counter top backsplash.
 4. Range Hood Electrical Hook-up: See Section "Residential Appliances." Comply with NFPA 70 (NEC):
 - a. Electric service: Install insulated wire from range hood through concealed spaces to house panel, anchoring wire, and providing necessary fittings.
 5. Water Heater Electrical Hook-up: See Division 15 Section "Domestic Water Heaters." Comply with NFPA 70 (NEC).
 6. Furnace Electrical Hook-up: See Section "Furnaces." Comply with NFPA 70 (NEC).
 7. Smoke Detector Electrical Hook-up: See "Fire Alarm." Comply with NFPA 70 (NEC).
- F. Integrating Existing Work
1. Protection: Protect existing improvements from damage.
 - a. Where new work is to be connected to existing work, exercise special care not to disturb or damage existing work more than necessary.
 - b. Damaged Work: Replace, repair and restored to its original condition at no cost to the Owner.

END OF SECTION 01 51 13 00



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01 - General Requirements

Task	Specification	Specification Description
01 51 13 00	01 00 00 00	General Requirements
01 51 13 00	26 24 16 00	Panelboards
01 51 26 00	01 00 00 00	General Requirements
01 52 00 00	01 00 00 00	General Requirements
01 52 13 00	01 00 00 00	General Requirements
01 52 13 00	01 11 19 00	No Specification Required
01 52 13 00	01 50 00 00	Temporary Facilities and Controls
01 52 19 00	01 00 00 00	General Requirements
01 52 19 00	01 50 00 00	Temporary Facilities and Controls
01 53 00 00	01 00 00 00	General Requirements
01 53 16 00	01 00 00 00	General Requirements
01 53 16 00	01 11 19 00	No Specification Required
01 53 23 00	01 00 00 00	General Requirements
01 54 00 00	01 00 00 00	General Requirements



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SECTION 01 54 23 00 - TEMPORARY SCAFFOLDING AND PLATFORMS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of scaffolding-tubular steel. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.

1.2 PRODUCTS

- A. Tubular steel or aluminum scaffolding system shall comply with OSHA Safety and Health Standards, Section 29 CFR, 1926/1910.

1.3 EXECUTION - (Section not used.)

END OF SECTION 01 54 23 00



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Task	Specification	Specification Description
01 54 23 00	01 00 00 00	General Requirements
01 54 23 00	01 11 19 00	No Specification Required
01 54 23 00	04 20 00 00	Unit Masonry
01 54 26 00	01 00 00 00	General Requirements
01 54 26 00	01 11 19 00	No Specification Required
01 55 00 00	01 00 00 00	General Requirements
01 55 23 00	01 00 00 00	General Requirements
01 55 23 00	01 11 19 00	No Specification Required
01 55 26 00	01 00 00 00	General Requirements
01 55 26 00	01 11 19 00	No Specification Required
01 56 00 00	01 00 00 00	General Requirements
01 56 16 00	01 00 00 00	General Requirements
01 56 16 00	01 11 19 00	No Specification Required
01 56 26 00	01 00 00 00	General Requirements
01 56 26 00	01 11 19 00	No Specification Required
01 56 29 00	01 00 00 00	General Requirements
01 56 29 00	01 11 19 00	No Specification Required
01 56 33 00	01 00 00 00	General Requirements
01 56 33 00	01 11 19 00	No Specification Required



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SECTION 01 56 39 00 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. The Work of this Section Includes: General protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.
- B. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls" for temporary controls, utilities, support facilities, temporary site fencing, and, if applicable, temporary erosion and sedimentation controls if not specified in Section 311000 "Site Clearing".
 - 2. Section 311000 "Site Clearing" for removing existing trees and shrubs and for temporary erosion- and sedimentation-control measures if not specified in Section 015000 "Temporary Facilities and Controls".
 - 3. Section 329600 "Transplanting" for relocating existing trees and plants.

1.2 DEFINITIONS

- A. Caliper: Diameter of a trunk measured by **[a diameter tape][or][the average of the smallest and largest diameters]** at a height **6 inches** above the ground for trees up to and including **4-inch** size at this height and as measured at a height of **12 inches** above the ground for trees larger than **4-inch** size.
- B. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by **[a diameter tape][or][the average of the smallest and largest diameters]** at a height **54 inches** above the ground line **[for trees with caliper of 8 inches or greater as measured at a height of 12 inches above the ground]**.
- C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and **[indicated on Drawings][defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated][defined by a circle concentric with each tree with a radius 12 times the tree's caliper size and with a minimum radius of 96 inches unless otherwise indicated]<Insert requirement>**.
- E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]** as directed by the Owner.
 - 1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
 - a. Tree-service firm's personnel and equipment needed to make progress and avoid delays.
 - b. Arborist's responsibilities.

- c. Quality-control program.
- d. Coordination of Work and equipment movement with the locations of protection zones.
- e. Trenching by hand or with air spade within protection zones.
- f. Field quality control.
- g. <Insert agenda items>.

1.4 ACTION SUBMITTALS

A. Product Data:

- 1. General protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction

B. Shop Drawings:

- 1. Include plans, elevations, and sections showing trees and plants to be protected, locations of protection-zone fencing and signage, and the relationship between equipment-movement routes and material storage locations with protection zones.
- 2. Detail fabrication and assembly of protection-zone fencing and signage.
- 3. Indicate extent of utility boring and trenching by hand or with air spade within protection zones.
- 4. Include existing irrigation system that will be used to water plants.

C. Samples: For each type of the following:

- 1. Organic Mulch: [1-pint][1-quart] volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
- 2. Protection-Zone Fencing: Assembled Samples of [manufacturer's standard size made from full-size components], as directed by the Owner.
- 3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.

D. Tree-Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

- 1. Species and size of tree.
- 2. Location on site plan. Include unique identifier for each.
- 3. Reason for pruning.
- 4. Description of pruning to be performed.
- 5. Description of maintenance following pruning.

E. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

F. Mitigation Requirements: As required by jurisdiction or as developed by arborist, for mitigation of damage to trees and other plantings. [Include the following:]

- 1. Local ordinances governing tree mitigation.
- 2. Standards established under the approved tree mitigation report developed by the arborist.
- 3. "Digital Guide for Plant Appraisal" by Council of Tree and Landscape Appraisers.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For arborist and tree service firm.

- B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction in accordance with recognized standards and that trees were promptly and properly treated and repaired when damaged.
- C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.
- D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
 - 1. Use sufficiently detailed photographs or video recordings.
 - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
- E. Quality-control program.

1.6 QUALITY ASSURANCE

- A. Arborist Qualifications: **[Certified Arborist as certified by ISA][Board Certified Master Arborist as certified by ISA][Certified Arborist-Municipal Specialist as certified by ISA][Licensed arborist in jurisdiction where Project is located][Current member of ASCA][Registered Consulting Arborist as designated by ASCA].**
- B. Tree-Service Firm Qualifications: An experienced tree-service firm that has successfully completed temporary tree- and plant-protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.
- C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection-zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

1.7 FIELD CONDITIONS

- A. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Moving or parking vehicles or equipment.
 - 3. Foot traffic.
 - 4. Erection of sheds or structures.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.
 - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.
- D. Take precautions to protect plants from airborne contaminants, such as paint or fireproofing overspray.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Backfill Soil: **[Stockpiled soil from location indicated on Drawings][Stockpiled soil mixed with planting soil][Planting soil]** of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.
1. Mixture: Well-blended mix of **[2 parts stockpiled soil to 1 part planting soil]**.
 2. Planting Soil: Planting soil **<Insert drawing designation>** as specified in **[Section 329113 "Soil Preparation"]****[Section 329115 "Soil Preparation (Performance Specification)."]**
- B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
1. Type: **[Shredded hardwood][Ground or shredded bark][Wood and bark chips]**.
 2. Size Range: **[3 inches maximum, 1/2 inch minimum]**.
 3. Color: Natural.
- C. Protection-Zone Fencing: Fencing fixed in position and meeting **[one of]** the following requirements:**[Previously used materials, as directed by the Owner]**
1. Chain-Link Protection-Zone Fencing: **[Galvanized-steel][Polymer-coated steel][Polymer-coated galvanized-steel]** fencing fabricated from minimum **2-inch** opening, **0.148-inch-**diameter wire chain-link fabric; with pipe posts, minimum **2-3/8-inch-** OD line posts, and **2-7/8-inch-** OD corner and pull posts**;** **with 1-5/8-inch- OD top rails****;** **with 0.177-inch- diameter top tension wire** and **0.177-inch-** diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.
 - a. Height: **[48 inches][72 inches][96 inches]**.
 - b. Polymer-Coating Color: **[Dark green][Olive green][Brown][Black]**.
 2. Plywood Protection-Zone Fencing: Plywood framed with four **2-by-4-inch** rails, with **[4-by-4-inch]** preservative-treated wood posts spaced not more than **96 inches** apart.
 - a. Height: **[48 inches][72 inches]**.
 - b. Plywood and Lumber: Comply with requirements in Section 061000 "Rough Carpentry."
 3. Wood Protection-Zone Fencing: Constructed of two **2-by-4-inch** horizontal rails, with **[4-by-4-inch]****<Insert dimensions>** preservative-treated wood posts spaced not more than **96 inches** apart, and lower rail set halfway between top rail and ground.
 - a. Height: **[48 inches]**.
 - b. Lumber: Comply with requirements in Section 061000 "Rough Carpentry."
 4. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with **2-inch** maximum opening in pattern and weighing a minimum of **0.4 lb/ft.**; remaining flexible from **minus 60 to plus 200 deg F**; inert to most chemicals and acids; minimum tensile yield strength of **2000 psi** and ultimate tensile strength of **2680 psi**; secured with plastic bands or galvanized-steel or stainless steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than **96 inches** apart.

- a. Height: **[48 inches]**.
 - b. Color: High-visibility orange, nonfading.
5. Gates: **[Single-][Double-]** swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width **[24 inches][36 inches][As indicated]**.
- D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:
 1. Size and Text: **[As indicated on Drawings]**.
 2. Lettering: **[3-inch-]** high minimum, **[white][black]** characters on **[white][red]** background.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

- A. Locate and clearly identify trees, shrubs, and other vegetation to remain **[or to be relocated]**. **[Flag][Tie a 1-inch blue vinyl tape around]** each tree trunk at **54 inches** above the ground.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

3.3 TREE PROTECTION

- A. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.
 1. Apply **[2-inch][4-inch]** uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within **[6 inches]** of tree trunks.
 2. Install temporary root-protection matting over mulch to the extent indicated.
- B. Trunk Protection: Protect the trunk of each tree to remain as follows:
 1. Install **[2-by-4-inch][2-by-6-inch]** wood planks around trunk at maximum **3 inches** apart. Minimum three planks per tree. Band together with no less than three steel bands stapled to the planks to hold them securely in place. **[Wrap orange plastic construction fencing to a minimum of three layers outside slats. Fasten wrap with wire.]**
 - a. Height: **[48 inches][96 inches][12 inches from lowest branch]**.
 2. Wrap trunk with **[orange plastic construction fencing to 2 inches in thickness][minimum 1/4-**



inch closed-cell foam pads]. Install **[2-by-4-inch][2-by-6-inch]** wood planks around trunk over wrap at maximum **3 inches** apart. Minimum three planks per tree. Band together with no less than three steel bands stapled to the planks to hold them securely in place.

- a. Height: **[48 inches][96 inches][12 inches from lowest branch]**.
- b. Trunk protection to remain in place no longer than **[six months][12 months]**. If construction exceeds timeframe indicated, inspect trunk protection at **[six-month][12-month]** intervals and loosen if necessary.

3.4 PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones **[before materials or equipment are brought on the site and construction operations begin]** in a manner that will prevent people **[and animals]** from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
 1. Chain-Link Fencing: Install to comply with ASTM F567 and with manufacturer's written instructions.
 2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to the Owner.
 3. Access Gates: Install **[where indicated]**; adjust to operate smoothly, easily, and quietly; free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
 4. Plastic Fencing: Stretch fabric taut and secure to posts without bows or sags.
- B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner as directed by the Owner. Install one sign spaced approximately every **[20 ft.][35 ft.][50 ft.]** on protection-zone fencing, but no fewer than **[four]** signs with each facing a different direction.
- C. Maintain protection zones free of weeds and trash.
- D. Maintain hydration of plants to assure plant survival.
- E. Maintain protection-zone fencing and signage in good condition as directed by the Owner and remove when construction operations are complete and equipment has been removed from the site.
 1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
 2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.5 EXCAVATION

- A. General: Excavate at edge of protection zones and for trenches indicated within protection zones in accordance with requirements in Section 312000 "Earth Moving" unless otherwise indicated.
- B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring,

or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

3.6 ROOT PRUNING

- A. Prune tree roots that are affected by temporary and permanent construction. Prune roots **[as indicated on Drawings][.][and][as follows:]**
 - 1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
 - 2. Cut Ends: Do not paint cut root ends.
 - 3. Temporarily support and protect roots from damage until they are permanently covered with soil.
 - 4. Cover exposed roots with burlap and water regularly.
 - 5. Backfill as soon as possible in accordance with requirements in Section 312000 "Earth Moving."
- B. Root Pruning at Edge of Protection Zone: Prune tree roots **[12 inches outside][12 inches inside][6 inches outside][6 inches inside][flush with the edge]** of the protection zone by cleanly cutting all roots to the depth of the required excavation.
- C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.7 CROWN PRUNING

- A. Prune branches that are affected by temporary and permanent construction. Prune branches **[as indicated on Drawings, under direction of arborist][as directed by arborist]**.
 - 1. Prune to remove only **[injured,]** broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
 - 2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
 - 3. Pruning Standards: Prune trees in accordance with ANSI A300 (Part 1) **[and as indicated on Drawings]**.
 - a. Type of Pruning: **[Cleaning][raising][reducing][and][thinning]** where indicated.
 - b. Specialty Pruning: **[Structural][restoration][vista][espalier][pollarding][palm][and][utility]** where indicated.
- B. Unless otherwise directed by arborist and as directed by the Owner, do not cut tree leaders.
- C. Cut branches with sharp pruning instruments; do not break or chop.
- D. Do not paint or apply sealants to wounds.
- E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.
- F. Chip removed branches and **[spread over areas as directed by the Owner][stockpile in areas as directed by the Owner][dispose of off-site]**.

01 - General Requirements

3.8 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
 - 1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.
- C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- D. Minor Fill within Protection Zone: Where existing grade is **[2 inches]** or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.9 FIELD QUALITY CONTROL

- A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.10 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner **as directed by the Owner**.
 - 1. Submit details of proposed pruning and repairs.
 - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours in accordance with arborist's written instructions.
 - 3. Replace trees and other plants that cannot be repaired and restored to full-growth status, **as directed by the Owner**.
- B. Trees: Remove and replace trees indicated to remain that are more than **[25][66]** percent dead or in an unhealthy condition **[before the end of the corrections period]** or are damaged during construction operations that the Owner determines are incapable of restoring to normal growth pattern.
 - 1. Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures **[6 inches][4 inches]** or smaller in caliper size.
 - 2. Large Trees: Provide **[one][two]** new tree(s) of **[6-inch][4-inch]** caliper size for each tree being replaced that measures more than **[6 inches][4 inches]** in caliper size.
 - a. Species: as directed by the Owner.
 - 3. Plant and maintain new trees as specified in Section 329300 "Plants."
- C. Soil Aeration: as directed by the Owner, aerate surface soil compacted during construction. Aerate **[10 ft.]** beyond drip line and no closer than **[36 inches]** to tree trunk. Drill **[2-inch-]** diameter holes a minimum of **12 inches** deep at **[24 inches]** o.c. Backfill holes with an equal mix of augered soil and sand.



END OF SECTION 01 56 39 00



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01 - General Requirements

Task	Specification	Specification Description
01 56 39 00	01 00 00 00	General Requirements
01 56 39 00	01 11 19 00	No Specification Required
01 57 00 00	01 00 00 00	General Requirements
01 57 13 00	01 00 00 00	General Requirements



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SECTION 01 57 23 00 - TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Temporary stormwater pollution controls.

1.2 STORMWATER POLLUTION PREVENTION PLAN

- A. The Stormwater Pollution Prevention Plan (SWPPP) is part of the Contract Documents and is bound into this Project Manual.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]**.
 - 1. Meet with Owner, Architect, **[Construction Manager]**, and earthwork subcontractor, as directed by the Owner.
 - 2. Review requirements of the SWPPP, including permitting process, worker training, and inspection and maintenance requirements.

1.4 INFORMATIONAL SUBMITTALS

- A. Stormwater Pollution Prevention Plan (SWPP): Within **[15]** days of date established for commencement of the Work, submit completed SWPPP.
- B. EPA authorization under the EPA's "2017 Construction General Permit (CGP)."
- C. Stormwater Pollution Prevention (SWPP) Training Log: For each individual performing Work under the SWPPP.
- D. Inspection reports.

1.5 QUALITY ASSURANCE

- A. Stormwater Pollution Prevention Plan (SWPPP) Coordinator: Experienced individual or firm with a record of successful water pollution control management coordination of projects with similar requirements.
 - 1. SWPPP Coordinator shall complete and finalize the SWPPP form.
 - 2. SWPPP Coordinator shall be responsible for inspections and maintaining of all requirements of the SWPPP.
- B. Installers: Trained as indicated in the SWPPP.



PART 2 - PRODUCTS

2.1 TEMPORARY STORMWATER POLLUTION CONTROLS

- A. Provide temporary stormwater pollution controls as required by the SWPPP.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with all best management practices, general requirements, performance requirements, reporting requirements, and all other requirements included in the SWPPP.
- B. Locate stormwater pollution controls in accordance with the SWPPP.
- C. Conduct construction as required to comply with the SWPPP and that minimize possible contamination or pollution or other undesirable effects.
 - 1. Inspect, repair, and maintain SWPPP controls during construction.
 - a. Inspect all SWPPP controls not less than every seven days, and after each occurrence of a storm event, as outlined in the SWPPP.
- D. Remove SWPPP controls at completion of construction and restore and stabilize areas disturbed during construction.

END OF SECTION 01 57 23 00



01 - General Requirements

Task	Specification	Specification Description
01 57 23 00	01 00 00 00	General Requirements
01 58 00 00	01 00 00 00	General Requirements
01 58 13 00	01 00 00 00	General Requirements
01 58 13 00	01 11 19 00	No Specification Required



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SECTION 01 60 00 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. The Work of This Section Includes: Administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for Contractor requirements related to Owner-furnished products.
 - 2. Section 012100 "Allowances" for products selected under an allowance.
 - 3. Section 012300 "Alternates" for products selected under an alternate.
 - 4. Section 012500 "Substitution Procedures" for requests for substitutions.
 - 5. Section 014200 "References" for applicable industry standards for products specified.
 - 6. Section 017700 "Closeout Procedures" for submitting warranties.

1.2 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products unless otherwise indicated.
 - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
 - 1. Evaluating Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. **[Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.]**
- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products



qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
 - 1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
 - 2. Data indicating compliance with the requirements specified in "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."
- F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.3 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
 - 1. Resolution of Compatibility Disputes between Multiple Contractors:
 - a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Architect will determine which products will be used.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
 - 1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is inconspicuous.
 - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.
 - 3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.4 COORDINATION

- A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.
- C. Storage:
 - 1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
 - 2. Store products to allow for inspection and measurement of quantity or counting of units.
 - 3. Store materials in a manner that will not endanger Project structure.
 - 4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
 - 5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 7. Protect stored products from damage and liquids from freezing.
 - 8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections are to be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of Owner or endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of Owner or endorsed by manufacturer to Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.



2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in Specifications establish salient characteristics of products.
 6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
 - a. Submit additional documentation required by Architect[**through Construction Manager**] in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by Architect, whose determination is final.
- B. Product Selection Procedures:
1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
 2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
 3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience **[will][will not]** be considered[**unless otherwise indicated**].

- a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
 4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.
 - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
 5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience **[will][will not]** be considered **unless otherwise indicated**.
 - a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
 6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
 - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
 7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
 - a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.
- C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
- E. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements in

Division 01 sustainability requirements Section and individual Specification Sections.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:
1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.
- B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation within **[seven]<Insert number>** days of receipt of a request for a comparable product. Architect will notify Contractor **[through Construction Manager]** of approval or rejection of proposed comparable product within **[15]<Insert number>** days of receipt of request, or **[seven]<Insert number>** days of receipt of additional information or documentation, whichever is later.
1. Architect's Approval of Submittal: **[Marked with approval notation from Architect's action stamp][Marked with approval notation from Architect's and Construction Manager's action stamp][Indication of approval in web-based Project management software]<Insert method>**. See Section 013300 "Submittal Procedures."
 2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- C. Submittal Requirements, Two-Step Process: Approval by Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.
- D. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00 00



01 - General Requirements

Task	Specification	Specification Description
01 60 00 00	01 00 00 00	General Requirements
01 66 00 00	01 00 00 00	General Requirements
01 66 00 00	01 60 00 00	Product Requirements
01 66 19 00	01 00 00 00	General Requirements
01 66 19 00	01 11 19 00	No Specification Required
01 66 19 00	01 60 00 00	Product Requirements
01 66 23 00	01 00 00 00	General Requirements
01 66 23 00	01 60 00 00	Product Requirements
01 70 00 00	01 00 00 00	General Requirements
01 71 00 00	01 00 00 00	General Requirements
01 71 13 00	01 00 00 00	General Requirements
01 71 13 00	01 11 19 00	No Specification Required
01 71 23 00	01 00 00 00	General Requirements
01 71 23 16	01 00 00 00	General Requirements
01 71 36 00	01 00 00 00	General Requirements
01 74 00 00	01 00 00 00	General Requirements
01 74 13 00	01 00 00 00	General Requirements
01 74 16 00	01 00 00 00	General Requirements
01 74 16 00	01 11 19 00	No Specification Required



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SECTION 01 74 19 00 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous **[demolition][and][construction]** waste.
 - 2. Recycling nonhazardous **[demolition][and][construction]** waste.
 - 3. Disposing of nonhazardous **[demolition][and][construction]** waste.
- B. Related Requirements:
 - 1. Section 011200 "Multiple Contract Summary" for coordination of responsibilities for waste management.
 - 2. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
 - 3. Section 044313.13 "Anchored Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
 - 4. Section 044313.16 "Adhered Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
 - 5. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.2 DEFINITIONS

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.
- C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may

be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within [7][30] days of date established for **[commencement of the Work][the Notice to Proceed][the Notice of Award]**.

1.5 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use **[Form CWM-7 for construction waste][and][Form CWM-8 for demolition waste]**. Include the following information:
 1. Material category.
 2. Generation point of waste.
 3. Total quantity of waste in **tons**.
 4. Quantity of waste salvaged, both estimated and actual in **tons**.
 5. Quantity of waste recycled, both estimated and actual in **tons**.
 6. Total quantity of waste recovered (salvaged plus recycled) in **tons**.
 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. LEED Submittal: Submit documentation to USGBC, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met. Respond to questions and requests from USGBC regarding construction waste management and disposal until the USGBC has made its determination on the project's LEED certification application. Document correspondence with USGBC as informational submittals.
- H. Qualification Data: For **[waste management coordinator][and][refrigerant recovery technician]**.
- I. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

- J. Refrigerant Recovery: Comply with requirements in [Section 024116 "Structure Demolition"] [Section 024119 "Selective Demolition"] for refrigerant recovery submittals.

1.6 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent **[may][may not]** serve as Waste Management Coordinator.
1. Firm employs a LEED-Accredited Professional, certified by the USGBC, as waste management coordinator.
 2. Waste management coordinator may also serve as LEED coordinator.
- B. Refrigerant Recovery Technician Qualifications: **[Type I][Type II][Type III][Universal]** certified by EPA-approved certification program.
- C. Refrigerant Recovery Technician Qualifications: Comply with requirements in [Section 024116 "Structure Demolition."] [Section 024119 "Selective Demolition."]
- D. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.
- E. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
 2. Review requirements for documenting quantities of each type of waste and its disposition.
 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. **[Distinguish between demolition and construction waste.]** Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of **[demolition][site-clearing][and][construction]** waste generated by the Work. Use **[Form CWM-1 for construction waste][and][Form CWM-2 for demolition waste]**. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use **[Form CWM-3 for construction waste][and][Form CWM-4 for demolition waste]**. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work in

compliance with [Section 024116 "Structure Demolition."][Section 024119 "Selective Demolition."]

2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there were no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use [Form CWM-5 for construction waste][and][Form CWM-6 for demolition waste]. Include the following:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include transportation and tipping fees and cost of collection containers and handling for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
6. Savings in transportation and tipping fees by donating materials.
7. Savings in transportation and tipping fees that are avoided.
8. Handling and transportation costs. Include cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of [50][75] percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials[.], **including the following:**

1. Demolition Waste:
 - a. Asphalt paving.
 - b. Concrete.
 - c. Concrete reinforcing steel.
 - d. Brick.
 - e. Concrete masonry units.
 - f. Wood studs.
 - g. Wood joists.
 - h. Plywood and oriented strand board.
 - i. Wood paneling.
 - j. Wood trim.
 - k. Structural and miscellaneous steel.

- l. Rough hardware.
- m. Roofing.
- n. Insulation.
- o. Doors and frames.
- p. Door hardware.
- q. Windows.
- r. Glazing.
- s. Metal studs.
- t. Gypsum board.
- u. Acoustical tile and panels.
- v. Carpet.
- w. Carpet pad.
- x. Demountable partitions.
- y. Equipment.
- z. Cabinets.
- aa. Plumbing fixtures.
- bb. Piping.
- cc. Supports and hangers.
- dd. Valves.
- ee. Sprinklers.
- ff. Mechanical equipment.
- gg. Refrigerants.
- hh. Electrical conduit.
- ii. Copper wiring.
- jj. Lighting fixtures.
- kk. Lamps.
- ll. Ballasts.
- mm. Electrical devices.
- nn. Switchgear and panelboards.
- oo. Transformers.

2. Construction Waste:

- a. Masonry and CMU.
- b. Lumber.
- c. Wood sheet materials.
- d. Wood trim.
- e. Metals.
- f. Roofing.
- g. Insulation.
- h. Carpet and pad.
- i. Gypsum board.
- j. Piping.
- k. Electrical conduit.
- l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
 - 1) Paper.
 - 2) Cardboard.
 - 3) Boxes.
 - 4) Plastic sheet and film.
 - 5) Polystyrene packaging.
 - 6) Wood crates.
 - 7) Wood pallets.
 - 8) Plastic pails.



- m. Construction Office Waste: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following construction office waste materials:
 - 1) Paper.
 - 2) Aluminum cans.
 - 3) Glass containers.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - 1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. **[Coordinator shall be present at Project site full time for duration of Project.]**
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
 - 1. Distribute waste management plan to everyone concerned within **[three]** days of submittal return.
 - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
 - 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.
- E. Waste Management in Historic Zones or Areas: Transportation equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, by **[12 inches]** or more.

3.2 SALVAGING DEMOLITION WASTE

- A. Comply with requirements in **[Section 024116 "Structure Demolition"]****[Section 024119 "Selective Demolition"]****[Section 024296 "Historic Removal and Dismantling]** for salvaging demolition waste.
- B. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
 - 1. Clean salvaged items.

2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
 3. Store items in a secure area until installation.
 4. Protect items from damage during transport and storage.
 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- C. Salvaged Items for **[Sale][and][Donation]**: **[Permitted][Not permitted]** on Project site.
- D. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area **[on-site][off-site][designated by Owner]**.
 5. Protect items from damage during transport and storage.
- E. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- F. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- G. Plumbing Fixtures: Separate by type and size.
- H. Lighting Fixtures: Separate lamps by type and protect from breakage.
- I. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.
- 3.3 RECYCLING **[DEMOLITION][AND][CONSTRUCTION]** WASTE, GENERAL
- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall **[accrue to Owner][accrue to Contractor][be shared equally by Owner and Contractor]**.
- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and

01 - General Requirements

- shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.4 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving: Grind asphalt to maximum [1-1/2-inch][4-inch] size.
 1. Crush asphaltic concrete paving and screen to comply with requirements in Section 312000 "Earth Moving" for use as general fill.
- B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.
- C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
 1. Pulverize concrete to maximum [1-1/2-inch][4-inch] size.
 2. Crush concrete and screen to comply with requirements in Section 312000 "Earth Moving" for use as satisfactory soil for fill or subbase.
- D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
 1. Pulverize masonry to maximum [3/4-inch][1-inch][1-1/2-inch][4-inch] size.
 - a. Crush masonry and screen to comply with requirements in Section 312000 "Earth Moving" for use as **[general fill][satisfactory soil for fill or subbase]**.
 - b. Crush masonry and screen to comply with requirements in Section 329300 "Plants" for use as mineral mulch.
 2. Clean and stack undamaged, whole masonry units on wood pallets.
- E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- F. Metals: Separate metals by type.
 1. Structural Steel: Stack members according to size, type of member, and length.
 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- H. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- J. Metal Suspension System: Separate metal members, including trim and other metals from acoustical panels and tile, and sort with other metals.
- K. Carpet[and Pad]: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet[**and pad**] in a closed container or trailer provided by carpet reclamation agency or carpet recycler.
- L. Carpet Tile: Remove debris, trash, and adhesive.
 1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by carpet reclamation agency or carpet recycler.
- M. Piping: Reduce piping to straight lengths and store by material and size. Separate supports, hangers, valves, sprinklers, and other components by material and size.
- N. Conduit: Reduce conduit to straight lengths and store by material and size.
- O. Lamps: Separate lamps by type and store according to requirements in 40 CFR 273.

3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 2. Polystyrene Packaging: Separate and bag materials.
 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:
 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
 - a. Comply with requirements in Section 329300 "Plants" for use of clean sawdust as organic mulch.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
 - a. Comply with requirements in Section 329300 "Plants" for use of clean ground gypsum board as inorganic soil amendment.
- D. Paint: Seal containers and store by type.

3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and

areas.

- B. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner's property.
- C. Burning: Do not burn waste materials.
- D. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

3.7 ATTACHMENTS

- A. Form CWM-1 for construction waste identification.
- B. Form CWM-2 for demolition waste identification.
- C. Form CWM-3 for construction waste reduction work plan.
- D. Form CWM-4 for demolition waste reduction work plan.
- E. Form CWM-5 for cost/revenue analysis of construction waste reduction work plan.
- F. Form CWM-6 for cost/revenue analysis of demolition waste reduction work plan.
- G. Form CWM-7 for construction waste reduction progress report.
- H. Form CWM-8 for demolition waste reduction progress report.

END OF SECTION 01 74 19 00



01 - General Requirements

Task	Specification	Specification Description
01 74 19 00	01 00 00 00	General Requirements
01 74 19 00	01 11 19 00	No Specification Required
01 74 23 00	01 00 00 00	General Requirements



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SECTION 01 91 13 00 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General requirements for coordinating and scheduling commissioning activities.
2. Commissioning meetings.
3. Commissioning reports.
4. Use of commissioning process test equipment, instrumentation, and tools.
5. Construction checklists, including, but not limited to, installation checks, startup, performance tests, and performance test demonstration.
6. Commissioning tests and commissioning test demonstration.
7. Adjusting, verifying, and documenting identified systems and assemblies.

B. Related Requirements:

1. Section 011000 "Summary" for Commissioning Authority responsibilities.
2. Section 011200 "Multiple Contract Summary" for Commissioning Authority responsibilities.
3. Section 013300 "Submittal Procedures" for submittal procedure requirements for commissioning process.
4. Section 017700 "Closeout Procedures" for Certificate of Construction-Phase Commissioning Process Completion submittal requirements.
5. Section 017823 "Operation and Maintenance Data" for preliminary operation and maintenance data submittal requirements.
6. Section 019119.43 "Exterior Enclosure Commissioning" for technical commissioning requirements for exterior closure.
7. Section 210800 "Commissioning of Fire Suppression" for technical commissioning requirements for fire suppression.
8. Section 220800 "Commissioning of Plumbing" for technical commissioning requirements for plumbing.
9. Section 230800 "Commissioning of HVAC" for technical commissioning requirements for HVAC.
10. Section 260800 "Commissioning of Electrical Systems" for technical commissioning requirements for electrical systems.
11. Section 270800 "Commissioning of Communications" for technical commissioning requirements for communications systems.
12. Section 280800 "Commissioning of Electronic Safety and Security" for technical commissioning requirements for electronic safety and security systems.

1.2 ALLOWANCES

A. Labor and management costs for the performance of commissioning process.

B. The following are excluded from the commissioning allowance:

1. Equipment and systems installation, startup, and field quality-control testing indicated in the Contract Documents.
2. Test equipment, instrumentation, and tools (including, but not limited to, proprietary test equipment, instrumentation, and tools) required to perform tests.
3. Work to correct commissioning issues.

4. Work to repeat tests when equipment and systems fail acceptance criteria.
5. **<Insert requirements>**.

1.3 UNIT PRICES

- A. Commissioning allowance may be adjusted up or down by the "List of Unit Prices" Article in Section 012200 "Unit Prices" when actual labor hours are computed at the end of commissioning process. See Section 012100 "Allowances" for commissioning allowance.
- B. The following are excluded from the computation for the adjustment of the commissioning allowance for technician labor hours:
 1. Work to correct commissioning issues.
 2. Work to repeat tests when equipment and systems fail acceptance criteria.

1.4 DEFINITIONS

- A. Acceptance Criteria: Threshold of acceptable work quality or performance specified for a commissioning activity, including, but not limited to, construction checklists, performance tests, performance test demonstrations, commissioning tests, and commissioning test demonstrations.
- B. Basis-of-Design Document: A document prepared by Architect that records concepts, calculations, decisions, and product selections used to comply with Owner's Project Requirements and to suit applicable regulatory requirements, standards, and guidelines.
- C. Commissioning Authority: An entity engaged by Owner, and identified in Section 011000 "Summary," to evaluate Commissioning-Process Work.
- D. Commissioning Plan: A document, prepared by Commissioning Authority, that outlines the organization, schedule, allocation of resources, and documentation of commissioning requirements.
- E. Commissioning: A quality-focused process for verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, and tested to comply with Owner's Project Requirements. The requirements specified here are limited to the construction phase commissioning activities. The scope of the commissioning process is defined in [**Section 011000 "Summary."**][**Section 011200 "Multiple Contract Summary."**]
- F. Construction-Phase Commissioning-Process Completion: The stage of completion and acceptance of commissioning process when resolution of deficient conditions and issues discovered during commissioning process and retesting until acceptable results are obtained has been accomplished. Owner will establish in writing the date construction-phase commissioning-process completion is achieved. See Section 017700 "Closeout Procedures" for Certificate of Construction-Phase Commissioning Process Completion submittal requirements.
 1. Commissioning process is complete when the Work specified of this Section and related Sections has been completed and accepted, including, but not limited to, the following:
 - a. Completion of tests and acceptance of test results.
 - b. Resolution of issues, as verified by retests performed and documented with acceptance of retest results.
 - c. Comply with requirements in Section 017900 "Demonstration and Training."
 - d. Completion and acceptance of submittals and reports.

- G. Owner's Project Requirements: A document that details the functional requirements of a project and the expectations of how it will be used and operated, including Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information. This document is prepared either by the Owner or for the Owner by the Architect or Commissioning Authority.
- H. Owner's Witness: Commissioning Authority, Owner's Project Manager, or Architect-designated witness authorized to authenticate test demonstration data and to sign completed test data forms.
- I. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.
- J. Test: Performance tests, performance test demonstrations, commissioning tests, and commissioning test demonstrations.
- K. Sampling Procedures and Tables for Inspection by Attributes: As defined in ASQ Z1.4.

1.5 COMPENSATION

- A. If Architect, Commissioning Authority, other Owner's witness, or Owner's staff perform additional services or incur additional expenses due to actions of Contractor listed below, compensate Owner for such additional services and expenses.
 - 1. Failure to provide timely notice of commissioning activities schedule changes.
 - 2. Failure to meet acceptance criteria for test demonstrations.
- B. Contractor shall compensate Owner for such additional services and expenses at the rate of **<Insert billing rate>** per labor hour, plus **<Insert rate>** per round trip for personnel travelling more than **[200]<Insert distance>** miles, plus per diem allowances for meals and lodging according to current U.S. General Services Administration (GSA) Per Diem Rates.

1.6 COMMISSIONING TEAM

- A. Members Appointed by Contractor(s):
 - 1. Commissioning Coordinator: A person or entity employed by Contractor to manage, schedule, and coordinate commissioning process.
 - 2. Project superintendent and other employees that Contractor may deem appropriate for a particular portion of the commissioning process.
 - 3. Subcontractors, installers, suppliers, and specialists that Contractor may deem appropriate for a particular portion of the commissioning process.
 - 4. Appointed team members shall have the authority to act on behalf of the entity they represent.
- B. Members Appointed by Owner:
 - 1. Commissioning Authority, plus consultants that Commissioning Authority may deem appropriate for a particular portion of the commissioning process.
 - 2. Owner representative(s), facility operations and maintenance personnel, plus other employees, separate contractors, and consultants that Owner may deem appropriate for a particular portion of the commissioning process.
 - 3. Architect, plus employees and consultants that Architect may deem appropriate for a particular portion of the commissioning process.

1.7 INFORMATIONAL SUBMITTALS

- A. Comply with requirements in Section 013300 "Submittal Procedures" for submittal procedure general requirements for commissioning process.
- B. Commissioning Plan Information:
 - 1. List of Contractor-appointed commissioning team members to include specific personnel and subcontractors performing the various commissioning requirements.
 - 2. Schedule of commissioning activities, integrated with the Construction Schedule. Comply with requirements in Section 013200 "Construction Progress Documentation" for the Construction Schedule general requirements for commissioning process.
 - 3. Contractor personnel and subcontractors participating in each test.
 - 4. List of instrumentation required for each test to include identification of parties that will provide instrumentation for each test.
- C. Commissioning schedule.
- D. Two-week look-ahead schedules.
- E. Commissioning Coordinator Letter of Authority:
 - 1. Within 10 days after approval of Commissioning Coordinator qualifications, submit a letter of authority for Commissioning Coordinator, signed by a principal of Contractor's firm. Letter shall authorize Commissioning Coordinator to do the following:
 - a. Make inspections required for commissioning process.
 - b. Coordinate, schedule, and manage commissioning process of Contractor, subcontractors, and suppliers.
 - c. Obtain documentation required for commissioning process from Contractor, subcontractors, and suppliers.
 - d. Report issues, delayed resolution of issues, schedule conflicts, and lack of cooperation or expertise on the part of members of the commissioning team.
- F. Commissioning Coordinator Qualification Data: For entity coordinating Contractor's commissioning activities to demonstrate their capabilities and experience.
 - 1. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of **[five]<Insert number>** previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- G. List test instrumentation, equipment, and monitoring devices. Include the following information:
 - 1. Make, model, serial number, and application for each instrument, equipment, and monitoring device.
 - 2. Brief description of intended use.
 - 3. Calibration record showing the following:
 - a. Calibration agency, including name and contact information.
 - b. Last date of calibration.
 - c. Range of values for which calibration is valid.
 - d. Certification of accuracy.
 - e. Certification for calibration equipment traceable to NIST.
 - f. Due date of the next calibration.

H. Test Reports:

1. Pre-Startup Report: Prior to startup of equipment or a system, submit signed, completed construction checklists.
2. Test Data Reports: At the end of each day in which tests are conducted, submit test data for tests performed.
3. Commissioning Issue Reports: Daily, at the end of each day in which tests are conducted, submit commissioning issue reports for tests for which acceptable results were not achieved.
4. Weekly Progress Report: Weekly, at the end of each week in which tests are conducted, submit a progress report.
5. Data Trend Logs: Submit data trend logs at the end of the trend log period.
6. System Alarm Logs: Daily, at the start of days following a day in which tests were performed, submit printout of log of alarms that occurred since the last log was printed.

I. Construction Checklists:

1. Material checks.
2. Installation checks.
3. Startup procedures, where required.

1.8 CLOSEOUT SUBMITTALS

A. Commissioning Report:

1. At Construction-Phase Commissioning Completion, include the following:
 - a. Pre-startup reports.
 - b. Approved test procedures.
 - c. Test data forms, completed and signed.
 - d. Progress reports.
 - e. Commissioning issue report log.
 - f. Commissioning issue reports showing resolution of issues.
 - g. Correspondence or other documents related to resolution of issues.
 - h. Other reports required by commissioning process.
 - i. List unresolved issues and reasons they remain unresolved and should be exempted from the requirements for Construction-Phase Commissioning Completion.
 - j. Report shall include commissioning work of Contractor.

B. Request for Certificate of Construction-Phase Commissioning Process Completion.

C. Operation and Maintenance Data: For proprietary test equipment, instrumentation, and tools to include in operation and maintenance manuals.

1.9 QUALITY ASSURANCE

A. Commissioning Coordinator Qualifications:

1. Documented experience commissioning systems of similar complexity to those contained in these documents on at least **[three]<Insert number>** projects of similar scope and complexity.
2. Certification of commissioning-process expertise. The following certifications are acceptable. Owner reserves the right to accept or reject certifications as evidence of qualification.
 - a. Certified Commissioning Authority, by AABC Commissioning Group (ACG).
 - b. Commissioning-Process Management Professional, by American Society of Heating,



- Refrigerating and Air-Conditioning Engineers.
- c. Certified Commissioning Professional, by Building Commissioning Association.
- d. Accredited Commissioning-Process Authority Professional, by University of Wisconsin.
- e. Accredited Commissioning-Process Manager, by University of Wisconsin.
- f. Accredited Green Commissioning-Process Provider, by University of Wisconsin.

- B. Calibration Agency Qualifications: Certified by The American Association for Laboratory Accreditation that the calibration agency complies with minimum requirements of ISO/IEC 17025.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

- A. Test equipment and instrumentation required to perform the commissioning process shall remain the property of Contractor unless otherwise indicated.
- B. Test equipment and instrumentation required to perform commissioning process shall comply with the following criteria:
 - 1. Be manufactured for the purpose of testing and measuring tests for which they are being used and have an accuracy to test and measure system performance within the tolerances required to determine acceptable performance.
 - 2. Calibrated and certified.
 - a. Calibration performed and documented by a qualified calibration agency according to national standards applicable to the tools and instrumentation being calibrated. Calibration shall be current according to national standards or within test equipment and instrumentation manufacturer's recommended intervals, whichever is more frequent, but not less than within six months of initial use on Project. Calibration tags shall be permanently affixed.
 - b. Repair and recalibrate test equipment and instrumentation if dismantled, dropped, or damaged since last calibrated.
 - 3. Maintain test equipment and instrumentation.
 - 4. Use test equipment and instrumentation only for testing or monitoring Work for which they are designed.

2.2 PROPRIETARY TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

- A. Proprietary test equipment, instrumentation, and tools are those manufactured or prescribed by tested equipment manufacturer and required for work on its equipment as a condition of equipment warranty, or as otherwise required to service, repair, adjust, calibrate, or perform work on its equipment.
 - 1. Identify proprietary test equipment, instrumentation, and tools required in the test equipment identification list submittal.
 - 2. Proprietary test equipment, instrumentation, and tools shall become the property of Owner at Substantial Completion.

2.3 REPORT FORMAT AND ORGANIZATION

A. General Format and Organization:

1. Bind report in three-ring binders.
2. Label the front cover and spine of each binder with the report title, volume number, project name, Contractor's name, and date of report.
3. Record report on compact disk.
4. Electronic Data: Portable document format (PDF); a single file with outline-organized bookmarks for major and minor tabs and tab contents itemized for specific reports.

B. Commissioning Report:

1. Include a table of contents and an index to each test.
2. Include major tabs for each Specification Section.
3. Include minor tabs for each test.
4. Within each minor tab, include the following:
 - a. Test specification.
 - b. Pre-startup reports.
 - c. Approved test procedures.
 - d. Test data forms, completed and signed.
 - e. Commissioning issue reports, showing resolution of issues, and documentation related to resolution of issues pertaining to a single test. Group data forms, commissioning issue reports showing resolution of issues, and documentation related to resolution of issues for each test repetition together within the minor tab, in reverse chronological order (most recent on top).

PART 3 - EXECUTION

3.1 PREPARATION

- A. Review preliminary construction checklists and preliminary test procedures and data forms.

3.2 CONSTRUCTION CHECKLISTS

- A. Construction checklists cannot modify or conflict with the Contract Documents.
- B. Create construction checklists based on actual systems and equipment to be included in Project.
- C. Material Checks: Compare specified characteristics and approved submittals with materials as received. Include factory tests and other evaluations, adjustments, and tests performed prior to shipment if applicable.
 1. Service connection requirements, including configuration, size, location, and other pertinent characteristics.
 2. Included optional features.
 3. Delivery Receipt Check: Inspect and record physical condition of materials and equipment on delivery to Project site, including agreement with approved submittals, cleanliness, and lack of damage.
 4. Installation Checks:

- a. Location according to Drawings and approved Shop Drawings.
 - b. Configuration.
 - c. Compliance with manufacturers' written installation instructions.
 - d. Attachment to structure.
 - e. Access clearance to allow for maintenance, service, repair, removal, and replacement without the need to disassemble or remove other equipment or building elements. Access coordinated with other building elements and equipment, including, but not limited to, ceiling and wall access panels, in a manner consistent with OSHA fall-protection regulations and safe work practices.
 - f. Utility connections are of the correct characteristics, as applicable.
 - g. Correct labeling and identification.
 - h. Startup Checks: Verify readiness of equipment to be energized. Include manufacturer's standard startup procedures and forms.
- D. Startup: Perform and document initial operation of equipment to prove that it is installed properly and operates as intended according to manufacturer's standard startup procedures, at minimum.
- E. Performance Tests:
- 1. Static Tests: As specified elsewhere, including, but not limited to, duct and pipe leakage tests, insulation-resistance tests, and water-penetration tests.
 - 2. Component Performance Tests: Tests evaluate the performance of an input or output of components under a full range of operating conditions.
 - 3. Equipment and Assembly Performance Tests: Test and evaluate performance of equipment and assemblies under a full range of operating conditions and loads.
 - 4. System Performance Tests: Test and evaluate performance of systems under a full range of operating conditions and loads.
 - 5. Intersystem Performance Tests: Test and evaluate the interface of different systems under a full range of operating conditions and loads.
- F. Deferred Construction Checklists: Obtain Owner approval of proposed deferral of construction checklists, including proposed schedule of completion of each deferred construction checklist, before submitting request for Certificate of Construction-Phase Commissioning Process Completion. When approved, deferred construction checklists may be completed after date of Construction-Phase Commissioning Completion. Include the following in a request for Certificate of Construction-Phase Commissioning Process Completion:
- 1. Identify deferred construction checklists by number and title.
 - 2. Provide a target schedule for completion of deferred construction checklists.
 - 3. Written approval of proposed deferred construction checklists, including approved schedule of completion of each deferred construction checklist.
- G. Delayed Construction Checklists: Obtain Owner approval of proposed delayed construction checklists, including proposed schedule of completion of each delayed construction checklist, before submitting request for Certificate of Construction-Phase Commissioning Process Completion. When approved, delayed construction checklists may be completed after date of Construction-Phase Commissioning Completion. Include the following in a request for Certificate of Construction-Phase Commissioning Process Completion:
- 1. Identify delayed construction checklist by construction checklist number and title.
 - 2. Provide a target schedule for completion of delayed construction checklists.
 - 3. Written approval of proposed delayed construction checklists, including approved schedule of completion of each delayed construction checklist.

3.3 GENERAL EXECUTION REQUIREMENTS

- A. Schedule and coordinate commissioning process with the Construction Schedule.
- B. Perform activities identified in construction checklists, including tests, and document results of actions as construction proceeds.
- C. Perform test demonstrations for Owner's witness. Unless otherwise indicated, demonstrate tests for 100 percent of work to which the test applies. In some instances, demonstration of a random sample of other than 100 percent of the results of a test is specified.
 - 1. Where sampling is specified, the sampling plan and procedure for the test demonstration shall be determined using ASQ Z1.4.
 - a. General Inspection: [Level I][Level II][Level III]<Insert level>.
 - b. Special Inspection: [Level S-1][Level S-2][Level S-3][Level S-4]<Insert level>.
 - c. Acceptance Quality Limit (AQL) of [1.5]<Insert AQL>.
 - 2. The "lot size" in ASQ Z1.4 is the sum of the number of items to which the test demonstration applies, as described in the scope subparagraph of each test.
 - 3. On determination of the sample size, the samples shall be selected randomly by Owner's witness at the time of the test demonstration.
 - 4. Include in the Commissioning Plan a detailed list of the test demonstrations with lot and sample quantities for each test.
- D. Report test data and commissioning issue resolutions.
- E. Schedule personnel to participate in and perform Commissioning-Process Work.
- F. Installing contractors' commissioning responsibilities include, but are not limited to, the following:
 - 1. Operating the equipment and systems they install during tests.
 - 2. In addition, installing contractors may be required to assist in tests of equipment and systems with which their work interfaces.

3.4 COMMISSIONING COORDINATOR RESPONSIBILITIES

- A. Management and Coordination: Manage, schedule, and coordinate commissioning process, including, but not limited to, the following:
 - 1. Coordinate with subcontractors on their commissioning responsibilities and activities.
 - 2. Obtain, assemble, and submit commissioning documentation.
 - 3. [Attend][Conduct] periodic on-site commissioning meetings. Comply with requirements in Section 013100 "Project Management and Coordination."
 - 4. Develop and maintain the commissioning schedule. Integrate commissioning schedule into the Construction Schedule. Update Construction Schedule at specified intervals.
 - 5. Review and comment on preliminary test procedures and data forms.
 - 6. Report inconsistencies and issues in system operations.
 - 7. Verify that tests have been completed and results comply with acceptance criteria, and that equipment and systems are ready before scheduling test demonstrations.
 - 8. Direct and coordinate test demonstrations.
 - 9. Coordinate witnessing of test demonstrations by Owner's witness.
 - 10. Coordinate and manage training. Be present during training sessions to direct video recording, present training, and direct the training presentations of others. Comply with requirements in Section 017900 "Demonstration and Training."

11. Prepare and submit specified commissioning reports.
12. Track commissioning issues until resolution and retesting is successfully completed.
13. Retain original records of Commissioning-Process Work, organized as required for the commissioning report. Provide Owner's representative access to these records on request.
14. Assemble and submit commissioning report.

3.5 COMMISSIONING TESTING

- A. Quality Control: Construction checklists, including tests, are quality-control tools designed to improve the functional quality of Project. Test demonstrations evaluate the effectiveness of Contractor's quality-control process.
- B. Owner's witness will be present to witness commissioning work requiring the signature of an owner's witness, including, but not limited to, test demonstrations. Owner's project manager will coordinate attendance by Owner's witness with Contractor's published Commissioning Schedule. Owner's witness will provide no labor or materials in the commissioning work. The only function of Owner's witness will be to observe and comment on the progress and results of commissioning process.
- C. Construction Checklists:
 1. Complete construction checklists as Work is completed.
 2. Distribute construction checklists to installing contractors before they start work.
 3. Installers:
 - a. Verify installation using approved construction checklists as Work proceeds.
 - b. Complete and sign construction checklists **[daily][weekly]<Insert frequency>** for work performed during the preceding **[day][week]<Insert time period>**.
 4. Provide Commissioning Authority access to construction checklists.
- D. Installation Compliance Issues: Record as an installation compliance issue Work found to be incomplete, inaccessible, at variance with the Contract Documents, nonfunctional, or that does not comply with construction checklists. Record installation compliance issues on the construction checklist at the time they are identified. Record corrective action and how future Work should be modified before signing off the construction checklist.
- E. Pre-Startup Audit: Prior to executing startup procedures, review completed installation checks to determine readiness for startup and operation. Report conditions, which, if left uncorrected, adversely impact the ability of systems or equipment to operate satisfactorily or to comply with acceptance criteria. Prepare pre-startup report for each system.
- F. Test Procedures and Test Data Forms:
 1. Test procedures shall define the step-by-step procedures to be used to execute tests and test demonstrations.
 2. Test procedures shall be specific to the make, model, and application of the equipment and systems being tested.
 3. Completed test data forms are the official records of the test results.
 4. Commissioning Authority will provide to Contractor preliminary test procedures and test data forms for performance tests and commissioning tests after approval of Product Data, Shop Drawings, and preliminary operation and maintenance manual.
 5. Review preliminary test procedures and test data forms, and provide comments within 14 days of receipt from Commissioning Authority. Review shall address the following:

- a. Equipment protection and warranty issues, including, but not limited to, manufacturers' installation and startup recommendations, and operation and maintenance instructions.
 - b. Applicability of the procedure to the specific software, equipment, and systems approved for installation.
 6. After Contractor has reviewed and commented on the preliminary test procedures and test data forms, Commissioning Authority will revise and reissue the approved revised test procedures and test data forms marked "Approved for Testing."
 7. Use only approved test procedures and test data forms marked "Approved for Testing" to perform and document tests and test demonstrations.
- G. Performance of Tests:
1. The sampling rate for tests is 100 percent. The sampling rate for test demonstrations is 100 percent unless otherwise indicated.
 2. Perform and complete each step of the approved test procedures in the order listed.
 3. Record data observed during performance of tests on approved data forms at the time of test performance and when the results are observed.
 4. Record test results that are not within the range of acceptable results on commissioning issue report forms in addition to recording the results on approved test procedures and data forms according to the "Commissioning Compliance Issues" Paragraph in this Article.
 5. On completion of a test, sign the completed test procedure and data form. Tests for which test procedures and data forms are incomplete, not signed, or which indicate performance that does not comply with acceptance criteria will be rejected. Tests for which test procedures and data forms are rejected shall be repeated and results resubmitted.
- H. Performance of Test Demonstration:
1. Perform test demonstrations on a sample of tests after test data submittals are approved. The sampling rate for test demonstrations shall be [100]<Insert number> percent unless otherwise indicated in the individual test specification.
 2. Notify Owner's witness at least [three days]<Insert alternative time> in advance of each test demonstration.
 3. Perform and complete each step of the approved test procedures in the order listed.
 4. Record data observed during performance of test demonstrations on approved data forms at the time of demonstration and when the results are observed.
 5. Provide full access to Owner's witness to directly observe the performance of all aspects of system response during the test demonstration. On completion of a test demonstration, sign the completed data form and obtain signature of Owner's witness at the time of the test to authenticate the reported results.
 6. Test demonstration data forms not signed by Contractor and Owner's witness at the time of the completion of the procedure will be rejected. Test demonstrations for which data forms are rejected shall be repeated and results shall be resubmitted.
 - a. Exception for Failure of Owner's Witness to Attend: Failure of Owner's witness to be present for agreed-on schedule of test demonstration shall not delay Contractor. If Owner's witness fails to attend a scheduled test, Contractor shall proceed with the scheduled test. On completion, Contractor shall sign the data form for Contractor and for Owner's witness, and shall note the absence of Owner's witness at the scheduled time and place.
 7. False load test requirements are specified in related sections.
 - a. Where false load testing is specified, provide temporary equipment, power, controls, wiring, piping, valves, and other necessary equipment and connections required to apply the specified load to the system. False load system shall be capable of steady-state operation and modulation at the level of load specified. Equipment and systems permanently

installed in this work shall not be used to create the false load without Architect's written approval.

I. Deferred Tests:

1. Deferred Test List: Identify, in the request for Certificate of Construction-Phase Commissioning Process Completion, proposed deferred tests or other tests approved for deferral until specified seasonal or other conditions are available. When approved, deferred tests may be completed after the date of Construction-Phase Commissioning Completion. Identify proposed deferred tests in the request for Certificate of Construction-Phase Commissioning Process Completion as follows:
 - a. Identify deferred tests by number and title.
 - b. Provide a target schedule for completion of deferred tests.
2. Schedule and coordinate deferred tests. Schedule deferred tests when specified conditions are available. Notify Architect and Commissioning Authority at least **[three working days]<Insert alternative time>** (minimum) in advance of tests.
3. Where deferred tests are specified, coordinate participation of necessary personnel and of Architect, Commissioning Authority, and Owner's witness. Schedule deferred tests to minimize occupant and facility impact. Obtain Architect's approval of the proposed schedule.

J. Delayed Tests:

1. Delayed Test List: Identify, in the request for Certificate of Construction-Phase Commissioning Process Completion, proposed delayed tests. Obtain Owner approval of proposed delayed tests, including proposed schedule of completion of each delayed test, before submitting request for Certificate of Construction-Phase Commissioning Process Completion. Include the following in the request for Certificate of Construction-Phase Commissioning Process Completion:
 - a. Identify delayed tests by test number and title.
 - b. Written approval of proposed delayed tests, including approved schedule of completion of delayed tests.
2. Schedule and coordinate delayed tests. Schedule delayed tests when conditions that caused the delay have been rectified. Notify Architect and Commissioning Authority at least **[three working days]<Insert alternative time>** (minimum) in advance of tests.
3. Where delayed tests are approved, coordinate participation of necessary personnel and of Architect, Commissioning Authority, and Owner's witness. Schedule delayed tests to minimize occupant and facility impact. Obtain Architect's approval of the proposed schedule.

K. Commissioning Compliance Issues:

1. Test results that are not within the range of acceptable results are commissioning compliance issues.
2. Track and report commissioning compliance issues until resolution and retesting are successfully completed.
3. If a test demonstration fails, determine the cause of failure. Direct timely resolution of issue and then repeat the demonstration. If a test demonstration must be repeated due to failure caused by Contractor work or materials, reimburse Owner for billed costs for the participation in the repeated demonstration.
4. Test Results: If a test demonstration fails to meet the acceptance criteria, perform the following:
 - a. Complete a commissioning compliance issue report form promptly on discovery of test results that do not comply with acceptance criteria.

- b. Submit commissioning compliance issue report form within **[24 hours]<Insert alternative time>** of the test.
 - c. Determine the cause of the failure.
 - d. Establish responsibility for corrective action if the failure is due to conditions found to be Contractor's responsibility.
- 5. Commissioning Compliance Issue Report: Provide a commissioning compliance issue report for each issue. Do not report multiple issues on the same commissioning compliance issue report.
 - a. Exception: If an entire class of devices is determined to exhibit the identical issue, they may be reported on a single commissioning compliance issue report. (For example, if all return-air damper actuators that are specified to fail to the open position are found to fail to the closed position, they may be reported on a single commissioning issue report. If a single commissioning issue report is used for multiple commissioning compliance issues, each device shall be identified in the report, and the total number of devices at issue shall be identified.
 - b. Complete and submit Part 1 of the commissioning compliance issue report immediately when the condition is observed.
 - c. Record the commissioning compliance issue report number and describe the deficient condition on the data form.
 - d. Resolve commissioning compliance issues promptly. Complete and submit Part 2 of the commissioning compliance issue report when issues are resolved.
- 6. Diagnose and correct failed test demonstrations as follows:
 - a. Perform diagnostic tests and activities required to determine the fundamental cause of issues observed.
 - b. Record each step of the diagnostic procedure prior to performing the procedure. Update written procedure as changes become necessary.
 - c. Record the results of each step of the diagnostic procedure.
 - d. Record the conclusion of the diagnostic procedure on the fundamental cause of the issue.
 - e. Determine and record corrective measures.
 - f. Include diagnosis of fundamental cause of issues in commissioning compliance issue report.
- 7. Retest:
 - a. Schedule and repeat the complete test procedure for each test demonstration for which acceptable results are not achieved. Obtain signature of Owner's witness on retest data forms. Repeat test demonstration until acceptable results are achieved. Except for issues that are determined to result from design errors or omissions, or other conditions beyond Contractor's responsibility, compensate Owner for direct costs incurred as the result of repeated test demonstrations to achieve acceptable results.
 - b. For each repeated test demonstration, submit a new test data form, marked "Retest."
- 8. Do not correct commissioning compliance issues during test demonstrations.
 - a. Exceptions will be allowed if the cause of the issue is obvious and resolution can be completed in less than **[five]<Insert number>** minutes. If corrections are made under this exception, note the deficient conditions on the test data form and issue a commissioning compliance issue report. A new test data form, marked "Retest," shall be initiated after the resolution has been completed.

3.6 COMMISSIONING MEETINGS

- A. **[Schedule and conduct][Commissioning Authority will schedule and conduct]** commissioning meetings. Comply with requirements in Section 013100 "Project Management and Coordination."

3.7 SEQUENCING

- A. Sequencing of Commissioning Verification Activities: For a particular material, item of equipment, assembly, or system, perform the following in the order listed unless otherwise indicated:
1. Construction Checklists:
 - a. Material checks.
 - b. Installation checks.
 - c. Startup, as appropriate. Some startup may depend on component performance. Such startup may follow component performance tests on which the startup depends.
 - d. Performance Tests:
 - 1) Static tests, as appropriate.
 - 2) Component performance tests. Some component performance tests may depend on completion of startup. Such component performance tests may follow startup.
 - 3) Equipment and assembly performance tests.
 - 4) System performance tests.
 - 5) Intersystem performance tests.
 2. Commissioning tests.
- B. Before performing commissioning tests, verify that materials, equipment, assemblies, and systems are delivered, installed, started, and adjusted to perform according to construction checklists.
- C. Verify readiness of materials, equipment, assemblies, and systems by performing tests prior to performing test demonstrations. Notify Architect if acceptable results cannot be achieved due to conditions beyond Contractor's control or responsibility.
- D. Commence tests as soon as installation checks for materials, equipment, assemblies, or systems are satisfactorily completed. Tests of a particular system may proceed prior to completion of other systems, provided the incomplete work does not interfere with successful execution of test.

3.8 SCHEDULING

- A. Commence commissioning process as early in the construction period as possible.
- B. Commissioning Schedule: Integrate commissioning activities into Construction Schedule. See Section 013200 "Construction Progress Documentation."
1. Include detailed commissioning activities in monthly updated Construction Schedule and short-interval schedule submittals.
 2. Schedule the start date and duration for the following commissioning activities:
 - a. Submittals.
 - b. Preliminary operation and maintenance manual submittals.
 - c. Installation checks.

- d. Startup, where required.
 - e. Performance tests.
 - f. Performance test demonstrations.
 - g. Commissioning tests.
 - h. Commissioning test demonstrations.
3. Schedule shall include a line item for each installation check, startup, and test activity specific to the equipment or systems involved.
 4. Determine milestones and prerequisites for commissioning process. Show commissioning milestones, prerequisites, and dependencies in monthly updated critical-path-method construction schedule and short-interval schedule submittals.
- C. Two-Week Look-Ahead Commissioning Schedule:
1. Two weeks prior to the beginning of tests, submit a detailed two-week look-ahead schedule. Thereafter, submit updated two-week look-ahead schedules weekly for the duration of commissioning process.
 2. Two-week look-ahead schedules shall identify the date, time, beginning location, Contractor personnel required, and anticipated duration for each startup or test activity.
 3. Use two-week look-ahead schedules to notify and coordinate participation of Owner's witnesses.
- D. Owner's Witness Coordination:
1. Coordinate Owner's witness participation via Architect.
 2. Notify Architect of commissioning schedule changes at least **[two]<Insert number>** work days in advance for activities requiring the participation of Owner's witness.

3.9 COMMISSIONING REPORTS

- A. Test Reports:
1. Pre-startup reports include observations of the conditions of installation, organized into the following sections:
 - a. Equipment Model Verification: Compare contract requirements, approved submittals, and provided equipment. Note inconsistencies.
 - b. Preinstallation Physical Condition Checks: Observe physical condition of equipment prior to installation. Note conditions including, but not limited to, physical damage, corrosion, water damage, or other contamination or dirt.
 - c. Preinstallation Component Verification Checks: Verify components supplied with the equipment, preinstalled or field installed, are correctly installed and functional. Verify external components required for proper operation of equipment correctly installed and functional. Note missing, improperly configured, improperly installed, or nonfunctional components.
 - d. Summary of Installation Compliance Issues and Corrective Actions: Identify installation compliance issues and the corrective actions for each. Verify that issues noted have been corrected.
 - e. Evaluation of System Readiness for Startup: For each item of equipment for each system for which startup is anticipated, document in summary form acceptable to Owner completion of equipment model verification, preinstallation physical condition checks, preinstallation component verification checks, and completion of corrective actions for installation compliance issues.
 2. Test data reports include the following:

- a. "As-tested" system configuration. Complete record of conditions under which the test was performed, including, but not limited to, the status of equipment, systems, and assemblies; temporary adjustments and settings; and ambient conditions.
 - b. Data and observations, including, but not limited to, data trend logs, recorded during the tests.
 - c. Signatures of individuals performing and witnessing tests.
 - d. Data trend logs accumulated overnight from the previous day of testing.
3. Commissioning Compliance Issue Reports: Report as commissioning compliance issues results of tests and test demonstrations that do not comply with acceptance criteria. Report only one issue per commissioning compliance issue report. Use sequentially numbered facsimiles of commissioning compliance issue report form included in this Section, or other form approved by Owner. Distribute commissioning compliance issue reports to parties responsible for taking corrective action. Identify the following:
 - a. Commissioning compliance issue report number. Assign unique, sequential numbers to individual commissioning compliance issue reports when they are created, to be used for tracking.
 - b. Action distribution list.
 - c. Report date.
 - d. Test number and description.
 - e. Equipment identification and location.
 - f. Briefly describe observations about the performance associated with failure to achieve acceptable results. Identify the cause of failure if apparent.
 - g. Diagnostic procedure or plan to determine the cause (include in initial submittal)
 - h. Diagnosis of fundamental cause of issues as specified below (include in resubmittal).
 - i. Fundamental cause of unacceptable performance as determined by diagnostic tests and activities.
 - j. When issues have been resolved, update and resubmit the commissioning issue report forms by completing Part 2. Identify resolution taken and the dates and initials of the persons making the entries.
 - k. Schedule for retesting.
4. Weekly progress reports include information for tests conducted since the preceding report and the following:
 - a. Completed data forms.
 - b. Equipment or system tested, including test number, system or equipment tag number and location, and notation about the apparent acceptability of results.
 - c. Activities scheduled but not conducted per schedule.
 - d. Commissioning compliance issue report log.
 - e. Schedule changes for remaining Commissioning-Process Work, if any.
5. Data trend logs shall be initiated and running prior to the time scheduled for the test demonstration.
 - a. Trend log data format shall be multiple data series graphs. Where multiple data series are trend logged concurrently, present the data on a common horizontal time axis. Individual data series may be presented on a segmented vertical axis to avoid interference of one data series with another, and to accommodate different axis scale values. Graphs shall be sufficiently clear to interpret data within the accuracy required by the acceptance criteria.
 - b. Attach to the data form printed trend log data collected during the test or test demonstration.
 - c. Record, print out, and attach to the data form operator activity during the time the trend log is running. During the time the trend log is running, operator intervention not directed by

the test procedure invalidates the test results.

6. System Alarm Logs: Record and print out a log of alarms that occurred since the last log was printed. Evaluate alarms to determine if the previous day's work resulted in any conditions that are not considered "normal operation."
 - a. Conditions that are not considered "normal operation" shall be reported on a commissioning issue report attached to the alarm log. Resolve as necessary. The intent of this requirement is to discover control system points or sequences left in manual or disabled conditions, equipment left disconnected, set points left with abnormal values, or similar conditions that may have resulted from failure to fully restore systems to normal, automatic control after test completion.

3.10 CERTIFICATE OF CONSTRUCTION-PHASE COMMISSIONING PROCESS COMPLETION

- A. When Contractor considers that construction-phase commissioning process, or a portion thereof which Owner agrees to accept separately, is complete, Contractor shall prepare and submit to Owner and Commissioning Authority through Architect a comprehensive list of items to be completed or corrected. Failure to include an item on such list does not alter Contractor's responsibility to compete commissioning process.
- B. On receipt of Contractor's list, Commissioning Authority will make an inspection to determine whether the construction-phase commissioning process or designated portion thereof is complete. If Commissioning Authority's inspection discloses items, whether included on Contractor's list, which is not sufficiently complete as defined in "Construction-Phase Commissioning Process Completion" Paragraph in the "Definitions" Article, Contractor shall, before issuance of the Certificate of Construction-Phase Commissioning Process Completion, complete or correct such items on notification by Commissioning Authority. In such case, Contractor shall then submit a request for another inspection by Commissioning Authority to determine construction-phase commissioning process completion.
- C. Contractor shall promptly correct deficient conditions and issues discovered during commissioning process. Costs of correcting such deficient conditions and issues, including additional testing and inspections, the cost of uncovering and replacement, and compensation for Architect's and Commissioning Authority's services and expenses made necessary thereby, shall be at Contractor's expense.
- D. When construction-phase commissioning process or designated portion is complete, Commissioning Authority will prepare a Certificate of Construction-Phase Commissioning Process Completion that shall establish the date of completion of construction-phase commissioning process. Certificate of Construction-Phase Commissioning Process Completion shall be submitted prior to requesting inspection for determining date of Substantial Completion.

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SECTION 01 91 13 00A - COMMISSIONING OF FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section Includes:

1. Cx process requirements for the following fire-suppression systems, assemblies, and equipment:
 - a. Water-based fire-suppression systems.
 - b. Fire-extinguishing systems.
 - c. Fire pumps.
 - d. Fire-suppression water storage.
 - e. **<Insert additional systems>**.

B. Related Requirements:

1. Section 019113 "General Commissioning Requirements" for general Cx process requirements and CxA responsibilities.
2. For construction checklists, comply with requirements in various Division 21 Sections specifying fire-suppression systems, system components, equipment, and products.

1.2 DEFINITIONS

- A. Cx: Commissioning, as defined in Section 019113 "General Commissioning Requirements."
- B. CxA: Commissioning Authority, as defined in Section 019113 "General Commissioning Requirements."
- C. IgCC: International Green Construction Code.
- D. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fire-suppression testing technician.

B. Construction Checklists:

1. Draft Cx plan, including draft construction checklists to be prepared by CxA under Section 019113 "General Commissioning Requirements." Contractor is to review Construction Checklist in accordance with requirements in Section 019113 "General Commissioning Requirements" and NFPA 3 and to resolve any issues with the CxA.
2. Cx plan, including material, installation, and performance construction checklists for systems, assemblies, subsystems, equipment, and components relating to fire-suppression system to be part of the Cx process and in accordance with requirements in Section 019113 "General Commissioning Requirements" and NFPA 3.



- C. Test Equipment and Instruments: For all test equipment and instruments to be used in conducting Cx tests by Contractor, provide the following:
1. Equipment/instrument identification number.
 2. Planned Cx application or use.
 3. Manufacturer, make, model, and serial number.
 4. Calibration history, including certificates from agencies that calibrate the equipment and instrumentation.
 5. Equipment manufacturers' proprietary instrumentation and tools. For each instrument or tool, identify the following:
 - a. Instrument or tool identification number.
 - b. Equipment schedule designation of equipment for which the instrument or tool is required.
 - c. Manufacturer, make, model, and serial number.
 - d. Calibration history, including certificates from agencies that calibrate the instrument or tool, where appropriate.

1.4 QUALITY ASSURANCE

- A. Fire-Suppression Testing Technician Qualifications: Technicians to perform fire-suppression Construction Checklist verification tests, Construction Checklist verification test demonstrations, Cx tests, and Cx test demonstrations shall have the following minimum qualifications:
1. Journey level or equivalent skill level with knowledge of fire-suppression system, electrical concepts, and building operations.
 2. Minimum **[three years']<Insert time>** experience installing, servicing, and operating systems manufactured by approved manufacturer.
- B. Clean-Agent Fire-Suppression Systems Testing Technician Qualifications: Technicians to perform clean-agent fire-suppression system Construction Checklist verification tests, Construction Checklist verification test demonstrations, Cx tests, and Cx test demonstrations shall have the following minimum qualifications:
1. Journey level or equivalent skill level. Vocational school four-year-program graduate or an Associate's degree in mechanical systems, fire-suppression systems, or similar field. Degree requirement may be offset by three years' experience in servicing fire-suppression systems in the clean-agent fire-suppression systems industry. Generally, required knowledge includes clean-agent fire-suppression systems, electrical concepts, building operations, and application and use of tools and instrumentation to measure performance of fire-suppression system equipment, assemblies, and systems.
 2. Minimum **[three years']<Insert time>** experience installing, servicing, and operating systems manufactured by approved manufacturer.
- C. Testing Equipment and Instrumentation Quality and Calibration:
1. Capable of testing and measuring performance within the specified acceptance criteria.
 2. Be calibrated at manufacturer's recommended intervals with current calibration tags permanently affixed to the instrument being used.
 3. Be maintained in good repair and operating condition throughout duration of use on Project.
 4. Be recalibrated/repared if dropped or damaged in any way since last calibrated.
- D. Proprietary Test Instrumentation and Tools:
1. Equipment Manufacturer's Proprietary Instrumentation and Tools: For installed equipment

included in the Cx process, test instrumentation and tools manufactured or prescribed by equipment manufacturer to service, calibrate, adjust, repair, or otherwise work on its equipment or required as a condition of equipment warranty, shall comply with the following:

- a. Be calibrated by manufacturer with current calibration tags permanently affixed.
- b. Include a separate list of proprietary test instrumentation and tools in operation and maintenance manuals.
- c. Fire-suppression system proprietary test instrumentation and tools become property of Owner at the time of Substantial Completion.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 Cx PROCESS

A. Perform Cx process for fire-suppression system in accordance with the following:

1. Section 019113 "General Commissioning Requirements."
2. NFPA 3.
3. **[IgCC, which requires compliance with ASHRAE 202.]**
4. **[Cx standards acceptable to the authority having jurisdiction.]**
5. **<Insert standard>.**

3.2 CONSTRUCTION CHECKLISTS

A. Preliminary detailed construction checklists are to be prepared under Section 019113 "General Commissioning Requirements" for each fire-suppression system, assembly, subsystem, equipment, and component required to be commissioned, as detailed in NFPA 3 **[and IgCC]<Insert Cx standard>**. Contractor performs the following:

1. Review fire-suppression system preliminary construction checklists and provide written comments on Construction Checklist items where appropriate.
2. Return preliminary Construction Checklist with review comments within **[10]<Insert number>** days of receipt.
3. When review comments have been resolved, the CxA will provide final construction checklists marked "Approved for Use, (date)."
4. Use only construction checklists marked "Approved for Use, (date)" when performing tests. Mark construction checklists in the appropriate place, as indicated Project events are completed, and provide pertinent details and other information.

B. Prepare preliminary detailed construction checklists for each fire-suppression system, assembly, subsystem, equipment, and component required to be commissioned, as detailed in **[NFPA 3][and IgCC]<Insert Cx standard>**.

1. Submit preliminary construction checklists to CxA and Designer for review.
2. When review comments have been resolved, the CxA will provide final construction checklists marked "Approved for Use, (date)."
3. Use only construction checklists marked "Approved for Use, (date)" when performing tests. Mark construction checklists in the appropriate place, as indicated Project events are completed, and provide pertinent details and other information.

C. Systems Required to Be Commissioned under IgCC:

1. Water-pumping and -mixing systems over **5 hp (4 kW)** and purification systems.

D. Additional Systems Required to Be Commissioned:

1. Facility fire-suppression water-distribution piping outside the building, including the following:
 - a. Fire-suppression water piping, fittings, and specialties outside the building.
 - b. Hydrants and fire-department connections.
 - c. Fire-alarm devices.
 - d. Meters and meter pits.
 - e. Outdoor water-storage tanks.
 - f. Sleeves and sleeve seals.
 - g. Meters and gauges.
 - h. General-duty and specialty valves.
 - i. Hangers and supports.
 - j. Heat tracing.
 - k. Vibration isolation[**and seismic restraints**].
 - l. Identification.
 - m. Insulation.
2. Fire-suppression standpipes, including the following:
 - a. Fire-suppression water piping, fittings, and specialties inside the building.
 - b. Fire-department connections.
 - c. Fire pumps, motors, accessories, and controls.
 - d. Pressure-maintenance pumps, motors, accessories, and controls.
 - e. Sleeves and sleeve seals.
 - f. Indoor water-storage tanks.
 - g. Meters and gauges.
 - h. General-duty and specialty valves.
 - i. Hangers and supports.
 - j. Heat tracing.
 - k. Vibration isolation[**and seismic restraints**].
 - l. Identification.
 - m. Insulation.
3. Fire-suppression sprinkler systems, including the following:
 - a. Wet-pipe sprinkler piping, fittings, sprinklers, and specialties.
 - b. Dry-pipe sprinkler piping, fittings, sprinklers, and specialties.
 - c. Pre-action, deluge sprinkler piping, fittings, sprinklers, and specialties.
 - d. Fire pumps, motors, accessories, and controls.
 - e. Pressure-maintenance pumps, motors, accessories, and controls.
 - f. Compressed-air piping, compressors, motors, accessories, and controls.
 - g. Sleeves and sleeve seals.
 - h. Meters and gauges.
 - i. General-duty and specialty valves.
 - j. Hangers and supports.
 - k. Heat tracing.
 - l. Vibration isolation[**and seismic restraints**].
 - m. Identification.
 - n. Insulation.
4. Clean-agent fire-extinguishing systems, including the following:

- a. Piping, fittings, outlets, and specialties.
 - b. Storage tanks, manifolds, mounting devices, controls, and accessories.
 - c. Sleeves and sleeve seals.
 - d. Meters and gauges.
 - e. General-duty and specialty valves.
 - f. Hangers and supports.
 - g. Vibration isolation[**and seismic restraints**].
 - h. Identification.
 - i. Insulation.
5. Documentation:
 - a. Fire-suppression system operating manuals.
 - b. Documentation of required Cx.
 - c. Documentation of required operator training.
6. **<Insert additional systems>.**

3.3 Cx TESTING PREPARATION

- A. Certify that fire-suppression systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating in accordance with the Contract Documents and approved submittals.
- B. Certify that fire-suppression system instrumentation and control systems have been completed and calibrated, that they are operating in accordance with the Contract Documents and approved submittals, and that pretest set points have been recorded.
- C. Set systems, subsystems, and equipment into operating mode to be tested in accordance with approved test procedures (for example, normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

3.4 Cx TEST CONDITIONS

- A. Perform tests using design conditions, whenever possible.
 1. Simulated conditions may, with approval of Architect, be imposed using an artificial load when it is impractical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by CxA, and document simulated conditions and methods of simulation. After tests, return configurations and settings to normal operating conditions.
 2. Cx test procedures may direct that set points be altered when simulating conditions is impractical.
 3. Cx test procedures may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are impractical.
- B. If tests cannot be completed because of a deficiency outside the scope of the fire-suppression system, document the deficiency and report it to Architect. After deficiencies are resolved, reschedule tests.
- C. If seasonal testing is specified, complete appropriate initial performance tests and documentation, and schedule seasonal tests.

3.5 Cx TESTS COMMON TO FIRE-SUPPRESSION SYSTEMS

- A. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment, and components, including operational and control functions, to verify compliance with acceptance criteria.
- B. Test systems, assemblies, subsystems, equipment, and components for operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and response compared to acceptance criteria.
- C. Coordinate schedule with, and perform Cx activities at the direction of, CxA.
- D. Comply with Construction Checklist requirements, including material verification, installation checks, startup, and performance test requirements specified in Division 21 Sections specifying fire-suppression systems and equipment.
- E. Provide technicians, instrumentation, tools, and equipment to perform and document the following:
 - 1. Cx Construction Checklist verification tests.
 - 2. Cx Construction Checklist verification test demonstrations.

3.6 CONSTRUCTION CHECKLIST EXAMPLES

- A. Vibration Isolation in Fire-Suppression Systems:
 - 1. Prerequisites: Acceptance of results of construction checklists for vibration[**and seismic**] control devices specified in **[Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."][Section 210548.13 "Vibration Controls for Fire-Suppression Piping and Equipment."]**
 - 2. Components to Be Tested:
 - a. Vibration isolation control devices in water-based fire-suppression systems.
 - b. **[Seismic control devices for proper device selection and installation.]**
 - c. Support systems.
 - 3. Test Purpose: Evaluate effectiveness of vibration isolation[**and proper installation of seismic**] control devices.
 - 4. Test Conditions: Measure vibration of the facility structure at **[three]<Insert number>** locations designated by Owner's witness while the isolated equipment operates.
 - a. Maximum speed.
 - b. Minimum speed.
 - c. Critical speed.
 - 5. Acceptance Criteria: Structure-borne vibration not to exceed specified performance.
- B. Supervision of Fire-Protection Valves in Water-Based Fire-Suppression Systems:
 - 1. Prerequisites: Acceptance of results of construction checklists for valves specified in the following Sections:
 - a. Section 210523 "General-Duty Valves for Water-Based Fire Protection Piping."
 - b. Section 211000 "Water-Based Fire-Suppression Systems."
 - c. Section 284600 "Fire Detection and Alarm."

- d. Section 284614 "Single- and Multiple-Station Alarms."
 - e. Section 331415 "Site Water Distribution Piping."
2. Equipment and Systems to Be Tested:
- a. Supervised valves in water-based fire-suppression systems.
 - b. Division 28 fire-detection and -alarm systems.
3. Test Purpose: Verify generation of supervisory alarm at the fire-alarm control panel in response to activation of valve supervision device or tamper switch.
4. Test Conditions:
- a. Fire-alarm system operating in normal, automatic mode.
 - b. Activate valve supervision devices and tamper switches, one at a time.
5. Acceptance Criteria: Activation of valve supervision device or tamper switch generates supervisory alarm at fire-alarm control panel.
- C. Heat Tracing in Water-Based Fire-Suppression Systems:
1. Prerequisites: Acceptance of results of construction checklists for heat tracing specified in water-based fire-suppression systems. Comply with requirements in Section 210533 "Heat Tracing for Fire-Suppression Piping."
2. Equipment and Systems to Be Tested:
- a. Self-regulating, parallel-resistance heating cables.
 - b. Heater trace circuit controller.
 - c. Interface with fire-alarm control panel.
3. Test Purpose:
- a. Evaluate response to ambient temperature below freeze-protection set point.
 - b. Evaluate heating cable fault alarm.
4. Test Conditions:
- a. Subject temperature sensor to temperature approximately [3 deg F (2 deg C)]<Insert value> above freeze-protection set point (initial set point [41 deg F (5 deg C)]<Insert value>). Monitor sensed temperature with a calibration-grade thermometer. Gradually change set point or sensed temperature until freeze-protection circuit is energized.
 - b. Subject temperature sensor to temperature approximately [3 deg F (2 deg C)]<Insert value> below freeze-protection set point (initial set point [41 deg F (5 deg C)]<Insert value>). Monitor sensed temperature with a calibration-grade thermometer. Gradually change set point or sensed temperature until freeze-protection circuit is de-energized.
 - c. Simulate an electrical fault on the heating cable.
5. Acceptance Criteria:
- a. Freeze-protection circuit is energized at set-point temperature of minus 2 deg F (1 deg C).
 - b. Freeze-protection circuit is de-energized at set-point temperature of plus 2 deg F (1 deg C).
 - c. Heater trace circuit controller initiates an alarm of cable fault. Alarm is correctly reported at the fire-alarm control panel.

3.7 Cx TESTS FOR DRY-PIPE SPRINKLER PIPING, FITTINGS, SPRINKLERS, AND SPECIALTIES

A. Air Compressor Run Time:

1. Prerequisites: Acceptance of results of construction checklists specified in Section 211316 "Dry-Piping Sprinkler Systems."
2. Systems and Equipment to Be Tested:
 - a. Air compressors in fire-suppression systems.
 - b. Associated compressed air piping, valves, and appurtenances.
 - c. Associated air pressure controllers.
3. Test Purpose: Evaluate air compressor run time and number of compressor starts.
4. Test Conditions:
 - a. Keep compressed air and associated sprinkler piping openings closed during test.
 - b. For systems with multiple compressors, lock out compressor motors on all but one compressor. Repeat test for each compressor in turn.
 - c. Record number of air compressor motor starts during a 14-day period.
 - d. Record air compressor motor run time during the same 14-day period.
5. Acceptance Criteria:
 - a. Number of compressor motor starts during test period shall not exceed **[20]<Insert number>**.
 - b. Compressor motor run time during test period shall not exceed **[60 minutes]<Insert time>**.

3.8 Cx TESTS FOR CLEAN-AGENT FIRE-EXTINGUISHING SYSTEMS

A. Carbon-Dioxide Concentration in Carbon-Dioxide Fire-Extinguishing System:

1. Prerequisites:
 - a. Acceptance of results of construction checklists specified in Section 212113.13 "High-Pressure, Carbon-Dioxide Fire-Extinguishing Systems."
 - b. Acceptance of results of construction checklists specified in Section 212113.16 "Low-Pressure, Carbon-Dioxide Fire-Extinguishing Systems."
 - c. Acceptance of construction checklists specified in Division 23 for systems and equipment serving the protected space.
 - d. Partitions, ceilings, doors, and other openings complete in the vicinity of the protected space.
2. Systems and Equipment to Be Tested:
 - a. High-pressure, carbon-dioxide fire-extinguishing systems.
 - b. Low-pressure, carbon-dioxide fire-extinguishing systems.
 - c. Protected space enclosure.
 - d. HVAC system protected space isolation equipment.
3. Test Purpose: Evaluate initial and final carbon-dioxide concentration in the protected space following carbon-dioxide release.
4. Test Conditions:

- a. HVAC systems operating in normal, occupied, automatic control.
 - b. Fire-detection and -alarm systems operating in normal, occupied, automatic control.
 - c. Carbon-dioxide fire-extinguishing system charged and operating in normal, occupied, automatic control.
 - d. Protected space air temperature is **70 deg F (21 deg C)**.
 - e. Create a fire-alarm event in the carbon-dioxide protected space, resulting in discharge of carbon-dioxide fire-extinguishing system.
 - f. Measure and record carbon-dioxide concentration at **[four]<Insert number>** locations selected by the CxA when the carbon dioxide is completely dispersed and at the end of holding time.
 5. Acceptance Criteria: Carbon-dioxide concentration is no less than **[34]<Insert number>** percent concentration by volume at **70 deg F (21 deg C)**.
- B. Clean-Agent Concentration in Clean-Agent Fire-Extinguishing System:
1. Prerequisites:
 - a. Acceptance of results of construction checklists for Section 212200 "Clean-Agent Fire-Extinguishing Systems."
 - b. Acceptance of construction checklists specified in Division 23 for systems and equipment serving the protected space.
 - c. Partitions, ceilings, doors, and other openings complete in the vicinity of the protected space.
 2. Systems and Equipment to Be Tested:
 - a. Clean-agent fire-extinguishing systems.
 - b. HVAC system protected space isolation equipment.
 - c. Protected space enclosure.
 3. Test Purpose: Evaluate initial and final clean-agent concentration in the protected space following carbon-dioxide release.
 4. Test Conditions:
 - a. HVAC systems operating in normal, occupied, automatic control.
 - b. Fire-detection and -alarm systems operating in normal, occupied, automatic control.
 - c. Clean-agent fire-extinguishing system charged and operating in normal, occupied, automatic control.
 - d. Protected space air temperature is **70 deg F (21 deg C)**.
 - e. Create a fire-alarm event in the clean-agent protected space, resulting in discharge of clean-agent fire-extinguishing system.
 - f. Measure and record clean-agent concentration at **[four]<Insert number>** locations selected by the CxA when the clean agent is completely dispersed and at the end of holding time.
 5. Acceptance Criteria: Clean-agent concentration is no less than **[34]<Insert number>** percent concentration by volume at **70 deg F (21 deg C)**.

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01 - General Requirements

Task	Specification	Specification Description
01 00 00 00MOD00001 00 00 00		General Requirements



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02 - Existing Conditions

Task	Specification	Specification Description
02 32 00 00	01 11 19 00	No Specification Required
02 32 13 00	01 11 19 00	No Specification Required
02 32 19 00	01 11 19 00	No Specification Required
02 41 13 13	02 41 19 00	Selective Demolition



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SECTION 02 41 16 00 - STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section Includes:

1. Demolition and removal of buildings or structures.
2. Demolition and removal of site improvements.
3. Abandoning in-place below-grade construction.
4. Removing below-grade construction.
5. Disconnecting, capping or sealing, and abandoning in-place site utilities.
6. Disconnecting, capping or sealing, and removing site utilities.
7. Salvaging items for reuse by Owner.

B. Related Requirements:

1. Section 011000 "Summary" for use of the premises and phasing requirements.
2. Section 013200 "Construction Progress Documentation" for preconstruction photographs taken before building demolition.
3. Section 024119 "Selective Demolition" for partial demolition of buildings, structures, and site improvements.
4. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade site improvements that are not part of building demolition.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner as indicated. Include fasteners or brackets needed for reattachment elsewhere.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 COORDINATION

- A. Arrange demolition schedule so as not to interfere with **[Owner's on-site operations][or][operations of adjacent occupied buildings]**.

1.5 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at **[Project site]**.
 - 1. Inspect and discuss condition of construction to be demolished.
 - 2. Review structural load limitations of existing structures.
 - 3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review and finalize protection requirements.
 - 5. Review procedures for **[noise control][and][dust control]**.
 - 6. Review procedures for protection of adjacent buildings.
 - 7. Review storage, protection, and accounting for items to be salvaged and returned to Owner.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Statements: For **[refrigerant recovery technician][specialty demolition contractor]**.
- B. Engineering Survey: Submit engineering survey of condition of building.
- C. Survey of Existing Conditions: Submit survey.
- D. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property[, **for environmental protection**][, **for dust control**][and][, **for noise control**]. Indicate proposed locations and construction of barriers.
 - 1. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain[**including means of egress from those buildings**].
- E. Schedule of Building Demolition Activities: Indicate the following:
 - 1. Detailed sequence of demolition work, with starting and ending dates for each activity.
 - 2. Temporary interruption of utility services. Indicate how long services will be interrupted.
 - 3. Coordination for shutoff and capping[**or re-routing**] of utility services.
- F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed in accordance with EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: **[Type I][Type II][Type III][Universal]** certified by an EPA-approved certification program.
- B. Specialty Demolition Contractor Qualifications: A competent person **[licensed by the authority having jurisdiction]**, who has training, knowledge, or experience in the use of each type of blasting method used and in the field of transporting, storing, handling, and using explosives; and has a working

knowledge of state and local laws and regulations pertaining to explosives.

1.9 FIELD CONDITIONS

- A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
- B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
 - 1. Provide not less than **[72]** hours' notice of activities that will affect operations of adjacent occupied buildings.
 - 2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
 - a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
- C. Conditions existing at time of inspection for bidding purpose will be maintained the Owner as far as practical.
- D. Hazardous Materials:
 - 1. It is not expected that hazardous materials will be encountered in the Work.
 - a. Hazardous materials will be removed by Owner before start of the Work.
 - b. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify the Owner. Hazardous materials will be removed by Owner under a separate contract.
 - 2. Hazardous materials are present in buildings and structures to be demolished. A report on the presence of hazardous materials is **[on file][included in Section 003126 "Existing Hazardous Material Information"]** for review and use. Examine report to become aware of locations where hazardous materials are present.
 - a. The Owner will provide material safety data sheets for hazardous materials that are known to be present in buildings and structures to be demolished because of building operations or processes performed there.
- E. On-site sale of removed items or materials is not permitted.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

2.2 SOIL MATERIALS

- A. Satisfactory Soils: Comply with requirements in Section 312000 "Earth Moving."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. **[Perform][Engage a professional engineer to perform]** an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.
- D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video[, **measured drawings**][and][**templates**]. Comply with Section 013233 "Photographic Documentation."
 - 1. Inventory and record the condition of items to be removed and salvaged. Photograph or video conditions that might be misconstrued as damage caused by removal.
 - 2. Photograph or video existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by demolition operations or removal of items for salvage.

3.2 PREPARATION

- A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
- B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of demolition.
- C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 015000 "Temporary Facilities and Controls."
 - 1. Protect adjacent buildings and facilities from damage due to demolition activities.
 - 2. Protect existing site improvements, appurtenances, and landscaping to remain.
 - 3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.

4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
 6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
 7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.
- D. Existing Utilities to Remain: Maintain utility services to remain and protect against damage during demolition operations.
1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
 2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.
 - a. Provide at least **[72]** hours' notice to occupants of affected buildings if shutdown of service is required during changeover.
- E. Existing Utilities to Be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.
1. Owner will arrange to shut off utilities when requested by Contractor.
 2. Arrange to shut off utilities with utility companies.
 3. If disconnection of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
 4. Cut off pipe or conduit a minimum of **[24 inches]** below grade at or outside the building or structure to be demolished and cap, valve, or plug and seal remaining portion of pipe or conduit **[after bypassing]** in accordance with requirements of authorities having jurisdiction.
 5. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing by authorities having jurisdiction.
- F. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment in accordance with 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 SALVAGE

- A. Items to be removed and salvaged are indicated **[on Drawings.][below:]**
1. Doors and door hardware.
 2. Windows.
 3. Cabinets.
 4. Mirrors.
 5. Tackboards.
 6. White boards.
 7. Plumbing fixtures.
- B. Comply with the following for salvaged items:
1. Clean salvaged items of dirt and demolition debris.
 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.

3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area [**designated by Owner**][**indicated on Drawings**].
5. Protect items from damage during transport and storage.

3.4 DEMOLITION, GENERAL

- A. General: Demolish indicated buildings[**and site improvements**] completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
 1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
 2. Maintain adequate ventilation when using cutting torches.
 3. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
 2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- C. Explosives: Use of explosives is not permitted.

3.5 DEMOLITION BY EXPLOSIVES

- A. Explosives: Perform explosive demolition operations in accordance with ANSI/ASSP A10.7 and regulations of authorities having jurisdiction.
 1. Obtain written permission from authorities having jurisdiction before bringing explosives to, or using explosives on, Project site.
 2. Do not damage adjacent structures, property, or site improvements when using explosives.
- B. Comply with recommendation in specialty explosives consultant's report.

3.6 DEMOLITION BY MECHANICAL MEANS

- A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Below-Grade Construction:

1. Abandon foundation systems and other below-grade construction. Cut below-grade construction flush with grade.
2. Demolish foundation systems and other below-grade construction that are within footprint of new construction and extending [5 ft.] outside footprint indicated for new construction. Abandon below-grade construction outside this area.
 - a. Remove below-grade construction, including basements, foundation systems, and footings, **[completely][to at least 6 inches below grade][to at least 12 inches below grade][to depths indicated]**.
3. Demolish foundation systems and other below-grade construction.
 - a. Remove below-grade construction, including basements, foundation systems, and footings, **[completely][to at least 6 inches below grade][to at least 12 inches below grade][to depths indicated]**.

D. Existing Utilities:

1. Abandon existing utilities and below-grade utility structures. Cut utilities flush with grade.
2. Demolish existing utilities and below-grade utility structures that are within [5 ft.] outside footprint indicated for new construction. Abandon utilities outside this area.
 - a. Fill abandoned utility structures with **[satisfactory soil materials][recycled pulverized concrete]** in accordance with backfill requirements in Section 312000 "Earth Moving."
3. Demolish and remove existing utilities and below-grade utility structures.

E. Hydraulic Elevator Systems: Demolish and remove elevator system, including cylinder, plunger, well assembly, steel well casing and liner, oil supply lines, and tanks.

3.7 SITE RESTORATION

A. Below-Grade Areas:

1. Rough grade below-grade areas ready for further excavation or new construction.
2. Completely fill below-grade areas and voids resulting from building demolition operations with **[satisfactory soil materials][recycled pulverized concrete][recycled pulverized masonry]** in accordance with backfill requirements in Section 312000 "Earth Moving."

B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.8 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.9 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site **[and dispose of them in an EPA-approved**



construction and demolition waste landfill acceptable to authorities having jurisdiction.][and recycle or dispose of them in accordance with Section 017419 "Construction Waste Management and Disposal."]

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

3.10 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

1. Clean roadways of debris caused by debris transport.

END OF SECTION 02 41 16 00

SECTION 02 41 16 13 - BUILDING DEMOLITION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for building demolition. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes the following:
 - a. Demolition and removal of buildings and site improvements.
 - b. Abandoning in place **OR** Removing, **as directed**, below-grade construction.
 - c. Disconnecting, capping or sealing, and abandoning in-place **OR** removing, **as directed**, site utilities.
 - d. Salvaging items for reuse by the Owner.

C. Definitions

1. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged.
2. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to the Owner ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.

D. Materials Ownership

1. Unless otherwise indicated, demolition waste becomes property of Contractor.
2. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to the Owner that may be uncovered during demolition remain the property of the Owner.
 - a. Carefully salvage in a manner to prevent damage and promptly return to the Owner.

E. Informational Submittals

1. Qualification Data: For refrigerant recovery technician.
2. Proposed Protection Measures: Submit informational report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control, **as directed**. Indicate proposed locations and construction of barriers.
 - a. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain.
3. Schedule of Building Demolition Activities: Indicate the following:
 - a. Detailed sequence of demolition work, with starting and ending dates for each activity.
 - b. Temporary interruption of utility services.
 - c. Shutoff and capping or re-routing of utility services.
4. Inventory: Submit a list of items to be removed and salvaged and deliver to the Owner prior to start of demolition.
5. Predemolition Photographs **OR** Video, **as directed**: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by building demolition operations. Submit before the Work begins.
6. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
7. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that



recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

F. Quality Assurance

1. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
2. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
3. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.
4. Predemolition Conference: Conduct conference at Project site.
 - a. Inspect and discuss condition of construction to be demolished.
 - b. Review structural load limitations of existing structures.
 - c. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - d. Review and finalize protection requirements.
 - e. Review procedures for noise control and dust control.
 - f. Review procedures for protection of adjacent buildings.
 - g. Review items to be salvaged and returned to the Owner.

G. Project Conditions

1. Buildings to be demolished will be vacated and their use discontinued before start of the Work.
2. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
 - a. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
 - b. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
 - 1) Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
3. the Owner assumes no responsibility for buildings and structures to be demolished.
 - a. Conditions existing at time of inspection for bidding purpose will be maintained by the Owner as far as practical.
 - b. Before building demolition, the Owner will remove certain items, as directed by the Owner.
4. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - a. Hazardous materials will be removed by the Owner before start of the Work.
 - b. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and the Owner. Hazardous materials will be removed by the Owner under a separate contract.

OR

Hazardous Materials: Hazardous materials are present in buildings and structures to be demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

- a. Hazardous material remediation is specified elsewhere in the Contract Documents.
 - b. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
 - c. the Owner will provide safety data sheets for materials that are known to be present in buildings and structures to be demolished because of building operations or processes performed there.
5. On-site storage or sale of removed items or materials is not permitted.

H. Coordination

1. Arrange demolition schedule so as not to interfere with the Owner's on-site operations **OR** operations of adjacent occupied buildings, **as directed**.

1.2 PRODUCTS

A. Soil Materials

1. Satisfactory Soils: Satisfactory Soils: For soils which is to be used for backfilling voids that result from demolition operations in below-grade areas, comply with requirements in Division 31 Section "Earth Moving".

1.3 EXECUTION

A. Examination

1. Verify that utilities have been disconnected and capped before starting demolition operations.
2. Review Project Record Documents of existing construction provided by the Owner. the Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
3. Inventory and record the condition of items to be removed and salvaged. Provide photographs **OR** video, **as directed**, of conditions that might be misconstrued as damage caused by salvage operations.
4. Perform **OR** Engage a professional engineer to perform, **as directed**, an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.
 - a. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
5. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

B. Preparation

1. Refrigerant: Remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction before starting demolition.
2. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.
 - a. the Owner will arrange to shut off indicated utilities when requested by Contractor.
OR
Arrange to shut off indicated utilities with utility companies, **as directed**.
 - b. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
 - c. Cut off pipe or conduit a minimum of 24 inches (610 mm) below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.**OR**
Existing Utilities: Refer to Division 22 & Division 26 for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing, **as directed**.
3. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
 - a. Strengthen or add new supports when required during progress of demolition.
4. Salvaged Items: Comply with the following:
 - a. Clean salvaged items of dirt and demolition debris.
 - b. Pack or crate items after cleaning. Identify contents of containers.
 - c. Store items in a secure area until delivery to the Owner.
 - d. Transport items to storage area designated by the Owner **OR** indicated on Drawings, **as directed**.
 - e. Protect items from damage during transport and storage.



C. Protection

1. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
2. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.
 - a. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by the Owner and authorities having jurisdiction.
 - b. Provide temporary services during interruptions to existing utilities, as acceptable to the Owner and authorities having jurisdiction.
 - 1) Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.
3. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction, and as indicated. Comply with requirements in Division 1 Section "Temporary Facilities And Controls".
 - a. Protect adjacent buildings and facilities from damage due to demolition activities.
 - b. Protect existing site improvements, appurtenances, and landscaping to remain.
 - c. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
 - d. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - e. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
 - f. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
 - g. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.
4. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

D. Demolition, General

1. General: Demolish indicated existing buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - a. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
 - b. Maintain fire watch during and for a specified time after flame cutting operations as directed by the Owner.
 - c. Maintain adequate ventilation when using cutting torches.
 - d. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
2. Engineering Surveys: During demolition, perform surveys to detect hazards that may result from building demolition activities.
3. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - a. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from the Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
 - b. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
4. Explosives: Use of explosives is not permitted, **unless directed otherwise**.

E. Demolition By Mechanical Means

1. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 - a. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
3. Salvage: Items to be salvaged are indicated on Drawings **OR** below, **as directed**:
 - a. Doors and door hardware.
 - b. Windows.
 - c. Cabinets.
 - d. Mirrors.
 - e. Chalkboards.
 - f. Tackboards.
 - g. Marker boards.
 - h. Plumbing fixtures.
 - i. Other items as directed.
4. Below-Grade Construction: Abandon foundation walls and other below-grade construction. Cut below-grade construction flush with grade.

OR

Below-Grade Construction: Demolish foundation walls and other below-grade construction that are within footprint of new construction and extending 5 feet (1.5 m) outside footprint indicated for new construction. Abandon below-grade construction outside this area.

 - a. Remove below-grade construction, including basements, foundation walls, and footings, completely **OR** to at least 6 inches (150 mm) below grade **OR** to at least 12 inches (300 mm) below grade **OR** to depths indicated, **as directed**.

OR

Below-Grade Construction: Demolish foundation walls and other below-grade construction.

 - b. Remove below-grade construction, including basements, foundation walls, and footings, completely **OR** to at least 6 inches (150 mm) below grade **OR** to at least 12 inches (300 mm) below grade **OR** to depths indicated, **as directed**.
5. Existing Utilities: Abandon existing utilities and below-grade utility structures. Cut utilities flush with grade.

OR

Existing Utilities: Demolish existing utilities and below-grade utility structures that are within 5 feet (1.5 m) outside footprint indicated for new construction. Abandon utilities outside this area.

 - a. Fill abandoned utility structures with satisfactory soil materials **OR** recycled pulverized concrete, **as directed**, according to backfill requirements in Division 31 Section "Earth Moving".
 - b. Piping: Disconnect piping at unions, flanges, valves, or fittings.
 - c. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

OR

Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.

 - a. Piping: Disconnect piping at unions, flanges, valves, or fittings.
 - b. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

F. Demolition By Explosives – ONLY IF APPROVED BY THE OWNER

1. Explosives: Perform explosive demolition according to governing regulations.
 - a. Obtain written permission from authorities having jurisdiction before bringing explosives to, or using explosives on, Project site.
 - b. Do not damage adjacent structures, property, or site improvements when using explosives.
2. Comply with recommendation in Explosives Consultant's report.



- G. Site Restoration
 - 1. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.
OR
Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials **OR** recycled pulverized concrete **OR** recycled pulverized masonry, **as directed**, according to backfill requirements in Division 31 Section "Earth Moving".
 - 2. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.
- H. Repairs
 - 1. Promptly repair damage to adjacent buildings caused by demolition operations.
- I. Disposal Of Demolished Materials
 - 1. Remove demolition waste materials from Project site and legally dispose of them in EPA approved landfill acceptable to authorities having jurisdiction. See Division 1 Section "Construction Waste Management And Disposal" for recycling and disposal of demolition waste.
 - a. Do not allow demolished materials to accumulate on-site.
 - b. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 2. Do not burn demolished materials.
- J. Cleaning
 - 1. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.
 - a. Clean roadways of debris caused by debris transport.

END OF SECTION 02 41 16 13



Task	Specification	Specification Description
02 41 16 13	02 41 16 00	Structure Demolition
02 41 16 13	02 41 19 00	Selective Demolition



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SECTION 02 41 19 00 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section Includes:

1. Demolition and removal of selected portions of exterior or interior of building or structure and site elements.
2. Removal and salvage of existing items for delivery to Owner and removal of existing items for reinstallation.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
3. Section 017300 "Execution" for cutting and patching procedures.
4. Section 013516 "Alteration Project Procedures" for general protection and work procedures for alteration projects.
5. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.
6. Section 330500 "Common Work Results for Utilities" for removal of site utility systems piping, equipment, and components.

1.2 DEFINITIONS

- A. Remove:** Detach items from existing construction and legally dispose of off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage:** Detach items from existing construction, in a manner to prevent damage, and deliver to Owner as indicated.
- C. Remove and Reinstall:** Detach items from existing construction, in a manner to prevent damage; prepare for reuse; and reinstall where indicated.
- D. Existing to Remain:** Existing items of construction that are not to be removed.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.**
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.**
1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

1.5 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at **[Project site]**.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.
 - 6. Review and finalize protection requirements.
 - 7. Review procedures for **[noise control][and][dust control]**.
 - 8. Review storage, protection, and accounting for items to be removed for salvage or reinstallation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Statements: For refrigerant recovery technician.
- B. Engineering Survey: Submit engineering survey of condition of building.
- C. Survey of Existing Conditions: Submit survey.
- D. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property[, **for environmental protection**][, **for dust control**][and][, **for noise control**]. Indicate proposed locations and construction of barriers.
- E. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Temporary interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed in accordance with EPA regulations. Include name and address of technician and date refrigerant was recovered.
- G. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: **[Type I][Type II][Type III][Universal]** certified by an EPA-approved certification program.

1.9 FIELD CONDITIONS

- A. Owner will **[not]** occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by the Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials:
 - 1. It is not expected that hazardous materials will be encountered in the Work.
 - a. Hazardous materials will be removed by Owner before start of the Work.
 - b. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
 - 2. Hazardous materials are present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is **[on file][included in Section 003126 "Existing Hazardous Material Information"]** for review and use. Examine report to become aware of locations where hazardous materials are present.
 - a. The Owner will provide material safety data sheets for hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.
- E. Historic Areas: Demolition and hauling equipment and other materials to be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by **[12 inches]** or more.
- F. On-site sale of removed items or materials is not permitted.

1.10 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.

- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.
- C. Sustainable Design Requirements for Building Reuse:
 - 1. Maintain the existing building structure, envelope, and interior nonstructural elements of an abandoned or blighted building. Do not demolish such existing construction beyond indicated limits.
 - 2. Maintain the existing building structural systems where indicated to remain. Do not demolish such existing construction beyond indicated limits.
 - 3. Maintain the existing interior ceilings, interior partitions, and/or demountable walls where indicated to remain. Do not demolish such existing construction beyond indicated limits.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. **[Perform][Engage a professional engineer to perform]** an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video[, **measured drawings**][and][**templates**]. Comply with Section 013233 "Photographic Documentation."
 - 1. Inventory and record the condition of items to be removed for salvage or reinstallation. Photograph or video conditions that might be misconstrued as damage caused by removal.

2. Photograph or video existing conditions of adjoining construction including finish surfaces, that might be misconstrued as damage caused by selective demolition operations or removal of items for salvage or reinstallation.

3.2 PREPARATION

- A. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 1. Strengthen or add new supports when required during progress of selective demolition.
- B. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location[**and cleaned**] and reinstalled in their original locations after selective demolition operations are complete.
- D. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment in accordance with 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND BUILDING SYSTEMS

- A. Existing Services/Systems to Remain: Maintain utilities and building systems and equipment to remain and protect against damage during selective demolition operations.
 1. Maintain fire-protection facilities in service during selective demolition operations.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utilities and building systems serving areas to be selectively demolished.
 1. Owner will arrange to shut off indicated utilities when requested by Contractor.
 2. Arrange to shut off utilities with utility companies.
 3. If disconnection of utilities and building systems will affect adjacent occupied parts of the building, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to those parts of the building.
 4. Demolish and remove existing building systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug

- remaining piping with same or compatible piping material.
 - b. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment and components.
- 5. Abandon existing building systems, equipment, and components indicated on Drawings to be abandoned in place.
 - a. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - b. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.
- 6. Remove and reinstall/salvage existing building systems, equipment, and components indicated on drawings to be removed and reinstalled or removed and salvaged:
 - a. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment and components; when appropriate, reinstall, reconnect, and make equipment operational.
 - b. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and components and deliver to Owner.

3.4 SALVAGE/REINSTALL

A. Removed and Salvaged Items:

- 1. Clean salvaged items.
- 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
- 3. Store items in a secure area until delivery to Owner.
- 4. Transport items to Owner's storage area **[on-site][off-site][designated by Owner][indicated on Drawings]**.
- 5. Protect items from damage during transport and storage.

B. Removed and Reinstalled Items:

- 1. Clean and repair items to functional condition adequate for intended reuse.
- 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
- 3. Protect items from damage during transport and storage.
- 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.

2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 5. Maintain adequate ventilation when using cutting torches.
 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
 2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- C. Work in Historic Areas: Selective demolition may be performed only in areas of Project that are not designated as historic. In historic spaces, areas, and rooms, or on historic surfaces, the terms "demolish" or "remove" to mean historic "removal" or "dismantling" as specified in Section 024296 "Historic Removal and Dismantling."

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete:
1. Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least **3/4 inch** at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
 2. Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive in accordance with recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." [**Do not use methods requiring solvent-based adhesive strippers.**]
- E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so

that building interior remains watertight and weathertight.

1. Remove existing roof membrane, flashings, copings, and roof accessories.
2. Remove existing roofing system down to substrate.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site **[and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.][and recycle or dispose of them in accordance with Section 017419 "Construction Waste Management and Disposal."]**
 1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
 4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

3.8 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 41 19 00

SECTION 02 41 19 13 - CUTTING AND PATCHING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for cutting and patching. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Summary

1. This Section includes procedural requirements for cutting and patching.

C. Definitions

1. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
2. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

D. Submittals

1. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - a. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - b. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - c. Products: List products to be used and firms or entities that will perform the Work.
 - d. Dates: Indicate when cutting and patching will be performed.
 - e. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.
 - f. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
 - g. the Owner's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

E. Quality Assurance

1. LEED Requirements for Building Reuse:
 - a. Credit MR 1.1 and 1.2, **as directed**: Maintain existing building structure (including structural floor and roof decking) and envelope (exterior skin and framing, excluding window assemblies and nonstructural roofing material) not indicated to be removed; do not cut such existing construction beyond indicated limits.
 - b. Credit MR 1.3: Maintain existing interior nonstructural elements (interior walls, doors, floor coverings, and ceiling systems) not indicated to be removed; do not cut such existing construction beyond indicated limits.
 - c. Credit MR 1.2 and 1.3, **as directed**: Maintain existing nonshell, nonstructural components (walls, flooring, and ceilings) not indicated to be removed; do not cut such existing construction beyond indicated limits.

2. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
 - a. **Refer to the Owner for list of elements that might otherwise be overlooked as structural elements and that require Architect's or Construction Manager's approval of a cutting and patching proposal.**
3. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:
 - a. Primary operational systems and equipment.
 - b. Air or smoke barriers.
 - c. Fire-suppression systems.
 - d. Mechanical systems piping and ducts.
 - e. Control systems.
 - f. Communication systems.
 - g. Conveying systems.
 - h. Electrical wiring systems.
 - i. Operating systems of special construction in Division 13.
4. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Exterior curtain-wall construction.
 - d. Equipment supports.
 - e. Piping, ductwork, vessels, and equipment.
 - f. Noise- and vibration-control elements and systems.
5. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
6. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

F. Warranty

1. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

1.2 PRODUCTS

A. Materials

1. General: Comply with requirements specified in other Sections.
2. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - a. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

1.3 EXECUTION

A. Preparation

1. Temporary Support: Provide temporary support of Work to be cut.
2. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
3. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
4. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize **OR** prevent, **as directed**, interruption to occupied areas.

B. Performance

1. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - a. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
2. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - a. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - b. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - c. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - d. Excavating and Backfilling: Comply with requirements in applicable Division 31 where required by cutting and patching operations.
 - e. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - f. Proceed with patching after construction operations requiring cutting are complete.
3. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
 - a. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 - b. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - 1) Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - 2) Restore damaged pipe covering to its original condition.
 - c. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - 1) Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.



02 - Existing Conditions

- d. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
- e. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- 4. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 02 41 19 13



Task	Specification	Specification Description
02 41 19 13	02 41 19 00	Selective Demolition
02 41 19 16	02 41 19 00	Selective Demolition
02 42 21 35	02 41 19 00	Selective Demolition
02 42 21 47	02 41 19 00	Selective Demolition
02 43 13 00	01 11 19 00	No Specification Required
02 43 13 13	01 11 19 00	No Specification Required



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SECTION 02 58 13 00 - SNOW FENCING

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of snow and other temporary fencing. Products shall match existing materials and/or shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: For each type of product indicated.
2. Shop drawings shall be submitted for approval.

1.2 PRODUCTS

A. Pickets:

1. Size: Wood pickets shall be 3/8 inch thick, 1-1/2 inches wide, and 48 inches high.
2. Coating: Red oil paint or stain.
3. Spacing: Approximately 2 inches apart.
4. Attachment: Bind together with 3 double strands of wire.

B. Framework:

1. Materials: Wire shall be 13 ga. galvanized steel, complying with ASTM A 641.
2. Types: The framework shall consist of 3 parallel double strands of wire twisted between pickets to hold them securely in place.
3. Wire Connectors: Wire for attaching fabric to metal posts shall be 9 ga.
4. Staples and Nails shall comply with Fed. Spec. FF-N-105. Staples and nails shall be zinc-coated and of sufficient length for purpose required.

C. Gates:

1. Frame: Frame shall consist of 2 parallel horizontal wooden members with pickets attached at two-inch spacing.
2. Bracing: 2 wooden members laced diagonally on the gate between the frame boards.
3. Hardware shall include 2 strap hinges, latching device, and stop bar, all of zinc-coated steel, in compliance with ASTM A 153.

D. Supports:

1. Steel: Line posts and uprights shall be drive type, T sections, and provided with suitable anchor plate. The sections shall be hot-rolled steel complying with ASTM A 702, galvanized in compliance with ASTM A 123. The T sections shall have the following minimum sizes:

Post Length (Feet) Post Weight (Pounds)

5	7.32
5 1/2	7.99
6	8.65
6 1/2	9.32
7	9.98
7 1/2	10.64
8	11.31
9	12.64
10	13.97

2. Wood: Posts shall be cut from cedar, Douglas fir, pine, or other approved species of timber. Posts shall be peeled, treated, dressed, and cured. All wood posts and braces shall be given a pressure preservative treatment in a closed retort. The treatment shall comply with Fed. Spec. TT-W-571. Wood cut or sawed after treatment shall have the cut surfaces well brush-coated with the preservative used in the treatment.
3. Braces: Steel braces shall have same configuration as line posts and uprights without the anchor plate. Wood braces shall be treated No. 2 or better grade, Douglas fir or southern yellow pine. Braces shall meet all of the requirements for wood posts.
4. Location: Posts shall be evenly spaced to adequately support the fence framework.

1.3 EXECUTION

A. Installation

1. Wood Posts: Hold in line in a true vertical position by temporary bracing until backfilling is completed. Compact by hand tamping or other suitable methods to a density comparable to that of adjacent ground.
2. Steel Posts: Hold in a vertical position and drive to the required depths by an approved post driver. Post tops shall not be damaged during driving.
3. Corner, Brace, Or End Panels: Construct corner, brace, or end panels at the beginning and terminal ends, at gate openings, at all intersections, and at all corners or changes in horizontal alignment of fences, in existing fence on both sides of junction with new fence (except when junction is at a corner already braced).
4. Pull Posts shall be constructed when the distance of unbraced fencing exceeds 640 feet. Pull posts shall be spaced equidistant in the fence at intervals of 640 feet or less.
5. Framework Installation: Stretch to proper tension and securely fasten to posts. Top and bottom wires of fabric shall be tied or stapled to each post. Tie or staple every other wire to alternating posts. Every wire shall be tied or stapled to corner, pull, end, and gate posts. Wire for tied fabrics shall be 9 ga.
6. Picket Replacement: Where required, new pickets shall be securely fastened into the existing wire framework using 13 ga. galvanized wire.
7. Restretching Existing Fabric: Fabric designated to be restretched shall be restretched to proper tension and refastened to posts. Excess fabric extending beyond the post shall be removed.

END OF SECTION 02 58 13 00

SECTION 02 61 00 00 - REMOVAL AND DISPOSAL OF CONTAMINATED SOILS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for disposal of hazardous materials. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Definition

1. Hazardous materials shall be defined as asbestos containing materials, lead-based paint, PCBs, bird waste, and other materials categorized as hazardous by the EPA.

C. Submittals

1. Before start of work: At the pre-construction meeting, the Contractor shall submit the following to the Owner's Representative for review. Do not start work until these submittal are returned with Owner's Representative stamp indicating that the submittal is returned for unrestricted use.
 - a. Copy of State or local license for hazardous waste hauler.
 - b. Certificate of at least one on-site supervisor which has satisfactorily completed the OSHA 40 hour Health and Safety course for handling hazardous materials.
 - c. Certificates of workers which have successfully completed the OSHA 40-Hour Health and Safety Course for Hazardous Materials.
 - d. List of the employees scheduled to perform this work.
 - e. Schedule of start and finish times and dates for this work.
 - f. Name and address of landfill where these waste materials are to be deposited. Include contact person and telephone number.
 - g. Safety Data Sheet (SDS) for all materials to be removed.
 - h. If contractor introduces any chemical into the work environment, a SDS for that chemical must be presented to the Owner's Representative prior to use.
 - i. Transporter must have notified the EPA and/or other appropriate local government agency in advance of its intentions to transport hazardous materials and, if applicable, receive an identification number.
 - j. Contingency Plan for handling emergencies with spills or leaks.
 - k. Certificates of workers which have successfully completed the OSHA 24-Hour Health and Safety Course for Hazardous Materials.

1.2 PRODUCTS

A. Materials

1. Drums: Recovery or salvage drums acceptable for disposal of hazardous waste. Prior approval of drums is required. Drums or containers must meet the required OSHA, EPA (40 CFR Parts 264-264 and 300), and DOT Regulations (49 CFR Parts 171-178). Use of damaged containers shall not be allowed.
2. Labels: As required by the EPA and OSHA for handling, transportation, and disposal of hazardous waste.
3. Absorbent Material: Clay, soil or any commercially available absorbent used for the purpose of absorbing hazardous or potentially hazardous materials.

1.3 EXECUTION



02 - Existing Conditions

- A. All waste shall be transported and disposed of in accordance with all federal, state and local guidelines and regulations. The contractor is to obtain all permits, licenses, etc., which are necessary for the transporting and disposal of hazardous waste.
- B. Waste haulers shall maintain waste manifest and shipment record forms.

END OF SECTION 02 61 00 00



Task	Specification	Specification Description
02 61 13 00	02 41 19 00	Selective Demolition
02 61 13 00	02 61 00 00	Removal and Disposal of Contaminated Soils
02 61 26 00	02 61 00 00	Removal and Disposal of Contaminated Soils
02 61 26 00	02 82 33 00	Removal Of Friable Asbestos-Containing Materials
02 65 00 00	02 41 19 00	Selective Demolition



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SECTION 02 82 16 00 - ENGINEERING CONTROL OF ASBESTOS CONTAINING MATERIALS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for encapsulation (lock-down) of asbestos-containing materials. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Product Data: Manufacturers technical information including label analysis and application instructions for each material proposed for use.
2. Installation Instructions: Manufacturer's installation instructions with specific project requirements noted.
3. Performance Warrantee: Manufacturers performance guarantee.
4. Safety Data Sheet: Safety Data Sheet in accordance with the OSHA Hazard Communication Standard (29 CFR 1910.1200) for each surfactant and encapsulating material proposed for use on the work. Include a separate attachment for each sheet indicating the specific worker protective equipment proposed for use with the material indicated.

C. Delivery And Storage: Deliver materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:

1. Name or title of material
2. Manufacturer's stock number and date of manufacture
3. Manufacturer's name
4. Thinning instructions
5. Application instructions
6. Deliver materials together with a copy of the OSHA Material
7. Safety Data Sheet for the material.

D. Job Conditions: Apply encapsulating materials only when environmental conditions in the work area are as required by the manufacturer's instructions.

E. Quality Assurance

1. Testing: Test material to be encapsulated using methods set forth in ASTM E1494 "Standard Practice for Encapsulants for Spray-or-Trowel-Applied Friable Asbestos- Containing Building Materials."

F. Warranty

1. Performance Warranty: Contractor shall submit written Performance Warranty, executed by the contractor, agreeing to repair/replace spray-on work which has cracked, fallen from substrate, or otherwise deteriorated to a condition where it would not perform effectively for its intended purposes due substantially to defective materials or workmanship and not due to abuse by occupants, improper maintenance, unforeseeable ambient exposures or other causes beyond anticipated conditions and contractors control. Warranty period shall be for at least one year after date of Final Completion.

1.2 PRODUCTS

A. Materials

1. Encapsulant system shall be an acrylic, elastomeric type, spray, brush or roller-applied, tinted penetrating or tinted bridging type, specifically designed for application to asbestos-containing material. System shall be equal to Global Encasement System as manufactured by GLOBAL

Encasement Inc., 132-32nd Street, Union City, NJ 07087 U.S.A., Tel. (800) 266-3982/(201) 902-9770.

- a. All encasement topcoat materials shall be warranted to be heavy-bodied, from the same manufacturer, and shall be long lasting, highly-pure (low VOC) materials that remain flexible, chalk resistant and resist cracking, peeling, algae and fungus that can cause future indoor air quality concerns.
- b. To allow for building movement without cracking or disturbing fibrous materials, coating systems shall have passed testing to ASTM standards for adhesion, permeability, aged flexibility and with aged elasticity for the encasement system of over 250%.
- c. Coatings shall be Class A Fire Rated, water-based, non-toxic, safe and easy to use, contain no hazardous ingredients by OSHA definition, comply with all known building codes and be non-flammable.
- d. Coating materials shall have low VOC (Volatile Organic Compound) content.
- e. Coating materials shall not release health threatening toxic smoke and fumes in a fire and shall comply with all known building codes.
- f. Coating materials shall have passed the following testing standards:
 - 1) ASTM E 119 fire tests demonstrating that applying a multi-layer system over fireproofing does not adversely affect the fireproof rating of the fireproofing (3 hour test).
 - 2) UPITT Combustion Toxicity Test proving nothing toxic is released in a fire.
 - 3) ASTM E 84 and E162 fire tests for "Class A" - Surface Flammability and Burning Characteristics (Flame Spread = 0, Smoke Developed = 5).
 - 4) "Pull-off Adhesion" test per ASTM E736 equals or exceeds 9,950 lbs./sq. ft. (89.1 lbs./sq. in.).
 - 5) ASTM D 1653 and E96 "Water Vapor Permeability" (showing the rate that water vapor can pass through the system).
 - 6) Impact Resistance, "Tensile Strength" shall exceed 150 psi; "Elongation" shall exceed 250%.
 - 7) System shall be mildew resistant, impact resistant, scrub resistant, non-yellowing, non-chalking, highly blister resistant, rust resistant, highly chemical resistant and shall remain flexible after 1000 hour ASTM Accelerated Weather testing.
 - 8) Water-Based materials (low VOC) Volatile Organic Content of Primer-Sealer-Neutralizer = 0.1 g/L (0.001 lb./gal.) and Encasement Top Coat = 0.1 g/L (0.001 lb./gal.) as tested by EPA Method 24.
 - 9) Materials comply with applicable standards for installation on interior and/or exterior surfaces of a building.
 - 10) Encasement Systems shall provide additional water-proofing protection.

B. Related Materials:

1. Elastomeric architectural sealants, caulking compounds, primers, and similar materials shall be approved by the manufacturer of the encasement coatings. All materials used shall be applied in accordance with its manufacturer's recommendations.

C. Applicable Standards

1. Product shall be rated as acceptable for use intended when field tested in accordance with ASTM E 1494.

1.3 EXECUTION

A. General

1. Prior to applying any encapsulating material in Work Areas, Contractor shall obtain final visual inspection approval by the Project Administrator.
2. Prior to applying any encapsulating material, Contractor shall ensure that application of the sealer will not cause the base material to fail and allow the sealed material to fall of its own weight or

separate from the substrate. Should Contractor doubt the ability of the installation to support the sealant, request direction from the Owner's Representative before proceeding with the encapsulating work.

3. Do Not Commence Application of encapsulating materials until all removal work within the work area has been completed.

B. Worker Protection

1. Before beginning work with any material for which a Safety Data Sheet has been submitted provide workers with the required protective equipment. Require that appropriate protective equipment be used at all times.

C. Application

1. Comply with all manufacturer's instructions for particular conditions of installation. Consult with manufacturer's technical representative for conditions not covered.
2. Encapsulate all surfaces in full compliance with manufacturer's procedures.
3. At completion of Encapsulation and before removal of Work Area enclosures and Pressure Differential System, decontaminate space in accordance with requirements of manufacturer's instructions.
4. Remove all debris from the project site and restore area to proper conditions by cleaning all surfaces in accordance with manufacturer's written recommendations.
5. At completion of work submit manufacturer's record of inspection of completed work and Manufacturers Performance Guarantee executed by both manufacturer and Contractor.

END OF SECTION 02 82 16 00



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SECTION 02 82 33 00 - REMOVAL OF FRIABLE ASBESTOS-CONTAINING MATERIALS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for removal of friable asbestos-containing materials. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Description

1. Furnish all labor, materials, facilities, equipment, services, employee training and testing, permits and agreements necessary to perform the work required for asbestos removal, encapsulation, repair, clean-up, decontamination, re-insulation and all other work in accordance with these specifications, in accordance with the latest regulations from the U.S. Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), the recommendations of National Institute of Occupational Safety and Health (NIOSH), and any other applicable federal, state and local government regulations. Whenever there is a conflict or overlap of the above references, the most stringent provision is applicable.
2. The work specified herein shall be performed by competent persons trained, knowledgeable and qualified in the state-of-the-art techniques of asbestos abatement, handling and subsequent cleaning of contaminated areas.

C. Scope

1. The quantities of materials and limits of abatement work area(s) shall be verified by the asbestos contractor.

D. Asbestos Hazard

1. Asbestos-containing material when damaged or disturbed is subject to fiber releases. Wet methods are a primary means of controlling fiber release.
2. Strict compliance with each of the provisions outlined in these specifications for the encapsulation, repair and handling of asbestos-containing material is of great importance, because:
 - a. The inhalation of airborne asbestos fibers can cause a very serious and often fatal disease.
 - b. Workers may not be aware they are inhaling asbestos fibers.
 - c. Symptoms of the disease do not appear for many years.
 - d. Only the Contractor and its employees can prevent the inhalation of asbestos fibers, which can lead to the development of asbestos-related disease.
 - e. No insurance is available to provide for asbestos-related disease.

E. Other Hazardous Material

1. Contractor shall comply with OSHA 29 CFR 1926.62 - Lead in Construction when demolishing any equipment or architectural component identified as lead-containing or lead-based paint. The work of this project is considered a demolition activity.
2. the Owner anticipates that a substantial amount of the Project will involve lead paint.

F. Qualifications

1. the Owner and the Owner's Representative will verify and approve the experience of the Asbestos Abatement Contractor based upon submission at the time of bidding by Contractor evidence of the following:
 - a. Experience: Provide the names and locations of at least three asbestos abatement projects of comparable size and complexity comparable with this work. Provide the names



and telephone numbers of contact person at previous projects. Provide the final air monitoring decontamination fiber levels achieved.

- b. Personnel: Provide the name(s) of "Competent Person" as defined by OSHA 29 CFR 1926.32(f) - Asbestos. Demonstrate the education and specialized training with successful completion of examination of an EPA approved course. Provide evidence of participation in five projects of complexity comparable with this project.
- c. Licensing and Certification: The Contractor must hold a current, valid asbestos license issued by the State in which the work is to be performed.

G. Notices And Record Keeping

- 1. Contractor shall maintain for at least 30 years, a record for each asbestos project in which the Contractor engages. Each record shall include the following information: name, address, and social security number of all personnel involved with the project, the name address and social security number of the OSHA "Competent Person" who will supervise the work, the amount of asbestos material that was removed, repaired, encapsulated or disturbed, the commencement and completion date of the work, copies of Hazardous Waste Manifest(s), personal air monitoring results and any other appropriate information.
- 2. The Contractor shall send written notification as required by USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M) to the Owner, at least 10 working days prior to beginning any work on asbestos-containing materials.
- 3. Include the following information:
 - a. Name and address of the Owner or operator.
 - b. Description of the facility being demolished or renovated, including the size, age, and prior use of the facility.
 - c. Estimate of the approximate amount of asbestos material present in the facility in terms of linear feet of pipe, and surface area on other facility components. For facilities in which the amount of asbestos materials is less than 260 linear feet on pipes and less than 160 square feet on other facility components, explain techniques of estimation.
 - d. Location of the facility being demolished or renovated.
 - e. Scheduled starting and completion dates of demolition or renovation.
 - f. Nature of planned demolition or renovation and method(s) to be used.
 - g. Procedures to be used to comply with the requirements of USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61 Subpart M).
 - h. Name and location of the waste disposal site where the asbestos waste material will be deposited.
- 4. Prior to commencement of work, the Contractor shall submit the following documents to the Owner's Representative. No work will be allowed to start until these documents have been approved:
 - a. The schedule of the work, including manpower, length and number of work shifts. Schedule shall be coordinated with the Owner's full occupancy of all areas of the building.
 - b. Satisfactory proof that written notification has been provided to the EPA regional office and the Owner.
 - c. Proof that all required permits, disposal site locations, and arrangements for transportation and disposal of asbestos-contaminated materials, supplies and the like have been obtained.
 - d. Complete a worker certificate indicating that all employees have had instruction and training on the hazards of asbestos exposure, the use and fitting of respirators, protective dress, wet and dry decontamination procedures, entry and exit from work areas, and all aspects of work procedures and protective measures.
 - e. Documentation indicating that all employees have received appropriate medical examinations and have successfully passed fit testing for the respirator to be worn. As a

- minimum, medical exams must be consistent with OSHA 29 CFR 1926.1101(K)(9)(viii)(G)-Asbestos Regulation.
 - f. Samples of signs to be used in and around the work area to comply with OSHA 29 CFR 1926.1101(K)(9)(viii)(I)- Asbestos regulations and as required by federal, state and municipal regulations.
 - g. Safety Data Sheets (OSHA form 174 or equivalent) for all chemicals used during work performed under this section.
 - h. Encapsulation data and encapsulation procedures.
 - i. Design of pressure differential system including calculation used to arrive at the number of machines necessary to achieve one air change per every 10 minutes.
 - j. Location of personnel and material decontamination units for each work area.
 - 5. Contractor shall provide written notification to the Owner's Representative of its intent to start work at least five days in advance. In no case will the Contractor start work until authorization to proceed is given.
 - 6. During the work, Contractor shall maintain a daily log which will be kept at the job site. Items to be included in the daily log shall include but are not limited to the following:
 - a. Meetings, purpose, attendees, discussions, items of resolution.
 - b. Visitations, authorized and unauthorized.
 - c. Sign-in sheets of all personnel entering and leaving the work area.
 - d. Special or unusual events (i.e., barrier breeching equipment failures).
 - e. Personal air monitoring results.
 - f. Two copies of the daily log are required for Project Closeout.
- H. Terminology (Definitions)
1. Abatement - Procedures to control fiber release from asbestos-containing materials. Includes removal, enclosure or encapsulation.
 2. Air Lock - A system for permitting ingress or egress without permitting air movement between any two adjacent areas consisting of two curtained doorways. The air lock must be maintained in an uncontaminated condition at all times.
 3. Air Monitoring; - The process of measuring the asbestos fiber content of a specific volume of air in a stated period of time using methods approved or recommended by OSHA, EPA, NIOSH or other method approved by the Owner or the Owner's Representative.
 4. Amended water - Water to which a surfactant has been added.
 5. Asbestos - A generic name given to a number of naturally occurring hydrated mineral silicates that possess a unique crystalline structure, are incombustible in air, and are separable into fibers. Asbestos includes the asbestiform varieties of Chrysotile (serpentine), Crocidolite (Riebeckite), Amosite (Cummingtonite-Grunente), Anthophyllite, Actinolite, and Tremolite.
 6. Asbestos-containing material (ACM) - Any material that contains more than 1 percent asbestos by weight as determined by Polarized Light Microscopy (PLM).
 7. Authorized Visitor - the Owner or its designated representative, or a representative of any regulatory or other agency having jurisdiction over the project.
 8. Class I - Asbestos work means activities involving the removal of thermal systems insulation (TSI) and surfacing ACM and PACM.
 9. Class II - Asbestos work means activities involving the removal of ACM which is not TSI or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastics.
 10. Class III - Asbestos work means repair and maintenance operations where "ACM" including TSI and surfacing ACM and PACM is likely to be disturbed.
 11. Class IV - Asbestos work means maintenance and custodial activities during which employees contact but do not disturb ACM or PACM and activities to clean-up dust, waste and debris resulting from Class I, II and III activities.
 12. Critical Barrier - A unit of temporary construction which provides the only separation between an asbestos work area and an adjacent, potentially occupied, space. The critical barrier is composed of at least one intact sheet of polyethylene sheeting.

13. Decontamination Enclosure System - A series of connected rooms with curtained doorways between any two adjacent rooms, for the decontamination of workers or of materials and equipment. A decontamination system contains at least two air locks.
14. Disposal - All procedures necessary to transport and deposit the asbestos-contaminated material stripped and removed from the building in a waste disposal site in compliance with applicable federal, state, and local regulations.
15. Disposal Site - A site approved by the EPA for the disposal of asbestos-containing wastes.
16. Encapsulant - A liquid which can be applied to asbestos-containing materials and which controls the possible release of fibers from the materials.
17. Encapsulation - The use of an agent to seal the surface (bridging encapsulant) or penetrate the bulk (penetrating encapsulant) of the asbestos-containing material.
18. HEPA -High Efficiency Particulate Air - A type of filter which is 99.97% efficient at filtering particles of 0.3 micrometers in diameter.
19. HEPA Vacuum Equipment - Vacuuming equipment equipped with a HEPA filter in the exhaust outlet, and so designed and maintained that 99.97% of all particles of 0.3 micrometer in diameter in the inlet air are collected and retained.
20. Negative Pressure Respirators - Respirators which function by the wearer breathing in air through a filter.
21. NIOSH - National Institute of Occupational Safety and Health.
22. the Owner's Representative - Authorized Consultants
23. Permissible Exposure Level (PEL) - A level of airborne fibers specified by OSHA as an occupational exposure standard for asbestos. It is 0.1 f/cc of air, eight-hour TWA, as measured by Phase Contrast Microscopy.
24. Repair - The restoration of damaged or deteriorated asbestos-containing material to intact condition.
25. Respirator Protection Program - A set of procedures and equipment required by OSHA if employees wear negative pressure respirators or if fiber levels are above the PEL.
26. Surfactant - Chemical wetting agent added to water to improve penetration, thus reducing the amount of water required for a given operation or area, and enhancing the effect of the water in reducing fiber release.
27. Thermal Systems Insulation - Material applied to pipes, fittings, boilers, breeching, tanks, ducts or other interior structural components to prevent heat loss or gain, or water condensation, or for other purposes.
28. Wet Cleaning - The process of eliminating asbestos contamination from building surfaces and objects by using cloths and mops or other cleaning tools that have been dampened with clean water and afterwards disposing of these cleaning tools as asbestos-contaminated waste.

I. Permits And Licenses:

1. The Contractor must maintain current licenses as required by applicable state or local jurisdictions for the removal, transporting, disposal or other regulated activity relative to the work of this contract.

J. Regulations

1. This section sets forth governmental regulations and industry standards which are included and incorporated herein by reference and made a part of the specifications. This section also sets forth those notices and permits which are known to the Owner and which either must be applied for and received, or which must be given to governmental agencies before start of work.
2. Except to the extent that more explicit or more stringent requirements are written directly into the contract documents, all applicable codes, regulations, and standards have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith.
3. The Contractor shall assume full responsibility and liability for the compliance with all applicable federal, state, and local regulations pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site. The Contractor

is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable federal, state, and local regulations. The Contractor shall hold the Owner and the Owner's Representative harmless for failure to comply with any applicable work, hauling, disposal, safety, health or other regulation on the part of itself, its employees, or its Sub-Contractors.

4. Federal requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following regulations:
 - a. U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA), including but not limited to:
 - 1) U.S. Department of Labor, OSHA, including, but not limited to:
 - a) Occupational Exposure to Asbestos, Tremolite, Anthophyllite and Actinolite; Final Rules
Title 29, Part 1910, Section 1001
Part 1926, Section 1101 of the Code of Federal Regulations
 - b) Respiratory Protection
Title 29, Part 1910, Section 134 of the Code of Federal Regulations
 - c) Construction Industry
Title 29, Part 1926.1011, of the Code of Federal Regulation
 - d) Access to Employee Exposure and Medical Records
Title 29, Part 1910, Section 2 of the Code of Federal Regulations
 - e) Hazard Communication
Title 29, Part 1910, Section 1200 of the Code of Federal Regulations
 - f) Specifications for Accident Prevention Signs and Tags
Title 29, Part 1910, Section 145 of the Code of Federal Regulations
 - 2) U.S. Environmental Protection Agency (EPA) including, but not limited to:
 - a) Asbestos Abatement Projects Rule
40 CFR Part 762
CPTS 62044, FRL 2843-9
Federal Register, Vol. 50 No. 134, July 12, 1985
P28530-28540
 - b) Regulation for Asbestos
Title 40, Part 61, Subpart A of the Code of Federal Regulations
 - c) National Emission Standard for Asbestos
Title 40, Part 61, Subpart M (Revised Subpart B) of the Code of Federal Regulations
 - 3) State requirements which govern asbestos abatement work and/or hauling and disposal of asbestos waste materials.
 - 4) Contractor shall abide by all local requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials including the following:
 - a) American National Standards Institute (ANSI)
1430 Broadway
New York, NY 10018
(212) 354-3300
 - b) Fundamentals Governing the Design and Operation of Local Exhaust Systems Publication Z9.2-79
 - c) Practices for Respiratory Protection Publication Z288.2-80
 - d) American Society for Testing and Materials (ASTM)
1916 Race Street
Philadelphia, PA 19103
(215) 299-5400
 - e) Specification for Encapsulants for Friable Asbestos-Containing Building Materials
 - f) Safety and Health Requirements Relating to Occupational Exposure to Asbestos



- K. the Owner's Representative
1. the Owner's Representative is authorized by the Owner to perform the following:
 - a. Have free access to all asbestos work areas.
 - b. To assist in interpretation of procedures.
 - c. To advise on all provisions of the contract documents pertaining to the control of asbestos.
 - d. To stop work if, in the course of performing their monitoring duties, an instance of substantial nonconformance with the contract documents is observed.
 - e. To stop work if a situation presenting a health hazard to workers or the Owner's employees or occupants of the building is observed.
 - f. To act as the Owner's liaison in technical matters involving the asbestos-related work.
 - g. To perform air sampling inside and outside the asbestos work area during the project. The Contractor shall cooperate fully with the Owner's Representative, its agents and employees, and ensure cooperation of its workers during collection of air samples and work area inspections.
 - h. the Owner's Representative role in advising the Owner on environmental health matters does not relieve the Contractor's obligation to comply with all applicable health and safety regulations. Air monitoring results generated by the Owner's Representative shall not be used by the Contractor to represent compliance with regulatory agency requirements for monitoring of worker's exposure to airborne asbestos, nor shall any other activity on the part of the Owner's Representative represent the Contractor's compliance with applicable health and safety regulations.
- L. Pre-Construction Conference
1. An initial progress meeting recognized as "Pre-Construction Conference" shall be held prior to start of any work. Contractor shall meet at project site, with General Superintendent, the Owner, the Owner's Representative, and other entities concerned with asbestos abatement work. Record discussions and agreements and furnish copy to each participant. Provide at least 72 hours advance notice to all participants prior to convening Pre-Construction Conference.
 2. This is an organizational meeting, to review responsibilities and personnel assignments, to locate the containment and decontamination areas; and temporary facilities including power, light, water, etc.
 3. Submit waivers on forms, and executed in a manner acceptable to the Owner. Administrative requirements that must proceed or coincide with Contractor's submittal for final payment shall consist of the following:
 - a. Completion of project closeout requirements.
 - b. Completion of items specified for completion beyond time of Final Completion (regardless of whether special payment application was previously made).
 - c. Assurance, satisfactory to the Owner, that unsettled claims will be settled and that work not actually completed and accepted will be completed without undue delay.
 - d. Transmittal of required project construction records to the Owner.
 - e. Landfill receipts for all asbestos-containing material.
 - f. Proof, satisfactory to the Owner, that taxes, fees and similar obligations of Contractor have been paid.
 - g. Removal of temporary facilities, services, surplus materials, rubbish and similar elements.
 - h. Consent of surety for final payment.
- M. Project Closeout
1. Project closeout is the term used to describe certain collective project requirements that indicate completion of the work to be fulfilled near the end of the contract time. Also, in preparation for final acceptance of the work by the Owner, as well as, final payment to the Contractor and the normal termination of the Contract.
 2. Include supporting documentation for completion as indicated in these contract documents.
 3. Submit a statement on accounting of changes to the Contract Sum.
 4. Advise the Owner of pending insurance change-over requirements.

5. Submit specific warranties, workmanship and maintenance bonds, maintenance agreements, final certifications and similar documents.
6. Obtain and submit releases enabling the Owner's full, unrestricted use of the work area and access to services and utilities. Where required, include occupancy permits, operating certificates and similar releases.
7. Results of the completed inspection will form the initial "punch-list" for final acceptance.
8. A complete record, certified by the testing laboratory, of all personal air monitoring results.
9. Complete the following cleaning operations as outlined in Paragraph "Decontamination Procedures" before requesting the Owner's Representative inspection for certification of Final Completion.
 - a. Remove exposed labels in finished spaces which are not required as permanent labels on materials supplied as part of the work, except for "Asbestos", "Asbestos Free", or Thermal Insulation Labels specified elsewhere.
 - b. Clean transparent materials, affected by the work including mirrors and window/door glass, to a polished condition, removing substances which are noticeably vision-obscuring materials. Replace broken glass and damaged transparent materials.
 - c. Clean exposed hard-surfaced finishes affected by the work, to a dirt-free condition, free of dust, stains, films and similar distracting substances. Except as otherwise indicated, avoid disturbance of natural weathering of exterior surfaces. Restore reflective surfaces to original reflective condition.
 - d. Clean plumbing fixtures affected by the work to a sanitary condition, free of stains including those resulting from water exposure.
 - e. Replace all HVAC filters using materials supplied by the Owner or clean non-replaceable filters after minimum of two days of operation of HVAC equipment.
 - f. Clean light fixtures and lamps, which have been affected by the work so as to function with full efficiency. Replace lamps where inoperable.
 - g. Repair any damage to wall, ceiling and floor surfaces caused by installation and removal of the polyethylene sheeting.

N. Personnel Protection

1. Prior to commencement of work, the workers shall be instructed and be knowledgeable in the areas described in Paragraph "Submittals and Notices" having to do with employees.
2. Worker Protection - shall comply with 29 CFR 1910.134 (Respiratory Protection).
 - a. Because there is no known safe level of exposure to asbestos, it is prudent to reduce worker's exposures to as low a level as possible. Proper respiratory protection is critical in minimizing exposure.
 - b. Workers shall be provided, as a minimum, with personally issued and marked respirators equipped with high efficiency particulate filters approved by NIOSH to be worn in the designated work area and/or whenever a potential exposure to asbestos exists. Sufficient filters shall be provided for replacement as required by the workers or applicable regulations. Disposable respirators shall not be used.
 - c. No worker shall be exposed to levels greater than 0.01 f/cc as determined by the protection factor of the respirator worn and the work area fiber levels.
 - d. Whenever powered purifying respirator protection is used, a sufficient supply of replacement batteries and HEPA filter cartridges shall be provided to the workers.
 - e. Air monitoring required by OSHA is work of the Contractor and not covered in this specification. Contractor shall post, on a daily basis, results of the air monitoring results from the previous shift. A complete record, certified by the testing laboratory, of all personal air monitoring tests and results will be furnished to the Owner and the Owner's Representative prior to Contractor's Request for Final Payment.
 - f. During encapsulation operations or usage of other organic base aerosols (e.g., spray glue, expanding foam), workers shall be provided with combination cartridges consisting of organic vapor and HEPA sections.



- g. Workers shall be provided with sufficient sets of protective full-body clothing to be worn in the designated work area and/or whenever potential exposure to asbestos exists. Such clothing shall include, but not be limited to, full-body coveralls, headgear and gloves. Workers shall assure that hoods covering their hair are worn in the designated work areas at all times. Eye protection and hard hats shall be provided as required by applicable safety regulations. Eye protection shall be worn during encapsulation operations. Non-disposable type protective clothing and footwear shall be left in the work area until the end of the asbestos abatement work, at which time such items will be disposed of as asbestos waste.
 - h. Non-skid footwear shall be provided to all abatement workers. Disposable clothing shall be adequately sealed to the footwear to prevent body contamination.
 - i. Protective clothing shall not be worn in lieu of street clothing outside the work area.
 - j. Visitor Clothing: The Contractor shall provide authorized visitors with suitable respirator, protective clothing, headgear, eye protection, and footwear as described herein, whenever they enter the work area.
3. Decontamination and Work Procedures: The decontamination and work procedures to be followed by workers shall be posted as described in these specifications.
4. Worker and Authorized Visitor Protection Procedures:
- a. Each worker and authorized visitor shall, upon entering the job site, remove street clothes in a designated clean change area and put on a respirator with new filters and clean protective clothing before entering the work area.
 - b. The Contractor's employees shall perform a positive/negative respirator fit test each time it enters the work area. If leakage occurs, the respirator must be re-adjusted or replaced.
 - c. Workers shall maintain their respirators in a safe operating condition. The condition of respirators shall be checked daily.
 - d. Workers and visitors shall complete the decontamination procedures as outlined in the specification upon exiting the work area.
 - e. Workers shall not eat, drink, smoke, or chew gum or tobacco in or near the asbestos work areas.
 - f. Workers shall be fully protected with respirators and protective clothing immediately prior to the first disturbance of asbestos-containing or contaminated materials and until final cleanup is completed.

O. Air Monitoring

- 1. The airborne fiber counts outside the work area will be monitored to detect faults in the work area isolation such as contamination of the building outside of the work areas with airborne asbestos fibers, failure of filtration or rupture in the negative pressure system. Should any of the above occur, the Contractor shall immediately cease asbestos abatement activities until the fault is corrected. Work shall not recommence until authorized by the Owner's Representative. In the case of mini-enclosures the Owner's Representative will monitor air in a remote location of the residence to determine the baseline of asbestos.
- 2. The airborne fiber counts in the work area will be monitored. The purpose of this air monitoring will be to detect airborne fiber counts which may significantly challenge the ability of the work area isolation procedures to protect the balance of the building or outside of the building from contamination by airborne fibers. In the case of mini-enclosures the Owner's representative may monitor air outside of several enclosures if they are in close proximity.
- 3. Contractor shall maintain an average airborne count inside the work area of less than 0.5 f/cc. If the fiber counts rise above this figure for any sample taken, revise work procedures to lower fiber counts. If the TWA fiber count for any work shift or eight-hour period exceeds 0.5 f/cc, stop all work, leave pressure differential system in operation and notify the Owner's Representative. Do not recommence work until authorized in writing by the Owner's Representative.
- 4. If airborne fiber counts exceed 1.0 f/cc for any period of time cease all work until fiber counts fall below 0.5 f/cc and notify the Owner's Representative. Do not recommence work until authorized in writing by the Owner's Representative.

5. If any air sample taken outside of the work area exceeds the 0.01 f/cc of air, Contractor shall immediately and automatically stop all work. If this air sample was taken inside the building and outside of critical barriers around the work area, immediately erect new critical barriers to isolate the affected area from the balance of the building. Erect Critical Barriers at the next existing structural isolation of the involved space (e.g., wall, ceiling, and floor). Leave Critical Barriers in place until completion of work and insure that the operation of the negative pressure system in the work area results in a flow of air from the balance of the building into the affected area.
6. If the exit from the clean room of the personnel decontamination unit enters the affected area, establish a temporary decontamination facility consisting of a shower room and changing room. After cleaning and decontamination of the affected area remove the shower room and leave the changing room in place as an air lock.
7. After certification of visual inspection in the work area, remove critical barriers separating the work area from the affected area. Final air samples will be taken within the entire area.
8. The following procedure will be used to resolve any disputes regarding fiber types when a project has been stopped due to excessive airborne fiber counts. "Airborne Fibers" referred to above include all fibers regardless of composition as counted in the Phase Contrast Microscopy (PCM) NIOSH 7400 Method procedures. If work has stopped due to high airborne fiber counts, air samples will be secured in the same area by the Owner's Representative for analysis by electron microscopy. "Airborne fibers" counted in samples analyzed by Scanning or Transmission Electron Microscopy (TEM) shall be only asbestos fibers, but of any diameter and length. Subsequent to analysis by Electron Microscopy the number of airborne fibers shall be determined by multiplying the number of fibers, regardless of composition, counted by the PCM NIOSH 7400 Method procedure by a number equal to asbestos fibers counted divided by all fibers counted in the electron microscopy analysis.
9. If electron microscopy is used to arrive at the basis for determining airborne fiber counts in accordance with the above paragraph, and if the average of airborne asbestos fibers in all samples taken exceeds 0.1 f/cc, or if any one sample exceeds 0.2 f/cc, then the cost of such analysis will be born by the Contractor, at no additional cost to the Owner.
10. the Owner's Representative will secure at least the following air samples to establish a base line before start of work involving large enclosures:

Location Sampled	Number of Samples	Analysis Method	Detection Limit f/cc	Minimum Volume Liters	Rate LPM
Each Work Area	1	PCM	0.01	1,900	2-16
Outside Each Work Area	1-3	PCM	0.01	1,900	2-16

11. Base Line is an action level expressed in f/cc, which is ten percent greater than the largest of the following:
 - a. Average of the samples collected on cellulose ester filters outside each work area.
 - b. Average of the samples collected on cellulose ester filters outside the building.
 - c. 0.01 fibers per cubic centimeter.
12. Daily: From start of work of Paragraph "Temporary Enclosure" through the work of Paragraph "Project Decontamination," the Owner may be taking the following samples on a daily basis. The location of each air sample will be determined by the Owner's Representative.
 - a. Baseline
 - b. Work Area
13. For larger enclosures samples will be collected on 25 mm cassettes with the following filter media:

PCM: 0.8 micrometer mixed cellulose ester.

Location Sampled	Number of Samples	Analysis Method	Detection Limit f/cc	Minimum Volume Liters	Rate LPM



Each Work Area	2	PCM	0.01	1,900 as required by conditions	2-16
Outside Each Work Area Critical Barrier	1	PCM	0.01	1,900	2-16
Clean Room	1	PCM	0.01	1,900	2-16
Equip Decon	1	PCM	0.01	1,900	2-16

14. Additional samples may be taken at the Owner or the Owner's Representative discretion. If airborne fiber counts exceed allowed limits, additional samples will be taken as necessary to monitor fiber levels.
15. The services of a testing laboratory will be employed by the Owner to perform laboratory analysis of the air samples. Samples will be sent daily so that verbal reports on air samples can be obtained in a timely manner. A complete record, certified by the testing laboratory, of all air monitoring tests and results will be furnished to the Owner's Representative, the Owner and the Contractor.
16. Air samples may be analyzed on site by the Owner's Representative, if they are to be analyzed by the NIOSH 7400 Method.
17. Cellulose ester filters will be analyzed using the PCM NIOSH 7400 Method. Thus analysis will be carried out at a laboratory located off the job site.
18. At the completion of the work in occupied areas and prior to the dismantling of the isolation system, final air clearance will be conducted by the Owner's Representative.
19. Decontamination of the work area will be considered complete when all samples indicate fiber levels are less than 0.01 f/cc of air as analyzed by PCM NIOSH 7400 Method or an average of less than 70 structures per square millimeter of filter area as analyzed by TEM; Level II AHERA Method.
20. The Contractor may conduct its own air monitoring and laboratory testing. If it elects to do this the cost of such air monitoring and laboratory testing shall be included in the Contract Sum.

P. Equipment Removal Procedures

1. Clean all external surfaces of contaminated waste containers and equipment thoroughly by wet sponging or HEPA vacuuming before moving such items into the equipment decontamination enclosure system washroom for final cleaning and removal to uncontaminated areas. Ensure that personnel do not leave the work areas through the equipment decontamination enclosure system.

Q. Disposal Activities

1. It is the responsibility of the Contractor to comply with current federal, state and local regulations concerning the waste handling, transportation, and disposal of asbestos-containing material (ACM) and accompanying solvents or residues.
2. The Contractor will document actual disposal of the waste at the designated landfill by completing Disposal Certificate or submitting proof of landfill receipt.

1.2 PRODUCTS

A. Materials

1. All Contractor's equipment delivered to the site shall be free of asbestos contamination.
2. Store all materials subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient to prevent damage or contamination.
3. Damaged or deteriorating materials shall not be used and shall be removed from the premises. Materials that become contaminated shall be disposed of in accordance with applicable regulations.

4. Polyethylene flame retardant sheet of 6-mil thickness shall be used unless otherwise specified. Polyethylene sheeting shall be sized to minimize the frequency of joints. Polyethylene sheeting must satisfy the National Fire Prevention Association Standard 701, "Small Scale Fire Test for Flame Resistant Textile and Film."
5. Adhesive tape shall be capable of sealing joints of adjacent sheets of polyethylene and for use in attachment of polyethylene sheet to finished or unfinished surfaces of similar materials and shall be capable of adhering under dry and wet conditions, including use of amended water. Contractor shall use adhesive tape compatible with finished surfaces.
6. Protective devices such as, but not limited to, disposable clothing, respirators, gloves, hard hats, etc. shall be used.
7. Wetting agent shall be a mixture of 50/50 polyoxyethylene ether and polyglycol ester or equivalent commercial product.
8. Encapsulant materials shall be the bridging and penetrating type and conform with the following characteristics:
 - a. Encapsulants shall not be solvent-based or utilize a hydrocarbon in the liquid in which the solid parts of the encapsulant are suspended.
 - b. Encapsulant shall not be flammable.
9. A non-hardening lagging sealer for enclosing and sealing raw exposed edges and surfaces of asbestos-containing materials.
10. Pre-mixed or job mixed insulating plaster manufactured for use on plumbing equipment shall be used when repairing damaged thermal insulation material.
11. Non-woven fibrous glass mat and open weave glass fiber mat cloth for repair of thermal systems insulation.
12. Fire retardant sealant shall prevent fire, smoke, water and toxic fumes from penetrating through sealants. Sealant shall have a flame spread, smoke and fuel contribution of zero, and shall be ASTM and Underwriter's Laboratory (UL) rated for three hours for standard method of fire test for fire stop systems.

B. Tools And Equipment

1. Provide suitable tools for repair and encapsulation of asbestos-containing materials and for removal of asbestos-containing materials that are beyond repair. Wire brushes shall not be used as a means of removing or cleaning asbestos-containing materials from surfaces, if they are used as the surface is being sprayed with water or amended water.
2. Provide sufficient number of HEPA-filtered vacuum cleaners equipped with pick-up adapters, steel floor wands, crevice tools, and carpet tools.
3. Airless sprayers capable of spraying amended water shall be provided in sufficient number to allow continuous uninterrupted work.
4. Asbestos filtration devices shall utilize high efficiency particulate air (HEPA) filtration systems.
5. Transportation equipment, as required, shall be suitable for loading, temporary storage, and unloading of contaminated waste without exposure to persons or property, and shall be quiet in motion if used within the building.

1.3 EXECUTION

A. Safety Procedures For Power And Lighting

1. The use of wet methods for removal, repair, encapsulation or cleaning procedures increases the potential for electrical shock when working around electrical panels, conduit, light fixtures, alarm systems, junction boxes, transformers, etc. In coordination with the Owner, de-energize as much electrical equipment as possible to prevent electrical shock to employees performing the work. The Contractor shall use the following precautions:
 - a. Use non-conductive tools and vacuum attachments.
 - b. Utilize "hot line" covers over energized cables and power lines when possible.

- c. Ensure all electrical equipment in use is properly grounded before the job starts. Check outlets, wiring, extension cords and power pickups.
- d. Avoid stringing wiring across floors. Elevate wiring if possible.
- e. Ensure electrical outlets are tightly sealed and taped to avoid water spray.
- f. Determine operating voltages of equipment and lines before working on or near energized parts.
- g. Energized parts must be insulated or guarded from employee contact and other conductive objects. Extension cords must be three-wire type and connected to a Ground Fault Interrupter (GFI) circuit.
- h. Lock or secure de-energized circuits at panel and post warning signs.
- i. Seal heating vents with two layers of polyethylene sheeting prior to the start of work. The Contractor shall repair any damage caused by Contractor's operations to duct work, grilles, dampers, louvers or HVAC equipment at the completion of the work at Contractor's expense. Coordinate all lock out and or de-energizing with the Owner.

B. Temporary Facilities

- 1. Use qualified tradesmen for installation of temporary services and facilities. Locate temporary services and facilities where they will serve the entire project adequately and result in minimum interference with the performance of the work and operations of the building. Coordinate all installations and shut downs with building owner.
- 2. Relocate, modify and extend services and facilities as required during the course of work so as to accommodate the entire work of the project.
- 3. Provide new or used materials and equipment that are undamaged and in serviceable condition. Provide only materials and equipment that are recognized as being suitable for the intended use, by compliance with appropriate standards.
- 4. During the erection and/or moving of scaffolding, care must be exercised so that the polyethylene floor covering is not damaged.
- 5. Clean, as necessary, debris from non-slip surfaces.
- 6. At the completion of abatement work, clean all construction aids within the work area, wrap in one layer of 6-mil polyethylene sheet and seal before removal from the work area.
- 7. Temporary water service connections to the Owner's water system shall include back flow protection. Valves shall be temperature and pressure rated for operation of the temperatures and pressures encountered.
- 8. Employ heavy-duty abrasion-resistant hoses with a pressure rating 50 percent greater than the maximum pressure of the water distribution system to provide water into each work area and to each Decontamination Unit. Provide fittings as required to allow for connection to existing wall hydrants or spouts, as well as temporary water heating equipment, branch piping, showers, shut-off nozzles and equipment.
- 9. Electrical Services shall comply with applicable NEMA, NECA and UL standards and governing regulations for materials and layout of temporary electric service.
- 10. Provide a weatherproof, grounded temporary electric power service and distribution system of sufficient size, capacity, and power characteristics to accommodate performance of work during the construction period. Install temporary lighting adequate to provide sufficient illumination for safe work and traffic conditions in every area of work.
- 11. Provide receptacle outlets equipped with ground fault circuit interrupters, reset button and pilot light, for plug-in connection of power tools and equipment.
- 12. Use only grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Use single lengths or use waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas of work. All cords shall be elevated off the floor inside the containment area.
- 13. Temporary wiring in the work area shall be type UL non-metallic sheathed cable located overhead and exposed for surveillance. Do not wire temporary lighting with plain, exposed (insulated) electrical conductors. Provide liquid tight enclosures or boxes for wiring devices.

14. Provide Type "A" fire extinguishers for temporary offices and similar spaces where there is minimal danger of electrical or grease-oil-flammable liquid fires. In other locations provide type "ABC" dry chemical extinguishers, or a combination of several extinguishers of NFPA recommended types for the exposures in each case.
15. Use of the Owner's existing toilet facilities, as indicated, will be permitted, so long as these facilities are properly cleaned and maintained in a condition acceptable to the Owner. At Final Completion, restore these facilities to the condition prevalent at the time of initial use. All provisions of these specifications regarding leaving the work area must be met.
16. When mini-enclosures area being used all of the requirements above will be enforced by the Owner's Representative. The construction and set-up of the mini-enclosures may be done by the Abatement Contractor.

C. Pressure Differential System

1. Before start of work Contractor shall submit design of pressure differential system to the Owner's Representative for review. Do not begin work until system has been approved by the Owner's Representative. Include in the submittal the following:
 - a. Number of pressure differential machines required and the calculations necessary to determine the number of machines.
 - b. Description of projected air-flow within work area and methods required to provide adequate air flow in all portions of the work area.
2. If the enclosure is not a mini-enclosure, the Contractor must supply the required number of asbestos air filtration units to the site in accordance with these specifications. Each unit shall include the following:
 - a. Cabinet constructed of steel or other durable materials able to withstand damage from rough handling and transportation. The width of the cabinet should be less than 30 inches to fit through standard-size doorways. Cabinet shall be factory sealed to prevent asbestos-containing dust from being released during use, transport, or maintenance. Access to and replacement of all air filters shall be from intake end. Unit shall be mounted on casters or wheels.
 - b. Rate capacity of fan according to useable air-moving capacity under actual operating conditions. Use centrifugal-type fan.
 - c. The final filter shall be the HEPA type. The filter media (folded into closely pleated panels) must be completely sealed on all edges with a structurally rigid frame.
 - d. A continuous rubber gasket shall be located between the filter and the filter housing to form a tight seal.
 - e. Provide HEPA Units that are individually tested and certified on site by an independent testing agency to have an efficiency of not less than 99.97 percent when challenged with 0.3 m dioctylphthlaate (DOP) particles when tested in accordance with Military Standard Number 2182 and Army Instruction Manual 136-300-175A. Provide filters that bear a UL586 label to indicate ability to perform under specified conditions.
 - f. Pre-filters, which protect the final filter by removing the larger particles, are required to prolong the operating life of the HEPA filter. Two stages of pre-filtration are required. The first-stage pre-filter shall be a low-efficiency type (e.g., for particles 10 microns and larger). The second-stage (or intermediate) filter shall have a medium efficiency (e.g., effective for particles down to 5 microns). Pre-filters and intermediate filters shall be installed either on or in the intake grid of the unit and held in place with special housings or clamps.
 - g. Each unit shall be equipped with a Magnahelic gauge or manometer to measure the pressure drop across filters and indicate when filters have become loaded and need to be changed. A table indicating the useable air-handling capacity for various static pressure readings on the Magnahelic gauge shall be affixed near the gauge for reference, or the Magnahelic reading indicating at what point the filters should be changed, noting Cubic Feet per Minute (CFM) air delivery at that point. Provide units equipped with an elapsed time meter to show the total accumulated hours of operation.

- h. The unit shall have an electrical (or mechanical) lockout to prevent fan from operating without a HEPA filter. Units shall be equipped with automatic shutdown system to stop fan in the event of a major rupture in the HEPA filter or blocked air discharge. Warning lights are required to indicate normal operation, too high a pressure drop across the filters (i.e., filter overloading), and too low of a pressure drop (i.e., major rupture in HEPA filter or obstructed discharge).
 - i. Electrical components shall be approved by the National Electrical Manufacturers Association (NEMA) and Underwriters' Laboratories (UL). Each unit shall be equipped with overload protection sized for the equipment. The motor, fan, fan housing, and cabinet shall be grounded.
 - j. If a mini-enclosure is used the air filtration unit may be a HEPA filtered vacuum with a flow rate of at least 100 cubic feet per minute (CFM).
- 3. Provide a fully operational pressure differential system within the work area maintaining continuously a pressure differential across work area enclosures of 0.02 inches of water for glove bag operations and mini-containments. Demonstrate to the Owner's Representative the pressure differential by use of pressure differential meter or a manometer, before disturbance of any asbestos-containing materials. In the case of a mini-enclosure visual evidence of pressure differential through the use of a smoke generation tube shall be sufficient as in paragraph C.13 of this section.
- 4. Continuously monitor and record the pressure differential between the work area and the building outside of the work area.
- 5. Provide fully operational negative pressure systems supplying a minimum of one air change every ten minutes (six changes per hour), less in the instance of a mini-enclosure. Determine the volume in cubic feet of the work area by multiplying floor area by ceiling height. Determine total ventilation requirement in cubic feet per minute (cfm) for the work area by dividing this volume by the air change rate.
- 6. $\text{Ventilation Required (CFM)} = \text{Volume of work area (cu. ft.)} / 10 \text{ min.}$
- 7. Determine number of units needed to achieve ten-minute change rate by dividing the ventilation requirement (CFM) above capacity of exhaust unit(s) used. Capacity of a unit for purposes of this section is the capacity in cubic feet per minute with fully loaded filters (pressure differential which causes loaded filter warning light to come on) in the machines labeled operating characteristics.
- 8. Add one additional unit as a backup in case of equipment failure or machine shutdown for filter changing.
- 9. Locate exhaust unit(s) so that makeup air enters work area primarily through decontamination facilities and traverses work area as much as possible. This may be accomplished by positioning the unit(s) at a maximum distance from the worker access opening or other makeup air sources.
- 10. Vent to outside of building, unless authorized in writing by the Owner's Representative.
- 11. Each unit shall be serviced by a dedicated minimum 115v-20A circuit with overload device tied into an existing building electrical panel which has sufficient spare capacity to accommodate the load of all pressure differential units connected. Dedication of an existing circuit may be accomplished by shutting down existing loads on the circuit.
- 12. Test pressure differential system before any asbestos-containing material is wetted or removed. After the work area has been prepared, the decontamination facility set up, and the exhaust unit(s) installed, start the unit(s) (one at a time). Demonstrate operation and testing of pressure differential system to the Owner's Representative.
- 13. Demonstrate of operations of the pressure differential system to the Owner's Representative will include, but not be limited to, the following:
 - a. Plastic barriers and sheeting move lightly in toward work area.
 - b. Curtain of decontamination units move lightly in toward work area.
 - c. There is a noticeable movement of air through the decontamination unit. Use stroke tube to demonstrate air movement from clean room, and from equipment room to work area.
 - d. Use smoke tubes to demonstrate a positive motion of air across all area in which work is to be performed.

- e. Use a differential pressure meter or manometer to demonstrate a pressure difference of at least 0.02 inches (as allowed) of water across every barrier separating the work area from the balance of the building or outside. This is not required in the case of a mini enclosure.
- 14. Start exhaust units before beginning work (before any asbestos-containing material is disturbed). After abatement work has begun, run units continuously to maintain a constant negative pressure until decontamination of the work area is complete. Do not turn off units at the end of the work shift or when abatement operations temporarily stop.
- 15. Do not shut down pressure differential system during encapsulating procedures, unless authorized by the Owner's Representative in writing. Start abatement work at a location farthest from the exhaust units and proceed toward them. If an electric power failure occurs, immediately stop all abatement work and do not resume until power is restored and exhaust units are operating again.
- 16. At completion of abatement work, allow exhaust units to run as specified to remove airborne fibers that may have been generated during abatement work and cleanup and to purge the work area with clean makeup air. The units may be required to run for a longer time after decontamination, if dry or only partially wetted asbestos material was encountered during any abatement work. In the case of a mini-enclosure the vacuum may be removed and the entrance sealed following encapsulation until the clearance sample is collected.
- 17. Prior to final air test, remove pre-filter and wipe out inside lip of negative air machine.
- 18. When a final inspection and the results of final air tests indicate that the area has been decontaminated, exhaust units may be removed from the work area. Before removal from the work area, remove and properly dispose of pre-filter, and seal Intake to the machine with 6-mil polyethylene to prevent environmental contamination from the filters.

D. Work Area Preparation

- 1. The work area is the location where asbestos-abatement work occurs. It is a variable of the extent of work of the contract. It may be a portion of a room, a single room, or a complex of rooms. A "work area" is considered contaminated during the work, and must be isolated from the balance of the building, and decontaminated at the completion of the asbestos-control work.
- 2. Pre-clean fixed objects, walls and floor surfaces within the proposed work areas using HEPA filtered vacuum equipment and wet cleaning methods as appropriate.
- 3. Seal all openings, supply and exhaust vents, and convectors within ten feet of the work area with 6-mil polyethylene sheeting secured and completely sealed with plastic adhesion tape.
- 4. Contact fire control agencies to review procedures prior to start of work.
- 5. Provide flame resistant polyethylene sheeting that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-resistant Textiles and Films. Provide largest size possible to minimize seams, four- or six- mils thick, frosted or black.
- 6. Provide spray adhesive in aerosol cans which is specifically formulated to stick tenaciously to sheet polyethylene and supporting surface.
- 7. Completely isolate the work area from other parts of the building so as to prevent asbestos-containing dust or debris from passing beyond the isolated area. Should the area beyond the work area(s) become contaminated with asbestos-containing dust or debris as a consequence of the work, clean those areas in accordance with the procedures indicated in Paragraph "Decontamination Procedures." All such required cleaning or decontamination shall be performed at no additional cost to the Owner.
- 8. Place all tools (i.e., scaffolding, staging) necessary for the work in the area to be isolated prior to erection of plastic sheeting temporary enclosure.
- 9. Disable ventilation systems or any other system bringing air into or out of the work area. Disable system by disconnecting wires, removing circuit breakers, by lockable switch or other positive means that will prevent accidental premature restarting of equipment.
- 10. Remove and dispose of all electrical and mechanical items, such as lighting fixtures, clocks, diffusers, registers, escutcheon plates, etc., which cover any part of the surface on which work is to be performed.



11. All general construction items such as cabinets, casework, doors and window trim, moldings, ceilings, trim, etc., which cover the surface of the work as required to prevent interference with the work. To be performed by the Owner: clean, decontaminate and reinstall all such materials, upon completion of all removal work with materials, finishes, and workmanship to match existing installations before start of work.
12. Permit Access to the work area only through the Decontamination Unit. All other means of access shall be closed off and sealed and warning signs displayed on the clean side of the sealed access.
13. Provide Warning Signs at each visual and physical barriers reading as follows in both English and Spanish:

<u>Legend</u>	<u>Notation</u>
KEEP OUT	3" Sans Serif Gothic or Block
BEYOND THIS POINT	1" Sans Serif Gothic or Block
ASBESTOS ABATEMENT WORK	1" Sans Serif Gothic or Block
IN PROGRESS	1" Sans Serif Gothic or Block
BREATHING ASBESTOS DUST MAY BE	14 Point Gothic
HAZARDOUS TO YOUR HEALTH	

14. Alternate methods of containing the work area may be submitted to the Owner's Representative for approval. Do not proceed with any such method(s) without prior written approval of the Owner's Representative.
15. Individually seal all ventilation openings (supply and exhaust), lighting fixtures, clocks, doorways, windows, convectors and speakers, and other openings into the work area with plastic adhesion tape alone or with polyethylene sheeting at least 4-mil in thickness, taped securely in place with plastic adhesion tape. Maintain seal until all work including Project Decontamination is completed. Take care in sealing off lighting fixtures to avoid melting or burning of sheeting.
16. Provide sheet plastic barriers at least 6-mil in thickness as required to completely seal openings from the work area into adjacent areas. Seal the perimeter of all sheet plastic barriers with plastic adhesion tape or spray cement.
17. Where applicable, construct framing of the containment out of fire treated wood or aluminum studs. Mini-enclosure frames may be constructed of Polyvinyl Chloride (PVC) tubing.
18. Cover all walls in work area extending to the underside of the ceiling grid system with one layer of polyethylene sheeting, at least 6-mil in thickness, mechanically supported and sealed with plastic adhesion tape or spray-glue in the same manner as "Critical Barrier" sheet plastic barriers. Tape all joints with plastic adhesion tape. Contractor shall be responsible for repair of damaged wall finishes.
19. Cover floor with two layers of 6-mil polyethylene sheeting (exclude for floor tile and adhesive).
20. Provide Pressure Differential System per Paragraph "Pressure Differential System."
21. If the enclosure barrier is breached in any manner that could allow the passage of asbestos debris or airborne fibers, then add the affected area to the work area, enclose it as required by this section of the specification and decontaminate it as described in Paragraph "Decontamination Procedures."
22. Establishing a Mini-Containment area:
 - a. Establish work area so that unauthorized entry is prevented; Construct a two-compartment fire treated wood frame around work area; install one layer 6-mil polyethylene sheeting to structural members and two layers 6 mil polyethylene sheeting to the floor. Exception: no floor required if mini-containment is being constructed to perform a floor tile activity. Seal all edges to wall, ceiling, and floor surfaces with duct tape. Install viewing inspection windows, where feasible.
 - b. Seal all penetrations with duct tape such as pipes, electrical conduit, or ducts contained within the mini-containment.

- c. Install triple 6-mil polyethylene flaps at both doorways. Place portable sprayer with clean water, disposable towels, and pre-labeled disposal bag in air lock.
- d. Install appropriate signs on outside of mini-containment area.
- e. Install HEPA vacuum; extend hose into mini-containment area for general vacuuming, negative air, and cleaning of disposal suit.
- f. Accumulate all loose materials for disposal. Place in approved container. Apply appropriate labels. Adequately wet clean all wall, floor, tool and equipment surfaces.
- g. Abatement worker must wear two disposable suits. Remove outer suit in work area and place in a plastic bag. Enter air lock.
- h. In air lock, wet wipe respirator and wash hands with clean water. Remove respirator and place in a clean plastic bag. Proceed to remote shower unit where inner suit may be removed.

E. Worker Protection

1. This section describes the equipment and procedures required for protecting workers against asbestos contamination and other work place hazards except for respiratory protection.
2. Respiratory Protection is specified in Paragraph "Respiratory Protection."
3. Train in accordance with EPA's Model Accreditation Plan, 40 CFR 763 - Asbestos, all workers in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and area protective measures. Include but do not limit the topics covered in the course to the following:
 - a. Methods of recognizing asbestos.
 - b. Health effects associated with asbestos.
 - c. Relationship between smoking and asbestos in producing lung cancer.
 - d. Nature of operations that could result in exposure to asbestos.
4. Importance of and instruction in the use of necessary protective controls, practices and procedures to minimize exposure including:

Engineering controls

Work practices

Respirators

Housekeeping procedures

Hygiene facilities

Protective clothing

Decontamination procedures

Emergency procedures

Waste disposal procedures

Appropriate work practices for the work

Requirements of medical surveillance program

Review of OSHA 29 CFR 1926.1101(k)(9)(viii)(G) - Asbestos

Pressure differential systems

Work practices including hands on or on job training

Personal decontamination procedures

Air monitoring, personal and area

5. Provide medical examinations for all workers who may encounter an airborne fiber level of 0.1 f/cc or greater for an 8 hour time weighted average. In the absence of specific airborne fiber data, provide medical examination for all workers who will enter the work area for any reason. Examination shall, at minimum, meet OSHA requirements as set forth in 29 CFR 1926.1101(k)(9)(viii)(G) - Asbestos. In addition, provide an evaluation of the individual's ability to work in environments capable of producing heat stress in the worker.
6. Before start of work Contractor shall submit the following to the Owner's Representative for review. Do not start work until receipt of the Owner's Representative.



- a. An original signed copy of the Certificate of Worker's Acknowledgement found at the end of this specification, for each worker who is to be at the job site or enter the work area.
 - b. Courses outline or name of institution providing the worker training course.
 - c. Report from medical examination conducted within last 12 months as part of compliance with OSHA medical surveillance requirements for each worker who is to enter the work area.
7. Provide disposable full-body coveralls and disposable head covers, and require that they be worn by all workers in the work area. Provide a sufficient number for all required changes, for all workers in the work area.
 8. Provide work boots with non-skid soles, and where required by OSHA, foot protectives, for all workers. Provide boots at no cost to workers. Paint uppers of all boots red with water proof enamel. Do not allow boots to be removed from the work area for any reason, after being contaminated with asbestos-containing material. Dispose of boots as asbestos contaminated waste at the end of the work.
 9. Provide head protectives (hard hats) as required by OSHA for all workers, and provide four spares for use by the Owner's Representative, and the Owner. Label hats with same warning labels as used on disposal bags. Require hard hats to be worn at all times that work is in progress that may potentially cause head injury. Provide hard hats with plastic strap type suspension. Require hats to remain in the work area throughout the work. Thoroughly clean, decontaminate and bag hats before removing them from work area at the end of the work.
 10. Provide eye protectives (goggles) as required by OSHA for all workers involved in scraping, spraying, or any other activity which may potentially cause eye injury.
 11. Provide work gloves to all workers and require that they be worn at all times in the work area. Do not remove gloves from work area. Dispose of gloves as asbestos contaminated waste at the end of the work.
 12. Respirators, disposable coveralls, head covers, and footwear covers shall be provided by the contractor for the Owner, the Owner's Representative, and other authorized representatives who may inspect the job site.
 13. Provide worker protection as required by the most stringent OSHA and/or EPA standards applicable to the work. The following procedures are minimums to be adhered to regardless of fiber count in the work area.
 14. Each time work is entered, remove all street clothes in the changing room of the Personnel Decontamination Unit and put on new disposable coverall, new head cover, and a clean respirator. Proceed through shower room to equipment room and put on work boots.
 15. In the event a mini-enclosure is used refer to Paragraph "Work Area Preparation" for personal decontamination procedures.

F. Respiratory Protection

1. Instruct and train each worker involved in asbestos abatement or maintenance and repair of friable asbestos-containing materials in proper respiratory use and require that each worker always wear a respirator, properly fitted on the face in the work area from the start of any operation which may cause airborne asbestos fibers until the work area is completely decontaminated. Use respiratory protection appropriate for the fiber level encountered in the work place or as required for other toxic or oxygen-deficient situations encountered.
2. Except to the extent that more stringent requirements are written directly into the Contract Documents, the following regulations and standards have the same force and effect (and are made a part of the Contract Documents by reference) as if copied directly into the Contract Documents, or as if published copies were bound herewith. Where there is a conflict in requirements set forth in these regulations and standards meet the more stringent requirement.
 - a. OSHA - U.S. Department of Labor Occupational Safety and Health Administration, Safety and Health Standards 29 CFR 1910, Section 1001 and Section 1910.134.29 CFR 1926.
 - b. ANSI - American National Standard Practices for Respiratory Protection. ANSI Z88.2-1980.
 - c. NIOSH - National Institute for Occupational Safety and Health.

d. MSHA - Mine Safety and Health Administration.

G. Type Of Respiratory Protection Required

1. Provide Respiratory Protection as indicated in paragraph below. Where paragraph below does not apply, determine the proper level of protection by dividing the expected or actual airborne fiber count in the work area by the "protection factors" given below. The level of respiratory protection which supplies an airborne fiber level inside the respirator, at the breathing zone of the wearer, at or below 0.01 fibers/cubic centimeter is the minimum level of protection allowed.
2. Eight-hour Time Weighted Average (TWA) of asbestos fibers to which any worker may be exposed shall not exceed 0.1 fibers/cubic centimeter.
3. For purposes of this section fibers are defined as all fibers regardless of composition as counted in the OSHA Reference Method (ORM), NIOSH P&CAM 239 or 7400 procedure, or asbestos fibers of any size as counted using either a scanning or transmission electron microscope.
4. Require that respiratory protection be used at all times that there is any possibility of disturbance of asbestos-containing materials whether intentional or accidental.
5. Require that a respirator be worn by anyone in a work area at all times, regardless of activity, during a period that starts with any operation which could cause airborne fibers until the area has been cleared for re-occupancy.

H. Respiratory Protection Factor

<u>Respirator Type</u>	<u>Protection Factor</u>
Air purifying:	10
Negative pressure respirator	
High efficiency filter	
Half facepiece	
Air purifying:	50
Negative pressure respirator	
High efficiency filter	
Full facepiece	
Powered-air purifying (PAPR):	100
Positive pressure respirator	
High efficiency filter	
Half or Full facepiece	
Type C supplied air:	100
Positive pressure respirator continuous-flow	
Half or full facepiece	
Type C supplied air:	1000
Positive pressure respirator pressure demand	
Full facepiece	
Type C supplied air:	over 1000
Positive pressure respirator pressure demand	
Full facepiece	
Equipped with an auxiliary positive pressure	
Self-contained breathing apparatus (SCBA)	
Self-contained breathing apparatus (SCBA):	over 1000
Positive Pressure respirator	

Pressure demand
Full facepiece

- I. Air Purifying Respirator
 - 1. Provide half face or full face type respirators. Equip full-face respirators with a nose cup or other anti-fogging device as would be appropriate for use in air temperatures less than 32 degrees Fahrenheit.
 - 2. Provide, at a minimum, HEPA type filters labeled with NIOSH and MSHA certification for "Radionuclides, Radon Daughters, Dust, Fumes, Mists including Asbestos-Containing Dusts and Mists" and color coded in accordance with ANSI Z228.2 (1980). In addition, a chemical cartridge section may be added, if required, for solvents, etc., in use. In this case, provide cartridges that have each section of the combination canister labeled with the appropriate color code and NIOSH/MSHA Certification.
 - 3. Supply with a sufficient quantity of respirator filters approved for asbestos, so that workers can change filters during the work day. Require that respirators be wet-rinsed, and filters discarded, each time a worker leaves the work area. Require that new filters be installed each time a worker re-enters the work area. Store respirators and filters at the job site in the changing room and protect totally from exposure to asbestos prior to their use. Do not use single use, disposable or quarterface respirators.
- J. Powered Air Purifying Respirator (PAPR)
 - 1. Provide full-facepiece type respirators. Provide nose-cups for full-facepiece respirators. Provide, at a minimum, HEPA type cartridges approved by NIOSH/MSHA and certified for use in atmospheres containing asbestos dusts.
 - 2. Provide, at a minimum, one extra battery pack for each respirator so that one can be charging while one is in use.
 - 3. Provide non-cloth belts capable of being decontaminated in shower.
 - 4. Supply with a sufficient quantity of high efficiency respirator filters approved for asbestos so that workers can change filters at any time that flow through the face piece decreases to the level at which the manufacturer recommends filter replacement. Require that regardless of flow, filter cartridges be replaced after 40 hours of use. Require that HEPA elements in filter cartridges be protected from wetting during showering. Require entire exterior housing of respirator including blower unit, filter cartridges, hoses, battery pack, face mask, belt, and cords to be washed each time a worker leaves the work area. Caution should be used to avoid shorting battery pack during washing.
- K. Required Respiratory Protection
 - 1. Regardless of airborne fiber levels, require the following minimum level of respiratory protection:
 - a. Half-face air purifying respirators may be used during set-up of the containment and removal of the material so long as fiber counts inside the respirator do not exceed .01 f/cc fibers per cubic centimeter.
- L. Decontamination Units -Three-Stage
 - 1. Provide a Personnel Decontamination Unit consisting of a serial arrangement of rooms or spaces, Changing Room, Shower Room, Equipment Room adjacent to each full containment area.
 - 2. Require all persons without exception to pass through this decontamination unit for entry into and exiting from the work area for any purpose. Do not remove equipment or materials through Personnel Decontamination Unit.
 - 3. Changing (Clean) Room:
 - a. Provide a room that is physically and visually separated from the rest of the building for the purpose of changing into protective clothing.
 - b. Locate so that access to work area from changing room is through shower room.

- c. Separate changing room from the building by a double-sheeted polyethylene flapped doorway.
 - d. Provide sub-panel at changing room to accommodate all removal equipment. Power sub-panel directly from a building electrical panel. Connect all electrical branch circuits in decontamination unit and particularly any pumps in shower room to a ground-fault circuit protection device.
4. Shower Room:
 - a. Provide a completely water tight operational shower to be used for transit by cleanly dressed workers heading for the work area from the changing room, or for showering by workers headed out of the work area after undressing in the equipment room.
 - b. Construct room by providing a shower pan and two shower walls in a configuration that will cause water running down walls to drip into pan. Install a freely draining wood floor in shower pan at elevation of top of pan.
 - c. Separate this room from rest of building, drying room and airlock with airtight walls fabricated of 6-mil polyethylene.
 - d. Provide splash proof entrances to Drying Room and Airlock.
5. Equipment Room (contaminated area):
 - a. Require work equipment, footwear and additional contaminated work clothing to be left here. This is a change and transit area for workers. Separate this room from the work area by a 6-mil polyethylene flap doorway.
 - b. Separate this room from the rest of the building, the shower room and work area with air tight walls fabricated of 6-mil polyethylene.
6. Clean Room: Provide Clean Room to isolate the holding room from the building exterior.
7. Load-out Area:
 - a. The load-out area is the transfer area from the building to a truck or dumpster.
 - b. Wet wipe bags before they are passed through the equipment decon-chamber.
 - c. When cleaning is complete pass items into holding room. Close all doorways except the doorway between the holding room and the Clean Room.
 - d. Workers from the area outside the containment area enter holding area and remove decontaminated equipment and/or containers for disposal.
 - e. Require these workers to wear full protective clothing and appropriate respiratory protection.
 - f. At no time is a worker from an uncontaminated area to enter the enclosure when a removal worker is inside.
 - g. Post an approximately 20 inch x 14 inch manufactured caution sign at each entrance to the work area displaying the following legend with letter sizes and styles of a visibility required by OSHA 29 CFR 1926.1101(k)(9)(viii)(J) - Asbestos.

LEGEND

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED
IN THIS AREA

- h. Provide spacing between respective lines at least equal to the height of the respective upper line.
 - i. Additional Signage: Shall also be posted in accordance with OSHA 29 CFR 1926.1101(k)(9)(viii)(J) - Asbestos

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD



AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA
DANGER
ASBESTOS
CANCER AND LUNG HAZARD
KEEP OUT

- j. Post an approximately 10 inch by 14 inch manufactured sign at each entrance to each work area displaying the following legend with letter sizes and styles of a visibility at least equal to the following:

<u>LEGEND</u>	<u>NOTATION</u>
No Food, Beverages or Tobacco Permitted	3/4 inch Block
All Persons Shall Don Protective Clothing (Coverings) Before Entering the Work Area	3/4 inch Block
All Persons Shall Shower Immediately After Leaving Work Area and Before Entering the Changing Area	3/4 inch Block

M. Decontamination Procedures

1. Contractor shall require all workers and visitors to adhere to the following personal decontamination procedures whenever they leave the work area:
 - a. Require that all workers use the following decontamination procedure as a minimum requirement whenever leaving the work area.
 - b. When exiting area, remove disposable coveralls, disposable head covers, and disposable footwear covers or boots in the Equipment Room.
 - c. Still wearing respirators, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator to avoid asbestos fibers while showering. The following procedure is required as a minimum:
 - 1) Thoroughly wet body including hair and face. If using a PAPR, hold blower unit above head to keep canisters dry.
 - 2) With respirator still in place thoroughly wash body, hair, respirator face piece, and all parts of the respirator except the blower unit and battery pack on a PAPR. Pay particular attention to seal between face and respirator and under straps.
 - 3) Take a deep breath, hold it and/or exhale slowly, completely wet hair, face, and respirator. While still holding breath, remove respirator and hold it away from face before starting to breathe.
 - 4) Carefully wash face-piece of respirator inside and out.
 - d. If using PAPR, shut down in the following sequence, first cap inlets to filter cartridges, then turn off blower unit (this sequence will help keep debris which has collected on the inlet side of filter from dislodging and contaminating the outside of the unit). Thoroughly wash blower unit and hoses. Carefully wash battery pack with wet rag. Be extremely cautious of getting water in battery pack as this will short out and destroy battery.
 - 1) Shower completely with soap and water.
 - 2) Rinse thoroughly.
 - 3) Rinse shower room walls and floor prior to exit.
 - 4) Proceed from shower to changing room and change into street clothes or into new disposable work items.

- e. Require that all workers use the following decontamination procedure as a minimum requirement whenever leaving the work area with a half or full face cartridge type respirator:
 - 1) When exiting area, remove disposable coveralls, disposable headcovers, and disposable footwear covers or boots in the equipment room.
 - 2) Still wearing respirators, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator and filters to avoid asbestos fibers while showering. The following procedure is required as a minimum:
 - 3) Thoroughly wet body from neck down.
 - 4) Wet hair as thoroughly as possible without wetting the respirator filter if using an air purifying type respirator.
 - 5) Take a deep breath, hold it and/or exhale slowly, complete wetting of hair, thoroughly wetting face, respirator and filter (air purifying respirator). While still holding breath, remove respirator and hold it away from face before starting to breath.
 - 6) Dispose of wet filters from air purifying respirator.
 - 7) Carefully wash facepiece of respirator inside and out.
 - 8) Shower completely with soap and water.
 - 9) Rinse thoroughly.
 - 10) Rinse shower room walls and floor prior to exit.
 - 11) Proceed from shower to changing room and change into street clothes or into new disposable work items.

N. Project Decontamination

- 1. If the asbestos abatement work is on damaged or friable materials, then the building space is deemed contaminated before start of the work and in need of decontamination. In this case, the procedure includes two cleanings of the primary barrier plastic prior to its removal and two cleanings of the room surfaces to remove any new or existing contamination.
- 2. Work of this section includes the decontamination of air in the work area which has been, or may have been contaminated by the elevated airborne asbestos fiber levels generated during abatement activities, or which may previously have had elevated fiber levels due to friable materials in the space.
- 3. Work of this section also includes the cleaning, decontamination, and removal of temporary facilities installed prior to abatement work and decontamination of all surfaces (ceiling, walls, floor) of the work area, and all furniture or equipment in the work area.
- 4. First Cleaning
 - a. Carry out a first cleaning of all surfaces of the work area including items of remaining sheeting, tools, scaffolding and/or staging by use of damp-cleaning and mopping, and/or a HEPA filtered vacuum. (Note: A HEPA vacuum will fail if used with wet material). Do not perform dry dusting or dry sweeping. Use each surface of a cleaning cloth one time only and then dispose as contaminated waste. Continue this cleaning until there is no visible debris from removed materials on plastic sheeting or other surfaces. Upon authorization of the Owner's Representative proceed with encapsulation of substrate.
 - b. Perform encapsulation of substrate where required at this time. Maintain pressure differential system in operation during encapsulation work. Allow encapsulant to dry before proceeding with removal of Secondary layer of plastic.
- 5. Second Cleaning
 - a. Upon authorization of the Owner's Representative, remove all Primary Barrier sheeting and Material Decontamination Unit, if there is one, leaving only the following:
 - 1) Critical Barrier which forms the sole barrier between the work area and other portions of the building or outside.
 - 2) Critical Barrier Sheeting over lighting fixtures and clocks, ventilation openings, doorways, convectors, speakers and other openings.

- 3) Personnel Decontamination Unit.
 - 4) Pressure Differential System in continuous operation.
 - b. Remove all filters in Air Handling System(s) and dispose of as asbestos-containing waste.
6. Final Cleaning: Carry out a final cleaning of all surfaces in the work in the same manner as the first cleaning immediately after removal of primary plastic. This cleaning is now being applied to existing room surfaces. Take care to avoid water marks or other damage to surfaces.
7. Visual Inspection: Perform a complete visual inspection with the Owner's Representative of the entire work area including decontamination unit, all plastic sheeting, seals over ventilation openings, doorways, windows, and other openings; look for debris from any sources, residue on surfaces, dust or other matter. If any such debris, residue, dust or other matter is found repeat cleaning and continue decontamination procedure from that point. When the area is visually clean, complete the certification at the end of this section.
8. Final Air Sampling
 - a. After the work area is found to be visually clean, air samples will be taken and analyzed in accordance with the procedures set forth in Paragraph "Powered Air Purifying Respirator (PAPR).
 - b. If Release Criteria are not met, repeat cleaning and continue decontamination procedure from that point.
 - c. If Release Criteria is met, remove the interior of the decontamination unit leaving in place only the Critical Barriers separating the work area from the rest of the building and the operating negative pressure system.
 - d. Any small quantities of residual material found upon removal of the plastic sheeting shall be removed with a HEPA filtered vacuum cleaner and local area protection. If significant quantities, as determined by the Owner's Representative, are found then the entire area affected shall be decontaminated as specified herein for the cleaning.

O. Work Area Clearance

1. Air Monitoring
 - a. Visual Inspection is required as a prerequisite of air testing.
 - b. To determine if the elevated airborne asbestos structure concentration during abatement operations have been reduced to the specified level, the Owner's Representative will secure samples and analyze them according to the following procedures.
2. Aggressive Sampling
 - a. All air samples will be taken using aggressive sampling techniques as follows. (There are no standards available for flow rate of leaf blowers or large fans. However, this information is not critical to the success of the procedure).
 - b. Before sampling pumps are started, the exhaust from forced-air equipment (leaf blower with at least 1 horsepower electric motor) will be swept against all walls, ceilings, floors, ledges and other surfaces in the room. This procedure will be continued for five minutes per 10,000 cubic feet of room volume.
 - c. Air samples will be collected in areas subject to normal air circulation away from room corners, obstructed locations, and sites near windows, doors or vents.
3. Schedule of Air Samples
 - a. General: The number and volume of air samples taken and analytical methods used by the Owner's Representative will be in accordance with the following schedule. Sample volumes given may vary depending upon the analytical instruments used. In each homogeneous work area after completion of all cleaning work, samples will be taken and analyzed by either PCM or TEM analysis.
 - b. Transmission Electron Microscopy (TEM) Samples:
 - 1) In each homogeneous work area after completion of all cleaning work, samples will be taken and analyzed by either PCM or TEM analysis as follows:
 - 2) Samples will be collected on 25 mm cassettes with filter media: TEM - 0.45 micrometer mixed cellulose ester or 0.40 micrometer polycarbonate, with 5.0 micron mixed cellulose ester backing filter.

Location Sampled	Number of Samples	Detection Limit (f/cc)	Minimum Volume (Liters)	Rate LPM
Each Work Area	5	0.005	1,300	2-10

- 3) TEM Analysis will be performed using the analysis method set forth in the AHERA Regulation 40 CFR Part 763 Appendix A.
- 4) Asbestos Structures referred to in this Section include asbestos fibers, bundles, clusters, or matrices, as defined by method of analysis.
- 5) Decontamination of the work site is complete when all the sample results are below 0.01 fibers per cubic centimeters (f/cc) of air or 70 structures per square millimeter.
- c. Phase Contrast Microscopy (PCM) Samples:
 - 1) In each homogeneous work area after completion of all cleaning work, samples may be taken and analyzed as follows:
 - 2) Samples will be analyzed by PCM for clearance in areas where ceiling tile and/or pipe insulation are removed
 - 3) Samples will be collected on 25 mm cassettes with filter media: PCM - 0.8 micrometer mixed cellulose ester.

Location Sampled	Number of Samples	Detection Limit (s/cc)	Minimum Volume (Liters)	Rate LPM
Each Work Area	1-5	0.01	2,400	2-10

- 4) PCM Analysis: Fibers on each filter will be measured using the NIOSH 7400 Method entitled "Fibers" published in the NIOSH Manual of Analytical Methods, 3rd Edition, Second Supplement, August 1987.
- 5) Fibers: Referred to in this section include fibers regardless of composition as counted by the phase contrast microscopy method used
- 6) Decontamination of the work site is complete when all the sample results are below 0.01 fibers per cubic centimeters (f/cc) of air or 70 structures per square millimeter.
4. Failure of Clearance Sampling: Should results from analysis of final clearance air samples not meet the specified criteria, Contractor will be responsible for the payment of all costs, including Consultant's time for subsequent clearance air sampling. The costs associated with subsequent re-sampling for final clearance shall be deducted from the Contractor's final payment of the contract amount.

P. Removal Of Pipe Insulation

1. The work of this section applied to the removal of asbestos-containing Pipe Insulation.
 - a. Place one layer of 6-mil fire retardant polyethylene sheeting directly below the work. The sheet shall be of sufficient size to completely wrap the pipe once it has been removed.
 - b. Thoroughly wet the ends of the pipe with amended water and scrape off a minimum of 6 inches of asbestos wrap from both ends of the pipe. Immediately place the wetted material into pre-labeled asbestos disposal bag(s).
 - c. Detach the pipe at each scraped end and place the pipe onto one sheet of 6-mil fire retardant polyethylene sheeting. Wrap the pipe with the 6-mil fire retardant polyethylene sheeting. Contractor shall wrap the pipe with a second sheet of 6-mil, fire retardant polyethylene sheeting and label as asbestos-containing material. Dispose of the bag(s) and duct in accordance with the Paragraph "Handling and Disposal of Asbestos Contaminated Waste" of this specification.
 - d. Upon clearance from the Owner's Representative, Contractor shall remove the 6-trail, fire retardant polyethylene sheeting from the openings.

Q. Glove Bag Removal

1. The work of this section applies to full containment or glovebag removal.
2. Isolate the area in accordance with Paragraph "Temporary Facilities."
3. Construct a decontamination unit as described in Paragraph "Decontamination Units" and attach to the work area.
4. Set up pressure differential isolation and ventilation of the work area in accordance to Paragraph "Pressure Differential System."
 - a. Upon approval of the enclosure by the Owner's Representative, Contractor may proceed to remove the material using the following method.
 - b. Thoroughly wet to satisfaction of the Owner's Representative, asbestos-containing insulation to be removed prior to stripping and/or tooling to reduce fiber dispersal into the air. Accomplish wetting by a fine spray (mist) of amended water or removal encapsulant. Saturate material sufficiently to wet the substrate without causing excess dripping. Allow time for removal encapsulant to penetrate material thoroughly. If amended water is used, spray material repeatedly during the work process to maintain a continuously wet condition. If a removal encapsulant is used, apply in strict accordance with manufacturer's written instructions. If insulation is covered with canvas, Contractor will wet the exterior covering and slice it with utility knife while saturating the material.
 - c. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels using commercially available "foggers."
 - d. Remove saturated asbestos-containing material in small sections from all areas. Do not allow material to dry out. As it is removed, simultaneously pack material while still wet into disposal bags. Twist neck of bags, bend over and seal with minimum three wraps of duct tape. Clean outside and move to wash down station adjacent to material decontamination unit.
 - e. Evacuate air from disposal bags with a HEPA filtered vacuum cleaner before sealing.
 - f. Contractor must always clean area of visible asbestos debris prior to end of shift.
5. These procedures shall be followed to remove pipe insulation elbows:
 - a. Install critical barriers to isolate the work site. Install 2 or 3 Stage Decontamination Units.
 - b. HEPA vacuum the work site.
 - c. Provide negative air machine in addition to those required, in the vicinity of the work. Arrange so that exhaust is into the work area, oriented in a direction away from the work. Extend a 2-inch diameter flexible non-collapsing duct from the intake end to a point no more than 4'-0" from any scraping or brushing activity.
 - d. Locate intake of duct so that airflow is horizontally and slightly downward into intake. Replace primary filter on negative air machine at an interval of no greater than 30 minutes. Allow no more than one scraping or brushing activity per negative air machine.
 - e. Check pipe where the work will be performed. Wrap damaged (broken lagging, hanging, etc.), pipe in 6 mil plastic and "candy-stripe" with duct tape. Place one layer of duct tape around undamaged pipe at each end where the glovebag will be attached.
 - f. Place necessary tools into pouch located inside glovebag. This will usually include: bone saw, utility knife, rags, scrub brush, wire cutters, tin snips and pre-wetted cloth.
 - g. Place one strip of plastic adhesion tape along the edge of the open top slit of glove bag for reinforcement.
 - h. Place the glove bag around section of pipe to be worked on and staple top together through reinforcing tape. Next, tape the ends of glovebag to pipe itself, where previously covered with plastic or tape.
 - i. Use smoke tube and aspirator bulb to test seal. Place tube into water sleeve (two-inch opening to glovebag) squeezing bulb and filling bag with visible smoke. Remove smoke tube and twist water sleeve closed. While holding the water sleeve tightly, gently squeeze glovebag and by using a flashlight, look for smoke leaking out, (especially at the top and ends of the glovebag). If leaks are found, tape closed using plastic adhesion tape and re-test.
 - j. Insert wand from garden sprayer through water sleeve. Plastic adhesion tape water sleeve tightly around the wand to prevent leakage.

- k. One person places its hands into the long-sleeved gloves while the second person directs garden sprayer at the work.
 - l. Use bone saw, if required, to cut insulation at each end of the section to be removed. A bone saw is a serrated heavy gauge wire with ring-type handles at each end. Throughout this process, spray amended water or removal encapsulant on the cutting area to keep dust to a minimum.
 - m. Remove insulation using putty knives or other tools. Place pieces in bottom of bag without dropping.
 - n. Rinse all tools with water inside the bag and place back into pouch.
 - o. Using scrub brush, rags and water, scrub and wipe down the exposed pipe. (Inexpensive horse rub-down mittens work well for this).
 - p. Remove water wand from water sleeve and attach the small nozzle from HEPA-filtered vacuum. Turn on the vacuum only briefly to collapse the bag.
 - q. Remove the vacuum nozzle, twist water sleeve closed and seal with plastic adhesion tape.
- R. Handling And Disposal Of Asbestos-Containing Waste
- 1. All waste and asbestos contaminated waste shall be double bagged in pre-labeled 6-mil airtight puncture resistant bags. Labeling shall be in accordance with OSHA and EPA requirements.
 - a. Bags of asbestos-containing waste shall be sealed with tape in the work area. Asbestos waste shall not be allowed to dry out prior to sealing bags. While in the work area, bags shall be decontaminated of any bulk debris by wet wiping. Bags shall be pre-labeled in accordance with OSHA and EPA.
 - b. The Contractor shall ensure that the sealed bags are transported to the waste disposal site.
 - 2. The Contractor shall establish a manifest system to enable the Owner to report the quantity of asbestos waste being deposited at the landfill. Contractor shall report the quantity of waste in pounds or tons as appropriate. The Contractor must be able to demonstrate custody over all asbestos waste from the time it is removed from the work area until it is deposited at the land fill.
 - a. Copies of the manifest and any receipts generated during the handling and disposal process shall be provided to the Owner's Representative and the Owner.
 - b. Final manifest and documents must be provided to the Owner's Representative and the Owner within two weeks of the removal of the asbestos materials from the site by the waste hauler.
- S. Encapsulation Of Asbestos-Containing Materials
- 1. General provisions of Contract, including General and Supplementary Conditions and Division 1, apply to work of this section.
 - a. The work includes the sealing of all piping or vessels from which asbestos-containing insulation has been removed with one coat of a lock down encapsulant.
 - b. Where repair work is being performed, the end will be sealed with a minimum of one coat of bridging encapsulant.
 - 2. Submittals
 - a. Product Data: Submit manufacturer's technical information including label analysis and application instructions for each material proposed for use.
 - b. Installation Instructions: Submit manufacturer's installation instructions with specific project requirements noted.
 - c. Performance Warrantee: Submit manufacturer's performance guarantee.
 - d. Certification: Submit written approval of entity installing the encapsulant from encapsulant manufacturer.
 - e. Safety Data Sheet: Submit the Safety Data Sheet, or equivalent, in accordance with the OSHA Hazard Communication Standard (29 CFR 1910.1200) for each surfactant and encapsulating material proposed for use on the work. Include a separate attachment for each sheet indicating the specific worker protective equipment proposed for use with the material indicated.

3. Deliver materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:
 - a. Name or title of material
 - b. Manufacturer's stock number and date of manufacture
 - c. Manufacturer's name
 - d. Thinning Instructions
 - e. Application Instructions
4. Deliver materials together with a copy of the OSHA Safety Data Sheet for the material.
5. Job Conditions
 - a. Apply encapsulating materials only when environmental conditions in the work area are as required by the manufacturer's instructions.
6. Quality Assurance
 - a. Installation of Spray-on Encapsulation Materials: Install spray-on materials by a firm and personnel approved by the manufacturer of the primary materials.
 - b. Testing: Test material to be encapsulated using methods set forth in ASTM E1494 "Standard Practice for Encapsulants Spray-or-Trowel-Applied for Friable Asbestos-Containing Building Materials."
 - c. Performance Warranty: Submit written Performance Warranty, executed by the manufacturer and co-signed by the Contractor, agreeing to repair/replace spray-on work which has cracked, fallen from substrate, or otherwise deteriorated to a condition where it would not perform effectively for its intended purposes due substantially to defective materials or workmanship and not due to abuse by occupants, improper maintenance, non-foreseeable ambient exposures or other causes beyond anticipated conditions and manufacturer's/contractor's control.
 - d. Compatibility: Selection and use of encapsulant shall be compatible with replacement materials. Submit manufacturer's data indicating compatibility with replacement materials.
7. Product Selection
 - a. Encapsulants: Provide penetrating or bridging type encapsulants specifically designed for application to asbestos-containing material.
 - b. Standards: Product shall be rated as acceptable for use intended when field tested in accordance with ASTM E1494 "Standard Practice for Encapsulants Spray-or-Trowel-Applied for Friable Asbestos-Containing Building Materials."
 - c. Fire Safety: Use only materials that have a flame spread index of less than 25, when dry, when tested in accordance with ASTM E84.
8. Manufacturers
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products, which may be incorporated in the work, include, but are not limited to the following:
 - 1) Penetrating Encapsulants: As currently accepted by the EPA. Refer to most recent EPA approval list.
 - 2) Bridging Encapsulants: As currently accepted by the EPA. Refer to most recent EPA approval list.
9. General
 - a. Prior to applying any encapsulating material, ensure that application of the sealer will not cause the base material to fail and allow the sealed material to fall of its own weight or separate from the substrate. Should Contractor doubt the ability of the installation to support the sealant, request direction from the Owner's Representative before proceeding with the encapsulating work.
 - b. Do Not Commence Application of encapsulating materials until all removal work within the work area has been completed.
10. Worker Protection
 - a. Before beginning work with any material for which a Safety Data Sheet has been submitted, provide workers with the required protective equipment. Require that appropriate protective equipment be used at all times.

- b. In addition to protective breathing equipment required by OSHA requirements or by this specification, use painting pre-filters on respirators to protect the dust filters when organic solvent based encapsulants are used.
 - 11. Substrate
 - a. Apply lock down encapsulant to all substrate after all asbestos-containing materials have been removed. Apply in strict accordance with the manufacturer's printed instructions for use of the encapsulation as an asbestos coating. Any deviations from such printed instructions shall be approved by the Owner's Representative in writing prior to commencing work.
 - b. Apply encapsulant with an airless spray gun with air pressure and nozzle orifice as recommended by the encapsulant manufacturer.
- T. Removal Of Floor Tile
 - 1. This section applies to the removal of floor tile.
 - a. Prior to start of work, wet wipe all surfaces including floor tile to remove any visible dust.
 - b. Isolate the room by sealing hallway or doors and installing critical barriers on all ducting, windows and other penetrations of the room, in the specified area. Install a splash guard a minimum of 4 feet high on the walls of the room with one layer of 6-mil fire retardant poly.
 - c. Install a two-stage decontamination configuration contiguous (under certain conditions may be remote) with the work in accordance with Paragraph "Decontamination Units."
 - d. Using water or amended water in a Hudson-type sprayer or garden sprayer, lightly mist the area where the material is to be removed. This may take several passes with the hose of the sprayer. Allow time for the water to soak into the material.
 - e. Immediately place individual tiles in proper asbestos disposal bags. Vacuum collapse the bag, twist the neck of the bag, tape with duct tape, fold the twisted portion over onto itself and tape again. Wipe the outside of the bag with clean damp cloths and place the bag into a second prelabeled disposal bag. Tape shut the second bag.
- U. Removal Of Fireproofing
 - 1. The work of this section applies to the removal of all asbestos containing fireproofing including all over-spray that may be located on concrete block, columns, metal deck, beams, fixtures conduit and ducting.
 - a. Isolate the floor per Paragraph "Temporary Enclosure."
 - b. Construct a decontamination unit as described in Paragraph "Decontamination Units" and attach to the work area.
 - c. Set up pressure differential isolation and ventilation of the work area in accordance to Paragraph "Temporary Pressure Differential and Air Circulation System."
 - d. Upon approval of the enclosure by the Owner's Representative, contractor may proceed to remove the material using the following method.
 - e. Pre-clean columns, beams, electrical, mechanical and plumbing systems in the work area using wet wipe and HEPA vacuuming methods. Mask off with flame retardant polyethylene sheeting to protect from contamination during bulk abatement.
 - f. Thoroughly wet to satisfaction of the Owner's Representative, asbestos-containing fireproofing to be removed prior to stripping and/or tooling to reduce fiber dispersal into the air. Accomplish wetting by a fine spray (mist) of amended water or removal encapsulant. Saturate material sufficiently to wet the substrate without causing excess dripping. Allow time for removal encapsulant to penetrate material thoroughly. If amended water is used, spray material repeatedly during the work process to maintain a continuously wet condition. If a removal encapsulant is used, apply in strict accordance with manufacturer's written instructions.
 - g. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels using commercially available "foggers."
 - h. Remove saturated asbestos-containing material in small sections from all areas. Do not allow material to dry out. As it is removed, simultaneously pack material while still wet into

disposal bags. Twist neck of bags, bend over and seal with minimum three wraps of duct tape. Clean outside and move to wash down station adjacent to material decontamination unit.

- i. Evacuate air from disposal bags with a HEPA filtered vacuum cleaner before sealing.
- j. Provide Pressure Differential Machine in addition to those required in Paragraph "Pressure Differential System," in the vicinity of the work. Arrange so that exhaust is into the work area, oriented in a direction away from the work. Extend a 12" diameter flexible non-collapsing duct from the intake end to a point no more than 4'-0" from any scraping or brushing activity.
- k. Locate intake of duct so that air flow is horizontally and slightly down-ward into intake. Replace primary filter on pressure differential machine at an interval of no greater than 30 minutes. Allow no more than one scraping or brushing activity per pressure differential machine.

V. Removal Of Wall Plaster: HEPA vacuum work site.

- 1. Place two layers of 6-mil flame retardant polyethylene sheeting on the floor adjacent to the wall to be demolished. Pull the wall down in manageable sections onto the polyethylene sheeting. Control dust and fiber release by misting the air and lightly wetting the material with amended water from a Hudson-type sprayer or garden sprayer as it is demolished.
- 2. Wrap the first layer of polyethylene sheeting around the material and seal with duct tape. Wrap the second layer of polyethylene sheeting around the bundle and seal with duct tape.
- 3. Label and dispose of the entire bundle.
- 4. Provide Pressure Differential Machine in addition to those required in Paragraph "Pressure Differential System," in the vicinity of the work. Arrange so that exhaust is into the work area, oriented in a direction away from the work. Extend a 12-inch diameter flexible non-collapsing duct from the intake end to a point no more than 4'-0" from any scraping or brushing activity.
- 5. Locate intake of duct so that air flow is horizontally and slightly down-ward into intake. Replace primary filter on negative air machine at an interval of no greater than 30 minutes.

W. Clean-Up Of Asbestos-Containing Debris On Ceiling Tile Or Solid Ceiling

- 1. This section applies to the decontamination of the entire plaster ceiling, removal of existing fiberglass on duct work and removal of all batt insulation covering the existing plaster ceiling.
 - a. Isolate the floor per Paragraph "Temporary Facilities."
 - b. Construct a decontamination unit as described in Paragraph "Decontamination Units" and attach to the work area. General Contractor will give direction regarding exact location of decontamination unit(s).
 - c. Set up pressure differential isolation and ventilation of the work area in accordance with Paragraph "Temporary Pressure Differential and Air Circulation System."
 - d. Upon approval of the enclosure by the Owner's Representative, contractor may proceed to remove the material using the following method:
- 2. These procedures shall be followed to for clean up of asbestos-containing debris on existing plaster ceiling:
 - a. This work will be performed prior to the removal of fireproofing. The isolation of the work area is considered essential to the pre-cleaning activities for the total area. Isolate the area in accordance with Paragraph "Temporary Facilities."
 - b. Remove asbestos-containing debris and fiberglass batt and duct insulation and decontaminate the area using the following procedures:
 - 1) Remove all small debris with the HEPA vacuum.
 - 2) Gently mist all fiberglass insulation, remove from ducts and ceiling and place into pre-labeled hazardous disposal bags and dispose of in accordance with Paragraph "Disposal of Asbestos Containing Waste Material."
 - 3) Exposure of ducting will expose all fireproofing overspray, this material may be removed during the removal of fireproofing from decks and beams.

- 4) Pick up all large visible debris on the ceiling or any horizontal surfaces and place in the bottom of a 6-mil polyethylene disposal bag conforming to the requirements of Paragraph "Disposal of Asbestos-Containing Waste." Place pieces in the bag without dropping and avoiding unnecessary disturbance and release of material.
 - 5) HEPA vacuum the entire plaster ceiling surface.
 - c. Upon completion of the decontamination of the area request a visual inspection of the ceiling and other horizontal surfaces. This area will be considered a portion of work area for the duration of the work and will be included in the final encapsulation of the area.
- X. Removal Of Adhesive: This section applies to the removal of all asbestos-containing floor tile and adhesive, sheet vinyl flooring, vinyl floor tile, and baseboard adhesive, etc.
 1. Ensure that workers are equipped with proper respiratory protection. In addition to the HEPA cartridges, respirators must also be equipped with organic solvent cartridges.
 2. Provide HEPA filtered fan units in the vicinity of the work. Arrange so that units exhaust outside the building. Replace primary filters on HEPA filtered fan units at an interval of no greater than 30 minutes.
 3. Apply adhesive removal solvent as recommended by manufacturer after removal of floor tile has been completed.
 4. Provide tile adhesive (mastic) remover that meets the following criteria:
 - a. Flash Point: 122E or greater.
 - b. Special Precautions: No heavy smoke generated if ignited.
 - c. Health Effects: Limited to mild skin rash or eye irritation.
 - d. Respiratory Protection: MSHA - NIOSH approved Organic vapor cartridges in conjunction with standard HEPA filters.
 - e. Petroleum Distillates: None.
 - f. Odor: Pine, Citrus or none.

Use of diesel fuel in the removal of tile and baseboard adhesive is strictly prohibited.

5. Remove adhesive in small sections from all areas. Do not allow material to dry out. As adhesive is removed, simultaneously pack rags contaminated with adhesive material into disposal bags. Twist neck of bags, bend over and seal with minimum three wraps of duct tape. Clean outside of bag and move to material decontamination unit.
6. Upon completion of adhesive removal, thoroughly clean bare substrate of all solvent residue.
7. Place adhesive residue in proper asbestos disposal bags. Vacuum collapse the bag, twist the neck of the bag, tape with duct tape, fold the twisted portion over onto itself and tape again. Wipe the outside of the bag with clean damp cloths and place bag into second prelabeled disposal bag. Tape shut the second bag.



CERTIFICATE OF WORKER'S ACKNOWLEDGEMENT

PROJECT NAME: _____

PROJECT ADDRESS: _____

CONTRACTOR: _____

WORKING WITH ASBESTOS CAN BE DANGEROUS. INHALING ASBESTOS FIBERS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCER IF YOU SMOKE AND INHALE ASBESTOS FIBERS, THE CHANCE THAT YOU WILL DEVELOP LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.

Your employer's contract with the Owner for the above project requires that: You be supplied with the proper respirator and be trained in its use. You be trained in safe work practices and in the use of the equipment found on the job. You receive a medical examination. These things are to have been done at no cost to you. By signing this certification you are assuring the Owner that your employer has met these obligations to you.

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators, and informed of the type respirator to be used on the above referenced project. I have a copy of the written respiratory protection manual issued by my employers. I have been equipped at no cost with the respirator to be used on the above project.

TRAINING COURSE: I have been trained in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and area protective measures. The topics covered in the course included the following:

- Physical characteristics of asbestos
- Health hazards associated with asbestos
- Respiratory protection
- Use of protective equipment
- Pressure differential systems
- Work practices including hands-on or on-the-job training
- Personal decontamination procedures
- Air monitoring, personal and area

MEDICAL EXAMINATION: I have had a medical examination within the last 12 months which was paid for by my employer. This examination included: health history, pulmonary function tests and may have included an evaluation of a chest x-ray.

Signature _____ Witness _____

Printed Name _____ Social Security Number _____



CERTIFICATION OF VISUAL INSPECTION

AREA _____

In accordance with Paragraph "Project Decontamination" the Contractor hereby certifies that it has visually inspected the work area (all surfaces including pipes, beams, ledges, walls, ceiling and floor, Decontamination Unit, sheet plastic, etc.) and has found no dust, debris or residue.

By: _____

Signature _____ Date _____

Print Name _____

Print Title _____

OWNER'S REPRESENTATIVE CERTIFICATION

the Owner's Representative hereby certifies that it has accompanied the Contractor on its visual inspection and verifies that this inspection has been thorough and to the best of its knowledge and belief, the Contractor's certification above is a true and honest one.

Signature _____ Date _____

Print Name _____

Print Title _____



RESPIRATORY PROTECTION PROGRAM

Project Name _____

Location _____

Date _____

Based upon airborne asbestos-fiber counts encountered on previous projects of similar type working on materials similar to those found on the above referenced project. The following level of respiratory protection is proposed for the indicated operations to maintain an Airborne Fiber Count (as measured by the NIOSH 7400 Method) below the specified Permissible Exposure Limit (PEL) inside the respirator face piece.

Operation	Anticipated f/cc	Respiratory Protection	Protection Factor	f/cc in Mask
Installing sheet plastic				
Removing trim in contact with asbestos-containing material				
Removal of architectural finish or fireproofing				
Removal of pipe insulation				
Removal of fitting insulation				
Encapsulation of pipe and boiler insulation				
Gross debris removal				
Cleaning "primary" sheet plastic				
Cleaning "critical" barrier				
Removing Decontamination Unit				
Other				

The Contractor certifies that to the best of its knowledge and belief the above represent a true and accurate representation of Airborne Fiber Counts to be expected for the operations indicated, and are based upon airborne fiber data from past projects with similar materials and operations.

Contractor _____

Signature _____

Date _____

Print Name _____

Title _____

END OF SECTION 02 82 33 00



SECTION 02 82 33 00a - REMOVAL OF NONFRIABLE ASBESTOS-CONTAINING MATERIALS

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for removal of nonfriable asbestos-containing materials. Products shall be as follows or as directed by the the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Definitions

1. ACM: Asbestos Containing material which is any material containing more than one percent asbestos.
2. Amended Water: Water containing a wetting agent or surfactant with a maximum surface tension of 2.9 Pa 29 dynes per centimeter when tested in accordance with ASTM D 1331.
3. Area Sampling: Sampling of asbestos fiber concentrations which approximates the concentrations of asbestos in the theoretical breathing zone but is not actually collected in the breathing zone of an employee.
4. Asbestos: The term asbestos collectively refers to a naturally occurring mineral known by the following specific names: chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.
5. Asbestos control Area: That area where asbestos removal operations are performed. The area shall be isolated by physical boundaries to assist in the prevention of the uncontrolled access by non-qualified persons.
6. Asbestos Fibers: Those fibers having an aspect ratio of at least 3:1 and longer than-5 micrometers as determined by National Institute for Occupational Safety and Health (NIOSH) Method 7400.
7. Asbestos Permissible Exposure Limit: 0.1 fibers per cubic centimeter of air as an e-hour time weighted average measured in the breathing zone as by defined 29 CFR 1926.1101 or other Federal legislation having legal jurisdiction for the protection of workers health.
8. Background: The ambient airborne asbestos concentration in an uncontaminated area as measured prior to any asbestos hazard abatement efforts. Background concentrations for contaminated areas are measured in similar but asbestos free locations.
9. Contractor: The Contractor is that individual, or entity under contract to the Owner to perform the herein listed work.
10. Contractor/Supervisor (Asbestos abatement): A person who has successfully completed training and is therefore accredited as a Contractor/Supervisor under a State Model Accreditation Plan or EPA Model Accreditation Plan as described in 40 CFR 763.
11. Critical Barrier: The layer of polyethylene sheeting that covers an opening or penetration in a room or area that is to become a negative pressure enclosure.
12. Encapsulation: The abatement of an asbestos hazard through the appropriate use of chemical encapsulants.
13. Encapsulants: Specific materials in various forms used to chemically or physically entrap asbestos fibers in various configurations to prevent these fibers from becoming airborne. There are four types of encapsulants as follows which must comply with performance requirements as specified herein.
 - a. Removal Encapsulant (can be used as a wetting agent)
 - b. Bridging Encapsulant (used to provide a tough, durable surface coating to asbestos containing material)
 - c. Penetrating Encapsulant (used to penetrate the asbestos containing material encapsulating all asbestos fibers and preventing fiber release due to routine mechanical damage)
 - d. Lock-Down Encapsulant (used to seal off or "lock-down" minute asbestos fibers left on surfaces from which asbestos containing material has been removed).



14. Friable Asbestos Material: Any material containing more than one percent asbestos that can be crumbled, pulverized, or reduced to powder by hand pressure when dry.
15. Glovebag Technique: Those asbestos removal and control techniques put forth in 29 CFR 1926.1101.
16. HEPA Filter Equipment: High efficiency particulate air (HEPA) filtered vacuum and/or exhaust ventilation equipment with a filter system capable of collecting and retaining asbestos fibers. Filters shall retain 99.97 percent of particles 0.3 microns or larger as indicated in UL 586.
17. the Owner: That qualified person employed directly by the Owner to monitor, sample, inspect the work, and advise the Owner.
18. Negative Pressure Enclosure (NPE): That engineering control technique described as a negative pressure enclosure in 29 CFR 1926.1101.
19. Non-friable Asbestos Material: Material that contains asbestos in which the fibers have been immobilized by a bonding agent, coating, binder, or other material so that the asbestos is well bound and will not normally release asbestos fibers during any appropriate use, handling, storage or transportation. It is understood that asbestos fibers may be released under other conditions such as demolition, renovation, removal, or mishap.
20. Personal Sampling: Air sampling which is performed to determine asbestos fiber concentrations within the breathing zone of a specific employee, as performed in accordance with 29 CFR 1926.1101.
21. Competent Person (CP): A person who has successfully completed training and is therefore accredited under a legitimate State Model Accreditation Plan or EPA Model Accreditation Plan as described in 40 CFR 763 as a Contractor/Supervisor and shall be appropriately licensed according to the Statutes of the State in which the work is to be performed.
22. TEM: Refers to Transmission Electron Microscopy.
23. Time Weighted Average (TWA): The TWA is an 8-hour time weighted average airborne concentration of asbestos fibers.
24. Wetting Agent: A chemical added to water to reduce the water's surface tension thereby increasing the water's ability to soak into the material to which it is applied. An equivalent wetting agent must have a surface tension of at most 2.9 Pa 29 dynes per centimeter when tested in accordance with ASTM D 1331.

C. Requirements

1. Description of Work: The work covered by this section includes the handling and control of asbestos containing materials and describes some of the resultant procedures and equipment required to protect workers, the environment and occupants of the building or area, or both, from contact with airborne asbestos fibers. The work also includes the disposal of any asbestos containing materials generated by the work. More specific operational procedures shall be outlined in the Asbestos Hazard Abatement Plan called for elsewhere in this specification. The asbestos work includes the use of non-friable removal technique(s) which is governed by 40 CFR 763 as indicated. Provide non-friable removal technique(s) as outlined in this specification for the locations indicated.
2. Medical Requirements: Provide medical requirements including but not limited to medical surveillance and medical record keeping as listed in 29 CFR 1926.1101.
 - a. Medical Examinations: Before exposure to airborne asbestos fibers, provide workers with a comprehensive medical examination as required by 29 CFR 1926.1101 or other pertinent State or local directives. This requirement must have been satisfied within the 12 months prior to the start of work on this contract. The same medical examination shall be given on an annual basis to employees engaged in an occupation involving asbestos and within 30 calendar days before or after the termination of employment in such occupation. Specifically identify x-ray films of asbestos workers to the consulting radiologist and mark medical record jackets with the word "ASBESTOS."
 - b. Medical Records: Maintain complete and accurate records of employees' medical examinations, medical records, and exposure data for a period of 30 years after termination of employment and make records of the required medical examinations and

- exposure data available for inspection and copying to: The Assistant Secretary of Labor for Occupational Safety and Health (OSHA), or authorized representatives of them, and an employee's physician upon the request of the employee or former employee.
- c. Medical Certification: Submit written certification for each worker and contractor/supervisor, signed by a licensed physician indicating that the worker and contractor/supervisor has met or exceeded all of the medical prerequisites listed herein and in 29 CFR 1926.1101 and 29 CFR 1910.134 as prescribed by law.
 3. Training: Train all personnel involved in the asbestos control work in accordance with United States Environmental Protection Agency (USEPA) Asbestos Hazard Emergency Response Act (AHERA) training criteria or State training criteria whichever is more stringent. The Contractor shall document the training by providing a copy of a current training certification to the the Owner for each person assigned to work on this project. Furnish each employee with respirator training and fit testing documentation as required by 29 CFR 1910.134. Provide instruction on the engineering and other hazard control techniques and procedures to be used on this project.
 - a. Employee Training: Submit copies of training certificates for each employee indicating that the employee has received training at the appropriate level in accordance with 40 CFR 763.
 4. Permits, Licenses, and Notifications: Notify the local air pollution control district/agency and the the Owner in writing 10 working days prior to commencement of work in accordance with 40 CFR 61-SUBPART M or applicable state and local regulations. Obtain necessary permits or licenses in conjunction with asbestos removal, encapsulation, hauling, and disposal. Post the permit and/or license at the work site, visible from a non-controlled area. Notify the local fire department 3 days prior to removing fire-proofing material from the building including notice that the material contains asbestos.
 5. Environment, Safety and Health Compliance: Comply with the applicable requirements of the current issue of 29 CFR 1926.1101, 40 CFR 61-SUBPART A, and 40 CFR 61-SUBPART M or applicable State or local regulations regarding handling, storing, transporting, and disposing of asbestos waste materials. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting the work. Where the requirements of this specification, applicable regulations, or referenced documents vary, the most stringent requirement shall apply.
 - a. Site Inspection: While performing asbestos engineering control work, the Contractor shall be subject to on-site inspection by the Federal, State, or local regulatory agencies and the Contracting Officer or its designated representative. If the work is found to be in violation of Federal, State, or local regulations or this specification, the Contracting Officer or its representative will issue a stop work order to be in effect immediately and until the violation is resolved. All related costs including standby time required to resolve the. violation shall be at the Contractor's expense.
 6. Respiratory Protection Program: Establish and implement a respirator program as required by ANSI 288.2 and 29 CFR 1910.134. Submit a written program manual or operating procedure including methods of compliance with regulatory statutes.
 - a. Respirator Program Records: Submit records of the respirator program as required by ANSI 288.2 and 29 CFR 1910.134.
 7. Contractor/Supervisor (Asbestos Abatement): The Contractor shall be represented on-site by a trained contractor/Supervisor. This person shall be on-site at all times when asbestos work is in progress. The Qualified Person, as defined herein, can be the Contractor/Supervisor.
 8. Hazard Communication: Adhere to all parts of 29 CFR 1910.1200 and 29 CFR 1926.59. Provide the Contracting Officer with a copy of the Safety Data Sheets (SDS) for all materials brought to the site. Review the Asbestos Survey Report(s) provided by the the Owner, if any.
 9. Asbestos Hazard Abatement Plan: Submit a detailed plan of the safety precautions such as lockout, tag-out, tryout, fall protection, and confined space entry procedures and equipment and work procedures to be used in the removal of materials containing asbestos. The plan shall be prepared by the Contractor (and reviewed and signed by an asbestos consultant (LAC) licensed according to the Statutes of the State in which the work is to be performed) for review and

recommendation for approval by the the Owner. The plan shall be forwarded to the the Owner for final approval at least 10 days prior to beginning abatement activities. The plan shall include but not be limited to the detailed description of personal protective equipment and work practices to be used including, but not limited to, respiratory protection, type of whole-body protection , the location of asbestos control areas including clean and dirty areas, buffer zones, showers, storage areas, change rooms, removal method, interface of trades involved in the construction, sequencing of asbestos related work, disposal plan, type of wetting agent and asbestos encapsulant to be used, locations of local exhaust equipment, planned air sampling strategies, and a detailed description of the method to be employed in order to control environmental pollution. The plan shall also include both fire and medical emergency response plans. The Asbestos Hazard Abatement Plan must be approved in writing prior to starting any asbestos work.

10. Testing Laboratory: Submit the name, address, and telephone number of each testing laboratory selected for the sampling, analysis, and reporting of airborne concentrations of asbestos fibers along with evidence that each laboratory selected holds the appropriate State license and/or permits and certification that each laboratory is American Industrial Hygiene Association (AIHA) accredited and that persons counting the samples have been judged proficient by current inclusion on the AIHA Asbestos Analysis Registry (AAR) and successful participation of the laboratory in the Proficiency Analytical Testing (PAT) Program. Where analysis to determine asbestos content in bulk materials or transmission electron microscopy is required, submit evidence that the laboratory is accredited by the National Institute of Science and Technology (NIST) under National Voluntary Laboratory Accreditation Program (NVLAP) for asbestos analysis.
11. Landfill Approval: Submit written evidence that the landfill for disposal is approved for asbestos disposal by the USEPA and State and local regulatory agency(s).
12. Waste Shipment Records/Asbestos Waste Manifest: Submit waste shipment records and/or asbestos manifest records, prepared in accordance with applicable Federal, State, or local regulations, signed and dated by an agent of the landfill, certifying the amount of asbestos materials delivered to the landfill, within 3 days after delivery.
13. Negative Exposure Assessment: Submit objective data demonstrating that the method(s) used for the specified non-friable ACM removal does not release airborne concentrations of asbestos fibers exceeding the TWA PEL or excursion limit. This data may be from previous work within the last 12 months or from initial exposure assessments on this project. Data from previous work must have been gathered by the firm employed on this contract, using workers trained to the same level, with the ACM and workplace conditions "closely resembling" the conditions for this contract.
14. Contractor Daily Reports: Prepare a written report for each day that asbestos work is being accomplished. The report should be submitted to the the Owner monthly. The report as a minimum shall include the following, where applicable:
 - a. Daily Visual Inspection Reports: Prepare a written report documenting compliance with the Asbestos Hazard Abatement Plan and Federal, State, or local regulations.
 - b. Air Sampling Reports: Complete fiber counting within 24 hours of the "time off" of the sample pump. Notify the the Owner immediately of any airborne levels of asbestos fibers in excess of the acceptable limits. Sampling results shall be submitted to the the Owner the day following receipt. The affected employees will be provided copies of the results where required by law within 3 working days. These results shall be signed by the air sampler and the testing laboratory employee that analyzed the sample.
 - c. Pressure Differential Recordings for Local Exhaust System-Not Used
 - d. Asbestos Disposal Quantity Report: The Contractor shall record and report daily the amount of asbestos containing material removed and the amount transported for disposal. Deliver the report for the previous day and cumulative totals with amounts of material removed reported in linear meters or square meters linear feet or square feet as described initially in this specification and the amounts of material transported for disposal reported in cubic meters yards.

D. Submittals

1. Submit the following in accordance with Section "Submittal Procedures."
 - a. Vacuums and tools
 - b. Respirators
 - c. Wetting Agent
 - d. Safety Data Sheets (SDS) for all materials proposed for transport to the project site
 - e. Local exhaust system
 - f. Pressure differential automatic recording instrument
 - g. Daily Reports
 - h. Asbestos hazard abatement plan
 - i. Testing laboratory
 - j. Training Certificates
 - k. Landfill approval
 - l. Employee training
 - m. Medical certification requirements
 - n. Waste shipment records/Asbestos waste manifest
 - o. Respiratory Protection Program
 - p. Negative Exposure Assessment
 - q. Local Exhaust system
 - r. Show compliance with ANSI Z9.2 by providing manufacturers' certifications.
 - s. Permits, licenses, and Notifications
 - t. Rental equipment
 - u. Respirator program records
 - v. Protective clothing decontamination quality control records
 - w. Protective clothing decontamination facility notification.

E. Quality Assurance

1. Glovebags-Not Used
2. Rental Equipment: Provide a copy of the written notification to the rental company concerning the intended use of the equipment and the possibility of asbestos contamination of the equipment.
3. Protective Clothing Decontamination Quality Control Records: Provide all records that document quality control for the decontamination of reusable outer protective clothing.
4. Protective Clothing Decontamination Facility Notification: Submit written evidence that persons who decontaminate, store, or transport asbestos contaminated clothing used in the performance of this contract were duly notified in accordance with 29 CFR 1926.1101.

1.2 PRODUCTS

A. Encapsulants

1. See Division 21 Section "Facility Fire-Suppression Water-Service Piping".

1.3 EXECUTION

A. Equipment

1. Respirators: Select respirators from those approved by the National Institute for Occupational Safety and Health (NIOSH). Provide personnel engaged in pre-cleaning, cleanup, handling, and removal of asbestos containing materials with the appropriate respiratory protection as specified in 29 CFR 1910.134.
2. Exterior Whole Body Protection
 - a. Outer Protective Clothing: Provide personnel exposed to asbestos with disposable "non-breathable," or reusable "non-breathable" whole body outer protective clothing, head



- coverings, gloves, and foot coverings. Provide disposable plastic or rubber gloves to protect hands. Cloth gloves may be worn inside the plastic or rubber gloves for comfort, but shall not be used alone. Make sleeves secure at the wrists, make foot coverings secure at the ankles, and make clothing secure at the neck by the use of tape. Reusable whole body outer protective clothing shall be either disposed of as asbestos contaminated waste upon exiting from the asbestos regulated work area or be properly decontaminated.
- b. Work Clothing-Not Used
 - c. Decontamination of Reusable Outer Protective Clothing: When reusable outer protective clothing is used, transport the double bagged clothing to a previously notified commercial/industrial decontamination facility for decontamination. Perform non-destructive testing to determine the effectiveness of asbestos decontamination. If representative sampling is used, ensure the statistical validity of the sampling results. If representative sampling is used, reject any entire batch in which any of the pieces exceed 40 fibers per square millimeter. Inspect reusable protective clothing prior to use to ensure that it will provide adequate protection and is not or is not about to become ripped, torn, deteriorated, or damaged, and that it is not visibly contaminated. Notify, in writing, all personnel involved in the decontamination of reusable outer protective clothing as indicated in 29 CFR 1926.1101.
 - d. Eye Protection: Provide goggles to personnel engaged in asbestos abatement operations when the use of a full face respirator is not required.
3. Warning Signs and Labels: Provide bilingual warning signs printed in English and Spanish at all approaches to asbestos control areas. Locate signs at such a distance that personnel may read the sign and take the necessary protective steps required before entering the area. Provide labels and affix to all asbestos materials, scrap, waste, debris, and other products contaminated with asbestos.
- a. Warning Sign: Provide vertical format conforming to 29 CFR 1926.1101 minimum 20 by 14 inches (500 by 355 mm) displaying the following legend in the lower panel:

DANGER
ASBESTOS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
AUTHORIZED PERSONNEL ONLY
WEAR RESPIRATORY PROTECTION AND
PROTECTIVE CLOTHING IN THIS AREA

- b. Warning Labels: Provide labels conforming to 29 CFR 1926.1101 of sufficient size to be clearly legible, displaying the following legend:

DANGER
CONTAINS ASBESTOS FIBERS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
DO NOT BREATHE DUST
AVOID CREATING DUST

- c. Provide the following asbestos labels, of sufficient size to be clearly legible, for display on waste containers (bags or drums) which will be used to transport asbestos contaminated material in accordance with United States Department of Transportation 49 CFR Parts 171 and 172.

NA2212, (WASTE) ASBESTOS, 9, PGIII

4. Vacuums and Tools: Vacuums shall be leak proof to the filter and equipped with HEPA filters. Filters on vacuums shall conform to ANSI Z9.2 and UL 586. Do not use power tools to remove asbestos containing materials unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation systems. Remove all residual asbestos from reusable tools prior to storage or reuse.
- B. General
1. Pre-Asbestos Work Conference: The Contractor and the Contractor/Supervisor shall meet with the Contracting officer prior to beginning work, to discuss in detail the Asbestos Hazard Abatement Plan, including work procedures and safety precautions. Once approved by the Owners Engineer, the plan will be enforced as if a part of this specification. Any changes required in the specification as a result of the plan shall be identified specifically in the plan to allow for free discussion and approval by the Owners Engineer prior to starting work.
 2. Asbestos Control Area Requirements: The Contractor shall demarcate the asbestos control area(s) using physical barriers and signs to prevent access by unauthorized personnel. This area is defined by 29 CFR 1926.1101 as the regulated area.
 3. Work Procedure: Perform asbestos related work in accordance with 29 CFR 1926.1101, 40 CFR 61-SUBPART M, applicable State or local regulation, and as specified herein. Use wet removal procedures. Personnel shall wear and utilize protective clothing and equipment as specified herein. Eating, smoking, drinking, chewing gum or tobacco, or applying cosmetics shall not be permitted in the asbestos control area(s). Personnel of other trades not engaged in the removal of asbestos containing material shall not be exposed at any time to airborne concentrations of asbestos. If an asbestos fiber release or spill, stop work immediately, correct the condition to the satisfaction of the Owners Engineer, including clean-up and clearance sampling, if appropriate, prior to resumption of work.
 4. Furnishings: Furniture will be removed from the area of work by the Owner before asbestos work begins.
 5. Pre-cleaning: Wet wipe and HEPA vacuum all surfaces potentially contaminated with asbestos prior to establishment of an enclosure.
- C. Removal Procedures: Wet asbestos containing material with a fine spray of amended water during removal, cutting, or other handling so as to reduce the emission of airborne fibers. Remove material and immediately place in 0.15 mm 6 mil plastic disposal bags. Remove asbestos containing material in a gradual manner, with continuous application of the amended water in such a manner that no asbestos material is disturbed prior to being adequately wetted. Where unusual circumstances prohibit the use of 0.15 mm 6 mil plastic bags, submit an alternate proposal for containment of asbestos fibers to the Owner's Engineer for approval. Asbestos containing material shall be containerized while wet. At no time shall asbestos containing material be allowed to accumulate or become dry. Handle asbestos containing material as indicated in 40 CFR 61-SUBPART M, applicable State or local regulation, and 29 CFR 1926.1101.
1. Exposed Pipe Insulation Edges-Not Used
 2. Negative Pressure Enclosure: Block and seal openings in areas where the release of airborne asbestos fibers can be expected. Establish an asbestos negative pressure enclosure with the use of curtains, portable partitions, or other enclosures in order to prevent the escape of asbestos fibers from the contaminated asbestos work area.
 - a. Personnel/Equipment Decontamination Unit: Provide a temporary facility with a separate equipment/dirty change room and clean change room. Provide a shower that complies with 29 CFR 1926.51 in between the dirty room and clean room for personnel required to wear whole body protective clothing. Provide two separate lockers for each asbestos worker, one in each locker room. Keep street clothing and street shoes in the clean locker. HEPA vacuum and remove asbestos contaminated disposable protective clothing while still wearing respirators at the boundary of the asbestos work area and seal in impermeable bags or containers for disposal. Do not wear work clothing between home and work. All



employees shall shower before changing into street clothes. Collect used shower water and filter with approved water filtration equipment to remove asbestos contamination. Dispose of filters and residue as asbestos waste. Discharge clean water to the sanitary system. Dispose of asbestos contaminated work clothing as asbestos contaminated waste or properly decontaminate as specified in the Asbestos Hazard Abatement Plan.

- b. Waste Load-Out Unit: Provide a separate temporary area expressly for short-term storage of bagged asbestos containing material that is ready for disposal. The unit shall be the only port used to transfer waste to a truck, dumpster, or other approved on-site storage facility. It shall not be used for personnel egress. A waste load-out unit shall be integral to each negative pressure enclosure.
3. Non-friable Removal Procedures:
 - a. Under normal conditions EPA Category II, non-friable asbestos containing materials may not be considered hazardous; however, this material may release airborne asbestos fibers during demolition and removal; therefore it must be handled in a manner to prevent the release of asbestos fibers. At no time will this material be mechanically chipped, sawed, sanded, or ground.
 - b. Prior to beginning removal, establish an Asbestos Control Area and install Critical Barriers as specified elsewhere in this section. Submit a Negative Exposure Assessment which is less than 12 months old to the the Owner for approval or conduct air sampling as specified elsewhere in this section to establish the exposure levels for the exact removal method being used. The Contractor will establish the correct level of Personal Protective Equipment required.
 - c. Acceptable methods of removal include, but are not limited to, the use of dry ice, a heat gun or lamp, citrus-based solvents, and hand tools with amended water. Removal shall be accomplished to keep the ACM substantially intact. Breakage into small pieces is an unacceptable work practice. The method shall be detailed in the Asbestos Abatement Plan and shall not be changed during the removal without Contracting Officer approval.
 - d. Upon completion of the removal and clean-up, but prior to removal of critical barriers, the Contractor Testing company shall conduct a visual inspection of all areas affected by the removal. Re-clean as required.

D. Field Quality Control Requirements

1. Visual Inspections: The the Owner will conduct periodic inspections of all areas where asbestos removal and activities are in progress to ensure compliance with the approved Asbestos Hazard Abatement Plan and Federal/State regulatory requirements. This inspection shall include confirmation of proper control/containment/enclosure, worker protection, housekeeping, exhaust equipment operation, decontamination procedures, proper wetting and disposal, and inspection of work progress and work practices. Each activity will be documented as acceptable or noted as unacceptable with justification for the non-compliance.
2. Air Sampling: Sampling of airborne concentrations of asbestos fibers shall be performed in accordance with 29 CFR 1926.1101 and as specified herein. Unless otherwise specified, use NIOSH Method 7400 for sampling and analysis. Air Sampling may be duplicated by the Government at the discretion of the Contracting Officer. If the air sampling results obtained by the Government differ from those results obtained by the Contractor, the Government will determine which results predominate.
 - a. Sampling Prior to Asbestos Work (Not Used)
 - b. Sampling During Asbestos Work
 - 1) The Contractor's testing company shall perform area sampling as indicated in 29 CFR 1926.1101 and governing environmental regulations. Perform area sampling at least once every week close to the work inside the enclosure, outside the personnel/equipment decontamination unit entrance to the enclosure.
 - 2) If sampling outside the enclosure shows airborne levels have exceeded background or 0.01 fibers per cubic centimeter, whichever is greater, stop all work, correct the condition(s) causing the fiber release, and notify the the Owner immediately.

Determine by testing if adjacent areas are contaminated. If so the Contractor shall clean the contaminated areas, visually inspect, and sample the areas as specified herein.

- 3) The Contractor shall conduct personal sampling of at least 25% of the workers engaged in asbestos handling (removal, disposal, transport and other associated work) throughout the duration of the project. If the quantity of airborne asbestos fibers monitored at the breathing zone of the workers at any time exceeds 0.1 fibers per cubic centimeter, notify the PQP immediately, evaluate work practices, and take corrective action to reduce airborne asbestos fibers.

E. Clean-Up And Disposal

1. Housekeeping

- a. Essential parts of asbestos dust control are housekeeping and clean-up procedures. Maintain surfaces of the asbestos control area free of accumulations of asbestos fibers. Give meticulous attention to restricting the spread of dust and debris; keep waste from being distributed over the general area. Use HEPA filtered vacuum cleaners. **DO NOT BLOW DOWN THE SPACE WITH COMPRESSED AIR.** All asbestos waste shall be placed in an approved on-site storage facility or transported for disposal daily. When asbestos removal is complete, all asbestos waste is removed from the work-site, and final clean-up is completed, the PQP shall visually inspect the asbestos control area for cleanliness. After final clean-up and acceptable pre-clearance airborne concentrations are attained but before the local exhaust system is turned off and the negative pressure enclosure removed), remove all pre-filters on the building HVAC system and provide new pre-filters.
- b. Dispose of filters as asbestos contaminated materials. Reestablish HVAC, mechanical, and electrical systems in proper working order.

2. Title to Materials: All waste materials, except as specified otherwise, shall become the property of the Contractor and shall be disposed of as specified in applicable Federal, State, and local regulations and herein.

3. Disposal of Asbestos

- a. Collect all removed asbestos containing material, contaminated materials, contaminated water, scrap, debris, bags, containers, expendable equipment, and asbestos contaminated clothing which may produce airborne asbestos fibers and place in sealed fiber-proof, waterproof, non-returnable containers (e.g. double plastic bags 0.15 mm 6 mils thick, cartons, drums or cans). Wastes within the containers must be adequately wet in accordance with 40 CFR 61-SUBPART M. Affix a warning and Department of Transportation (DOT) label to each container including the bags or use at least 0.15 mm 6 mils thick bags with the approved warnings and DOT labeling preprinted on the bag.
- b. Each container or bag shall clearly indicate that the waste generator is the Owner and the development at which the waste is generated, and the Job Order number of the project.
- c. Prevent contamination of the transport vehicle (especially if the transport vehicle is a rented truck likely to be used in the future for non-asbestos purposes). These precautions include lining the vehicle cargo area with plastic sheeting (similar to work area enclosure) and thorough cleaning of the cargo area after transport and unloading of asbestos debris is complete. Dispose of waste asbestos material at an Environmental Protection Agency (EPA) or State-approved asbestos landfill off the Owner's property. For temporary storage, store sealed impermeable bags in asbestos waste drums or skids. An area for interim storage of asbestos waste-containing drums or skids will be coordinated with the the Owner. Procedure for hauling and disposal shall comply with 40 CFR 61-SUBPART M, State, regional, and local standards. Sealed plastic bags may be dumped from drums into the burial site unless the bags have been broken or damaged. Damaged bags shall remain in the drum and the entire contaminated drum shall be buried. Uncontaminated drums may be recycled. Workers unloading the sealed drums shall wear appropriate respirators and personal protective equipment when handling asbestos materials at the disposal site.



02 - Existing Conditions

END OF SECTION 02 82 33 00a



02 - Existing Conditions

Task	Specification	Specification Description
02 82 33 00	01 11 19 00	No Specification Required
02 82 33 00	02 82 16 00	Engineering Control of Asbestos Containing Materials



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SECTION 02 83 00 00 - LEAD REMEDIATION

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for lead paint related abatement procedures. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. General Provisions

1. The site of this work will be occupied while work is being done. Perform the abatement work with the least inconvenience to the residents.
2. Take all necessary precautions to protect the property of the the Owner and its residents. Damaged property shall be repaired and restored to its original condition. If the damage is beyond repair, the Contractor shall replace it with new materials to match existing, at the Contractor's expense.
3. Hazardous waste generated during the abatement process (including lead-base paint) when carted away from the developments shall not be transferred from one vehicle to another except at a licensed transfer station.
4. Develop a work plan to be performed as requested by the the Owner. The detailed plan shall include sequencing of abatement work in a manner that will be least disruptive to the normal use of the non-work areas in the building. The plan should also include emergency procedures in case of fire.
5. The Contractor shall include all supplementary miscellaneous items not specified but implied or required in order to complete the work.
6. Workmanship required in the execution of the work herein specified shall be of good quality and subject to the approval of the the Owner.
7. Make in a timely fashion all applicable and necessary notifications to relevant Federal, State and Local authorities. The Contractor shall indemnify the the Owner and the the Owner's representative from, and pay all claims resulting from failure to adhere to these provisions.
8. the Owner may retain an independent Monitoring Contractor to monitor the abatement contract and conduct all wipe sampling and clearance tests.
9. Contractor performing lead-based paint abatement or renovation activities involving lead-based paint shall be a Certified Lead Abatement Contractor and shall ensure that supervisors and workers are trained and certified by U.S. EPA approved state program or equivalent, to perform lead paint removal operations.
10. Establish and implement a Chemical Hazard Communication Program as required by OSHA regulations 29 CFR 1926.59.
11. Provide workers with a comprehensive medical examination as required by OSHA regulations 29 CFR 1926.62 before exposure to lead contaminated dust. The medical examination shall be conducted to approve use of appropriate respirators and shall include biological monitoring. NIOSH/MSHA approved respirators shall be utilized.
12. For employees required to wear a negative pressure respirators: conduct a respirator fit test at the time of initial fitting and at least once every six (6) months thereafter as required by OSHA regulations 29 CFR 1926.62.
13. Determine if any worker will be exposed to lead at or above the action level in accordance with OSHA regulation 29 CFR 1926.62 and 29 CFR 1910.1025. Conduct an exposure assessment to identify the level of exposure a worker would be subjected to without respiratory protection. Assess the exposure level by obtaining personal monitoring samples representative of a full shift of at least an 8-hour TWA.
14. Furnish appropriate respirators approved by NIOSH/MSHA for use in atmospheres containing lead aerosols. Instruct workers in all aspects of respiratory protection. Maintain an adequate supply of HEPA filter elements and spare parts on site for all types of respirators in use.



15. For manual demolition, scraping, sanding, use of heat gun or power tool paint removal with HEPA collection systems, workers shall minimally use the half-mask negative pressure respirator with high efficiency filters (for airborne concentrations not in excess of 500µg/m³).
16. Ensure that work area preparation, work practices, and clean-up procedures comply with these specifications and applicable Federal, State and Local regulations.
17. Notify all applicable agencies five days prior to the date the abatement will begin and provide evidence of notifications to the the Owner at the pre-start meeting.

C. Submissions

1. Within ten (10) consecutive calendar days calculated from the date of the the Owner's Job Order, the Contractor shall tender all required submissions. Six (6) sets of each submission are required. Where physical samples are required two (2) physical samples shall be submitted for each item. In general, items shall include but not be restricted to the following:
 - a. Paint remover - corner cutter/Vac-Pac System by Pentek Inc; Decontamination Products Division 1026 Fourth Avenue, Corapolis, PA. 15108. Telephone No. (412) 262-0725 or approved equal.
 - b. Description of removal method to be used on each substrate condition including manufacturer's operating instructions and recommendation for equipment usage.
 - c. Copies of current training certificates of Staff to be assigned to the contract.
 - d. List of three previous lead abatement jobs performed successfully by Contractor and name, address, and telephone number of contact person for verification.
2. In the event that all or any portion of the submitted material is rejected by the the Owner, the Contractor shall tender new submissions. All submissions returned for corrections shall be resubmitted with the required corrections within ten(10) consecutive calendar days calculated from the date of rejection, until final submissions are obtained that require no further correction. In no event shall the Contractor be permitted to tender submissions hereunder beyond twenty (20) days from the the Owner's Job Order, unless duly extended in writing by the the Owner.
3. No work shall begin, nor shall the materials be ordered or delivered to the site until final approval of all submissions.

D. Applicable Regulations

1. 24 CFR Part 35
2. HUD "Guidelines For the Evaluation and Control of Lead-Based Paint Hazards in Housing"
3. Abatement work shall also be in accordance with applicable regulations of the Environmental Protection Agency (EPA), Occupational Safety & Health Agency (OSHA) and any State or Local LBP standards. Where there is a conflict between Federal, State or Local regulations, the more stringent requirement shall prevail.
4. OSHA Standards
 - a. 29 CFR 1926.20 General safety and health provisions;
 - b. 29 CFR 1926.21 Safety training and education;
 - c. 29 CFR 1925.25 Housekeeping;
 - d. 29 CFR 1926-28 Personal protective equipment;
 - e. 29 CFR 1926.51(f) Washing facilities;
 - f. 29 CFR 1926.55 Gases, vapors, fumes, dusts, and mists;
 - g. 29 CFR 1926.57 Ventilation
 - h. 29 CFR 1926.59 Hazardous Communication Standards;
 - i. 29 CFR 1926.103 Respiratory protection, and
 - j. 29 CFR 1926.62 Lead in Construction
5. The Contractor must comply with all applicable requirements of the Resource Conservation & Recovery Act (RCRA) of 1976 as amended in 1980 and 1984 by the Hazardous & Solid Waste Amendments (HSWA).
6. These Specifications refer to many requirements found in the preceding references but in no way is it intended to cite or reiterate all provisions therein or elsewhere. It is the Contractor's responsibility to obtain a copy, and know, understand and abide by all such regulations, guidelines and common practices.

1.2 PRODUCTS – (not used)

1.3 EXECUTION

A. Abatement

1. Have risk assessment or paint inspection performed by certified risk assessor or a certified inspector technician who is independent of the abatement contractor.
2. Develop a site specific lead hazard control plan, reviewed and signed by an asbestos consultant (LAC) who is licensed in the State in which the work is to be performed, and submit for review and approval to the the Owner.
3. Obtain any necessary building or waste permits, notify local authorities as required by applicable codes and laws.
4. Select specific building component replacement items, enclosure materials, paint removal equipment and/or chemicals, tools, and cleaning supplies. Consider waste management and historical preservation implications of selected treatment.
5. Develop project specific specifications.
6. Schedule other work so that leaded surfaces are not inadvertently disturbed and unprotected workers are not place at risk. Include time for clearance examinations and laboratory dust sample analysis in the scheduling process.
7. Select a certified abatement subcontractor.
8. Conduct a pre-construction conference to ensure that the subcontractor fully understands the work involved.
9. Notify residents of the dwelling and adjacent dwellings of the work and date it will begin. Coordinate this with the the Owner.
10. Correct any existing conditions that could impede the abatement work (i.e. trash removal, structural deficiencies).
11. Post warning signs and restrict entry to work area to authorized personnel. Implement worksite preparation procedures.
 - a. Place proper warning signs required by OSHA regulations at all entrances to the work area. Signage shall be minimum of 12" x 20" and shall state the following:

**WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING**

12. Coordinate test, pilot or sample portion approach to the project with the Owner.
13. Shut-down forced air heating, ventilation and air conditioning systems and cover all vents, diffusers, windows etc., with a single layer six-mil polyethylene sheet secured with duct tape. Exceptions shall be for minor disturbances of area less than 2 square feet and where if vents, diffusers, and windows are more than 5 feet away from surface being disturbed, they need not be covered.
14. Collect preabatement soil samples, which may not have to be analyzed until post abatement soil samples have been collected, analyzed, and compared to clearance standards. If postabatement soil levels are below applicable limits, the preabatement samples need not be analyzed.
15. Cover entrances to the work area with a single layer of 6 mil polyethylene sheets taped to the top and weighted at bottom.
16. Rig a containment non-flammable polyethylene sheet underneath the work area. This containment method should catch all stripped paint for proper disposal.
17. Execute abatement work.
18. Avoid spreading dust and debris outside the work area.
19. Store all waste in a secure area and make sure it is properly labeled with an accumulation start date.
20. Conduct daily and final cleanup.
21. Execute waste disposal procedures.

22. Maintain appropriate records.

B. Paint Removal

1. Do not use the following prohibited paint removal methods:
 - a. Dry scraping or sanding (except for limited areas)
 - b. Use of heat gun over 1,100°F
 - c. Open flame burning or torching
 - d. Machine sanding or grinding without HEPA vacuum exhaust tool
 - e. Abrasive blasting or sandblasting without HEPA vacuum exhaust tool
 - f. Uncontained hydro blasting or high-pressure wash
 - g. Use of chemical strippers containing Methylene chloride.
2. Select the appropriate worksite preparation level.
3. For heat gun work, provide fire extinguishers in the work area and ensure that adequate electrical power is available. Use for limited areas only. Train workers to avoid gouging or abrading the substrate.
4. For mechanical removal methods, use tools equipped with HEPA exhaust capability. Be sure workers keep the shroud against the surface being treated. Vacuum blasting and needle guns should not be used on wood, plaster, drywall, or other soft substrates. Observe all manufacturers directions for the amount of vacuum airflow required.
5. For wet scraping, use a spray bottle or wet sponge attached to the scraper to keep the surface wet while scraping. Apply enough water to moisten the surface completely, but not so much that large amounts of water run onto the ground or floor. Do not moisten areas near electrical circuits.
6. For chemical paint removers, determine if the building component can be removed and stripped offsite. Offsite stripping is generally preferred to onsite paint removal. Observe all manufacturers' directions for use of paint removers.
7. For offsite stripping, determine how to remove the component. Score the edges with a knife or razor blade to minimize the damage to adjacent surfaces. Punch or tag the building component, if similar building components are also being stripped offsite (i.e. doors). This will ensure that the individual component is reinstalled in the same location. Inform the offsite paint remover that the lead-based paint component is present for shipping. Wrap the component in plastic and send to the offsite stripping location. Clean all surfaces before reinstallation and remove any lead residue by HEPA vacuuming all surfaces, cleaning with other lead-specific cleaners, or phosphate detergents, and HEPA vacuuming again.
8. For onsite paint removal, first test the product on a small area to determine its effectiveness. Chemical paint removers may not be effective or desirable on exterior, deteriorated wood surfaces, aluminum, and glass. Provide neoprene, nitrile, rubber, or polyvinyl chloride (PVC) gloves (or other type of glove recommended by the manufacture); face shields; respirators with combination filter cartridges for lead dust and organic vapors(if appropriate); and chemically resistant clothing. Be sure to select the right type of organic vapor filter cartridge, gloves, and clothing for the specific chemical being used. Portable eyewash stations capable of providing a 15-minute flow must be on-site. Apply the chemical and wait the required period of time. Securely store chemical s overnight. For caustic chemical paint removers, neutralize the surface before repainting using glacial acetic acid (not vinegar). Repaint.
9. Make sure all debris is caught in the containment sheet for proper disposal.
10. Mark and legally dispose of waste in accordance with all applicable Federal, State and Local regulations. Most wastes from paint removal projects, such as paint chips and paint remover sludge, will need to be managed as hazardous waste.
11. Conduct clean-up
12. Have a certified risk assessor or inspector technician conduct a clearance examination and provide documentation and a Statement of Lead-Based Paint Compliance.

C. Building Component Replacement

1. Prepare work area by selecting proper worksite preparation level.
2. Prepare the hazardous material building component for removal. Turn off and disconnect any electrical circuits inside or near the building component to be removed.

3. Lightly mist the component to be removed (unless electrical circuits are located nearby).
4. Score all painted seams with a sharp knife.
5. Remove any screw, nails, or other fasteners.
6. Use flat pry instrument and hammer to pry component from the substrate.
7. Remove or bend back all nails.
8. Wrap and seal all bulk components in plastic and take them to a covered truck or secured waste storage area along a pathway covered in plastic. Shovel any debris. Dispose of properly.
9. HEPA vacuum any dust or chips in the area where the component was located.
10. Conduct cleaning and clearance activities.

D. Soil and Exterior Dust Abatement

1. Determine if soil lead hazard exists. For hazard to exist, a total of at least 9 square feet of soil in a single yard or area must be bare and soil concentrations must exceed 2,000µg/gram lead for the yard or building perimeter or 400µg/gram of lead for small, high-contact play areas (pending the development of an EPA soil standard). Bare soil above these levels shall be treated by either interim controls or abatement. Soil abatement is most appropriate when levels of lead are extraordinarily high (greater than 5,000µg/gram lead) and when use patterns indicate contact frequency and exposure will be high.
2. Collect Preabatement soil samples to determine baseline levels. These samples need not be analyzed if post abatement samples are below applicable clearance levels.
3. Determine the method of soil abatement (soil removal and replacement, soil cleaning, or paving). Soil cultivation (rototilling or turning over the soil) is not permitted.
4. If paving, use a high quality concrete or asphalt. Observe normal precautions associate with traffic load weight and thermal expansion and contraction. Obtain necessary permits. Keep soil cultivation to a minimum.
5. If removing and replacing soil.
 - a. Determine if waste soil will be placed in an offsite burial pit. Prepare vehicle operation and soil movement plan. Test new replacement soil (should not contain more than 200 µg/gram lead).
 - b. Contact local utilities to determine location of underground utilities including water, gas, cable TV, electric, telephone, and sewer. Mark all locations to be avoided
 - c. Remove fencing, if necessary to allow equipment access and define set limits with temporary fencing, signs, or yellow caution tape.
 - d. Tie and protect existing trees, shrubs, and bushes.
 - e. Have enough tools to avoid handling clean soil with contaminated tools.
 - f. Remove soil.
 - g. Clean all walkways, driveways, and street areas near abatement area.
 - h. Replace soil at proper grade to allow drainage. Replacement soil should be at least 2 inches above existing grade to allow for settling.
 - i. Install new soil covering (grass or sod) and maintain it through the growing season.
 - j. Determine if soil waste is hazardous and manage it accordingly
 - k. Conduct clean-up and clearance.
 - l. Provide walk-off doormats.
 - m. Maintain proper documentation.

E. Encapsulation

1. Determine if the applicable regulations allow encapsulates to be used. Do not encapsulate the following surfaces:
 - a. Friction surfaces, such as window jambs and door jambs.
 - b. Surfaces that fail patch tests.
 - c. Surfaces with substrates or existing coatings that have a high level of deterioration.
 - d. Surfaces in which there is a known incompatibility between two existing paint layers.
 - e. Surfaces that cannot support the additional weight stress of encapsulation due to existing paint thickness.
 - f. Metal surfaces that are prone to rust or corrosion.
2. Conduct field tests of surfaces to be encapsulated for paint film integrity.

3. Consider special use and environmental requirements (i.e. abrasion resistance and ability to span base substrate cracks).
4. Provide to the the Owner encapsulant test data provided by the manufacturer.
5. Conduct at least one test patch on each type of building component where the encapsulant will be used. Report the results to the the Owner.
6. For both nonreinforced and reinforced coatings, use a 6" x 6" test patch area. Prepare the surface in the manner selected to complete the job. Prepared surfaces for patch testing should be at least 2" larger in each direction than the patch area.
7. For fiber-reinforced wall coverings, use 3" x 3" patch. For rigid coatings that cannot be cut with a knife, use soundness test. For all encapsulants, carry out the appropriate adhesion tests.
8. For liquid coating encapsulants, allow coating to cure, then visually examine it for wrinkling, blistering, cracking, bubbling, or other chemical reaction with the underlying paint.
9. Record results of all patch tests and provide to the the Owner.
10. Implement proper work site preparation level.
11. Repair all building components and substrates as needed (i.e. caulk cracks and repair sources of water leaks).
12. Prepare surfaces. Remove all dirt, grease, chalking paint, mildew and other surface contaminants, remnants of cleaning solutions, and loose paint. All surfaces should be deglossed, as needed.
13. Ventilate the contaminated area whenever solvents or chemicals are used.
14. During encapsulant application or installation, monitor temperature and humidity. For liquid coatings monitor coating thickness to ensure that the encapsulant manufacturer's installation/application specifications are followed.
15. Conduct clean up and clearance.
16. Provide the the Owner information on how to care for the encapsulation system properly.
17. Maintain records on the exact detailed locations of encapsulant applications, patch test specifications and results, product name, subcontractor, date of application, a copy of the product label and Safety Data Sheet (SDS) for the product and provide to the the Owner.

F. Enclosure

1. Stamp, label or stencil all lead-based painted surfaces that will be enclosed with a warning approximately every 2 feet both horizontally and vertically on all components. The Warning shall read "**Danger Lead-Based Paint**". Deteriorated paint should not be removed from the surface to be enclosed.
2. Select the proper worksite preparation level.
3. Attach a durable drawing to the utility room closet showing where lead-based paint has been enclosed in the dwelling.
4. An independent inspector or technician or risk assessor should evaluate the integrity of the enclosure.
5. Repair any unsound substrates and structural members that will support the enclosure, if necessary.
6. Utilize appropriate enclosure material (drywall or fiberboard, wood paneling, laminated products, ridged tile and brick veneers, vinyl, aluminum m, or plywood).
7. Install extension rings for all electrical switches and outlets that will penetrate the enclosure.
8. If enclosing floors, remove all dirt with a HEPA vacuum to avoid small lumps in the new flooring.
9. Seal and back-caulk all seams and joints. Back-caulk means applying caulk to the underside of the enclosure.
10. When installing enclosure directly to painted surfaces, use adhesive and then anchor with mechanical fasteners (screws or nails).
11. Conduct clean up and clearance activities.
12. Maintain proper records and submit a Statement of Lead-Based Paint Compliance.

G. Final Cleaning Procedures

1. Use the following step-by-step procedures

- a. Assign responsibilities to specific workers for cleaning and for maintaining the cleaning equipment.
 - b. Have sufficient cleaning equipment and supplies before beginning work.
 - c. If contamination is extensive, conduct precleaning of the dwelling unit.
 - d. Conduct ongoing cleaning during the job, including regular removal of large and small debris and dust. Decontamination of all tools, equipment and worker protection gear is required before it leaves contaminated areas. Electrical equipment should be wiped and high-efficiency particulate air (HEPA) vacuumed, not wetted down, to minimize electrocution hazards.
 - e. Schedule sufficient time (usually 30 minutes to an hour) for complete daily cleaning, starting at the same time near the end of every workday after lead hazard control activity has stopped.
 - f. For final cleaning, wait at least 1 hour after active lead hazard control activity has ceased to let dust particles settle.
 - g. Use a vacuum cleaner equipped with a HEPA exhaust filter. HEPA vacuum all surfaces in the room (ceilings, walls, trim, and floors). Start with the ceiling and work down, moving toward the entry door. Completely clean each room before moving on.
 - h. Wash all surfaces with lead-specific detergent, high-phosphate detergent, or other suitable cleaning agent to dislodge any ground-in contamination, then rinse. Change the cleaning solution after every room is cleaned.
 - i. Repeat step g above. To meet clearance standards consistently, a HEPA vacuum, wet wash, and HEPA vacuum cycle is recommended. For interim control projects involving dust removal only, the final HEPA vacuuming step is usually not needed. Other cleaning methods are acceptable, as long as clearance criteria are met and workers are not over exposed.
 - j. After final cleaning perform visual examination to ensure that all surfaces requiring lead hazard control have been addressed and all visible dust and debris have been removed. Record findings and correct any incomplete work.
 - k. If other construction work will disturb the lead-based paint surfaces, it should be completed at this point. If those surfaces are disturbed, repeat the final cleaning step after construction work has been completed.
 - l. Paint and otherwise seal treated surfaces and interior floors.
 - m. Conduct clearance examination.
 - n. If clearance is not achieved, repeat final cleaning.
 - o. Continue clearance testing and repeated cleanings until dwelling unit achieves compliance with all clearance standards. The cost of repeated cleaning, after failure to achieve clearance is to be borne by the contractor.
 - p. Do not allow residents to enter work area until final cleaning is completed and clearance is established.
 - q. Cleaning equipment list is as follows:
 - 1) HEPA Vacuums
 - 2) Detergent
 - 3) Waterproof gloves
 - 4) Rags
 - 5) Sponges
 - 6) Mops
 - 7) Buckets
 - 8) HEPA vacuum attachments (crevice tools, beater bar for cleaning rugs)
 - 9) 6-mil plastic bags
 - 10) Debris containers
 - 11) Waste water containers
 - 12) Shovels
 - 13) Rakes
 - 14) Water-misting sprayers
 - 15) 6-mil polyethylene sheeting (or equivalent)
2. Order of execution for final cleaning steps should be as follows:

- a. As the first stage in final cleaning, floor plastic shall be misted and swept.
- b. Upper level plastic, such as on cabinets and counters should be removed first, after it has been misted and cleaned. All plastic should be carefully folded from the corners/ends to the middle to trap any remaining dust. Next remove both layers of plastic from the floor.
- c. Plastic sheets used to isolate contaminated rooms from noncontaminated rooms should remain in place until after cleaning and removal of other plastic sheeting, these sheets may then be misted, cleaned and removed last.
- d. Removed plastic should be placed into double 4-mil or single 6-mil plastic bags, or plastic bags with equivalent (or better) performance characteristics, which are sealed and removed from the premises. As with daily cleanings, this plastic removal process usually requires workers to use protective clothing and respirators.
- e. After plastic has been removed from the contaminated area, the entire area should be cleaned using the HEPA/wet wash/HEPA cycle.

H. Waste Testing And Disposal

1. General: All materials, whether hazardous or non-hazardous shall be properly disposed of. the Owner may hire an independent Monitoring Consultant to perform TCLP test to determine which of the wastes are hazardous. Contractor shall cooperate in this test. If less than 100kg (200 lbs) or 1/2 of a 55 gallon drum of hazardous waste per month will be generated, it is considered "conditionally exempt" abatement waste, and may be managed as solid non-hazardous waste. The RCRA hazardous waste manifest is not required when shipping this waste to an offsite disposal facility.
2. Separate Abatement Waste into The Following Four Categories:
 - a. Category I. Low lead waste (typically non-hazardous) e.g. Filtered personal and commercial wash water.
 - b. Category II. Architectural components - (painted finish carpentry items) e.g. Doors, windows, window trim and sills, baseboards, railings, moldings. (May do a TCLP to determine if they are hazardous).
 - c. Category III. Concentrated lead waste e.g. sludge from stripping, lead-base paint chip and dust, HEPA vacuum debris and filter, unfiltered wash waste, any waste included in EPA's list of hazardous waste.
 - d. Category IV. Material that cannot be determined to be either hazardous or non-hazardous must be tested by TCLP.

If the hazardous waste generated is greater than 100kg per month, dispose according to the referenced guidelines and RCRA hazardous waste management requirements including those listed below.

3. Disposal Requirements: Contact the regional EPA, state, local and all other pertinent authorities to determine lead-based paint debris disposal requirements. Comply with requirements of the Resource Conservation and Recovery Act (RCRA) and with applicable federal, state, county, or local waste requirements.
4. EPA ID Numbers: Obtain a Generator RCRA Hazardous Material ID number and coordinate this action through the State and secure any additional number as required.
5. Storage Requirements: Keep all hazardous items in a secure area or lockable container that is inaccessible to all persons other than the Contractor's personnel. Label all hazardous waste "Hazardous Waste" with the date that the Contractor began to collect the waste in that container. Keep hazardous and non-hazardous waste in separate containers. Until TCLP testing is completed, considered all items hazardous and store in a secured area or lockable container.
6. Waste Transportation: Transport hazardous waste using a RCRA/DOT/EPA certified Hazardous Waste Transporter. Submit names and qualifications of certified transporter/hauler for the Owner approval. The Contractor shall be responsible for all actions of the waste hauler as pertaining to waste removal and disposal under these procedures and all EPA, DOT and other applicable regulations.
7. Disposal Facility: Supply documents that detail the site(s) to be used for ultimate disposal. Submit documents from these sites proving that they are licensed/permitted to accept such waste and shall accept the waste proposed by the Contractor for treatment or ultimate disposal.

8. Waste Containers: Comply with EPA and DOT regulations for waste containers. Contact the state and local authorities to determine their criteria for containers. In the case of any conflict in regulations, the more stringent shall apply.
 9. Emergencies: Contact local fire, police, hospitals or local emergency response teams and inform them of the type of hazardous waste activity and ask for assistance in the event of any accident. Additionally, the container shall provide the following:
 - a. Keep and properly maintain a suitable fire extinguisher(s) on site.
 - b. Have a immediate means of communication with the regulatory agency in the event of an emergency.
 - c. Keep a list of phone numbers of regulatory agencies on site.
 - d. Appoint an emergency coordinator and ensure the coordinator is on site to supervise emergency procedures to be carried out in the event of an emergency.
 - e. Keep and maintain a "right to know" manual that is in an easily accessible location and in an area that is known to all employees.
 10. Transporting Waste: Provide certifications that the transporter is registered with the U.S. Department of Transportation is required by 49 CFR Part 107(a) transport hazardous waste.
 - a. Provide certifications that each vehicle dedicated to haul hazardous waste has been assigned a "U.S. DOT Hazardous Material Registration Number" as required by 49 CFR Part 107.
 - b. Be responsible for all other applicable permits pertaining to hauling, transport, reduction, and disposal of hazardous waste as they may apply to this project.
 - c. Vehicle: Ensure that all non-hazardous waste is transported in covered vehicles to a landfill, or lined landfill, if required.
 - d. Container Handling: Carefully place the containers into the truck or dumpster used for disposal. At no time shall debris or containers be thrown or dropped.
 - e. Liquid Wastes: Contain and properly dispose of all liquid wastes, including lead-contaminated wash water.
 - f. Containers: HEPA vacuum the exterior of all waste containers prior to removing the waste containers from the work area. Wet wipe the containers to ensure that there is no residual contamination. Then move containers out of the work area into the designated storage area.
- I. Clearance
1. Clearance on all abatement projects must be done by an independent certified risk assessor or inspector technician. Follow all jurisdictional law with regard to licensure requirements for personnel conducting clearance activities.
 2. Clearance step-by-step procedures are as follows:
 - a. Finish the lead hazard control clean-up effort. Seal floors before clearance (if necessary).
 - b. Wait 1 hour to allow any airborne dust to settle. Do not enter work area during that hour.
 - c. Conduct visual examination
 - 1) Determine if all required work has been completed and all lead-based paint hazards have been controlled.
 - 2) Determine if there is visible settled dust, paint chips, or debris in the interior or around the exterior.
 - d. Complete the Visual Clearance Form required by the the Owner; if all work is not completed inform the the Owner and order completion of the work and repeat cleanup, if necessary.
 - e. Conduct clearance dust sampling of the floors, interior window sills, and window troughs using approved protocol.
 - f. Conduct soil sampling if bare soil is present that was not sampled previously, or if exterior paint work was completed as part of the lead hazard control effort. Whenever exterior work has been don, it may be necessary to take samples from the soil that is not bare to determine if contamination has occurred. If results are above 1,000 µg/g (or 400 µg/g in high contact play area), compare the results to baseline soil sampling results to determine what additional measures are needed.
 - g. Complete the Dust and Soil Sampling Clearance Form required by the the Owner.

- h. Submit samples to a U.S. Environmental Protection Agency (EPA) recognized laboratory participating in the National Lead Laboratory Accreditation program (NLLAP) for analysis.
- i. Interpret results by comparing them to Interim Clearance Standards as listed below:

1) Floors	400 µg/ft ²
2) Window sills	250 µg/ft ²
3) Window Troughs	800 µg/ft ²
4) Soils (Play area with children under 6 years of age)	400 µg/gram
- j. If clearance is achieved go to step N.
- k. Order repeated cleanings or soil treatments if results are above applicable standards. Clean all surfaces the sample represents.
- l. Continue sampling and repeated cleanings until the dwelling achieves compliance with all applicable clearance standards.
- m. Complete any related construction work that does not disturb a surface with lead-based paint (all work that does disturb painted surfaces or that could generate lead dust should be completed as part of the lead hazard control effort).
- n. Issue any necessary statements of lead-based paint compliance or releases and maintain appropriate records.

J. Labels

1. Use the following labels on drums used for disposal.

HAZARDOUS WASTE FEDERAL LAW PROHIBITS IMPROPER DISPOSAL. IF FOUND, CONTACT THE NEAREST POLICE OR PUBLIC SAFETY AUTHORITY OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY. GENERATOR INFORMATION: NAME _____ ADDRESS _____ PHONE _____ CITY _____ STATE _____ ZIP _____ EPA- / MANIFEST ID NO. / DOCUMENT NO. _____ / _____ ACCUMULATION START DATE _____ EPA WASTE NO. _____ HAZARDOUS WASTE, SOLID, N.O.S. (_____) NA3077 D.O.T. PROPER SHIPPING NAME AND UN OR NA NO. WITH PREFIX HANDLE WITH CARE! STYLE HWM12	



WORKPLACE ACCUMULATION CONTAINER		
Proper D.O.T. Shipping Name: _____	HAZARDOUS WASTE FEDERAL LAW PROHIBITS IMPROPER DISPOSAL. IF FOUND, CONTACT THE NEAREST POLICE OR PUBLIC SAFETY AUTHORITY OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY. HANDLE WITH CARE!	Workplace Accumulation Start Date:
UN or NA# _____		Waste Accumulation Area:
Generator Information: Name: _____		
Facility: _____		
Address: _____		
Phone: _____		
City: _____		
State: _____ Zip: _____		
EPA / Manifest ID No. / Document No. _____		
State Manifest Document No. _____		
EPA Waste No. _____		MANEJESE CON CUIDADO CONTIENE DESPERDICIOS TOXICOS

K. Disposal of lead-based paint waste.

1. Follow the RCRA and HUD recommended practices as defined in the table below:

Waste Management Practices	Category I: Low Lead Waste	Category II: Architectural Components	Category III: Concentrated Lead Waste	Category IV: Other waste
RCRA Requirements	Manage as nonhazardous Waste	Depending upon knowledge or TCLP testing results, manage as solid hazardous or nonhazardous waste	If more than 100 kg/ month, manage as hazardous waste. If less than 100 kg/month manage as solid waste.	Use TCP to determine if waste is hazardous.
HUD Recommended Practices	Applicable	Applicable, if knowledge or TCLP testing indicates that it is nonhazardous.	Applicable if less than 100 kg/month otherwise subject to full RCRA regulations	Only applicable if TCLP testing shows waste is nonhazardous
Wrapped in plastic; seal all seams with tape (if acceptable to the disposal facility).	X	X	X	X
Stored in designated, secure area.	X	X	X	X
Covered During Transport	X	X	X	X
Prohibit cutting/breaking outside work area.	X	X	X	X
Cover ground with 6-mil plastic if handling outside.	X	X	X	X
Prohibit disposal in solid waste incinerators and reuse recycling for mulch	X	X	X	X
Recommended disposal in State licensed/permited	X	X	If appropriate.	X

solid waste landfill.				

L. Safety Requirements

1. To protect the health and safety of all persons involved, it is of the utmost importance that deleading is safely and correctly done in a timely manner. The following specific safety requirements are the responsibility of the Deleading Contractor.

K. General Safety:

1. General
 - a. NO ONE is to be allowed in the work area without an approved respirator except for methods that have been documented not requiring a respirator.
 - b. Each work area must be sealed from the remainder of the dwelling by taping plastic sheets (6 mil thick). Work areas must remain sealed off until both work and clean-up are completed.
 - c. Cover all floors, carpets, furniture and appliances with 6 mil plastic within the work area. Use automotive masking tape (2 inches wide) to seal all edges and seams.
 - d. Make certain all electrical connections are properly grounded.
 - e. At least three days prior to the start of any deleading work, post appropriate warning signs at all entrances and exits of work areas and leave in place until all clearance testing indicates that these areas are safe for re-occupancy. The signs must include the following phrase: "CAUTION LEAD HAZARD-KEEP OUT". Post bilingual signs when necessary.
2. Worker Safety: The Deleading Contractor shall take the following minimum precautions to protect the health of all individuals involved in the deleading process.
 - a. Pre-Abatement Medical Exam: Each employee shall undergo a medical examination to determine both respiratory fitness capability and also pre-existing/current blood lead level. Said results shall be provided to the employee and also to the Owner within 3 days of receipt of same, and in all cases, prior to employee's commencement to active abatement. Records of same are required to be kept by the Contractor for 40 years.
 - b. Medical Surveillance is the monitoring of worker blood levels. It is required that the Contractor have blood level monitoring of all active abatement and clean-up workmen and on-site supervisors performed and said results provided to the Owner.
 - 1) Before assignment to active abatement activity for each worker.
 - 2) 30 days after active abatement has begun.
 - 3) At least every two months during the first six months and every six months throughout the deleading job.
 - 4) At least every two months for each employee whose blood lead analysis indicated a blood lead level at or above 25 micrograms per deciliter. (20 micrograms per deciliter for women of child bearing age).
 - 5) At termination of employment.
 - 6) Contractor shall reassign any employee whose blood lead has reached 25 µg/dl (20 µg/dl for women of child bearing age) to a job function deemed safe from lead exposure. Said employee shall remain away from active abatement until such time as 2 consecutive months' blood tests indicate µg/dl below 20 µg/dl.
 - c. Respiratory Protection Programs must be established by the Contractor in accordance with OSHA regulations and qualitative respirator fit testing must be conducted daily by the on-site supervisor. Medical examinations must be performed by a physician prior to fit testing and at anytime when a worker demonstrates any difficulty breathing during the use of or the fit testing of respirators. The following are minimal acceptable respiratory protection program requirements as set up and administered by the Contractor:
 - 1) Written standard operating procedures which oversees the selection and use of respirators.
 - 2) Selection of respirators on the basis of hazards to which the worker is exposed.
 - 3) Worker training on the limitations and use of respirators (includes fit testing).
 - 4) Individual workers assigned respirators for their exclusive use only.

- 5) Daily cleaning and disinfecting of respirators.
- 6) Proper storage of all respirators.
- 7) Proper inspection of all respirators for wear and tear.
- 8) Continual surveillance of work area conditions and level of worker exposure or stress.
- 9) Use of approved respirators only, modified as needed by the weekly exposure monitoring results.
- 10) Supply weekly report covering items 1-9 to the Owner or its Lead Consultant.
- d. Exposure Monitoring is the measured concentration of lead in the workers breathing zones. The Contractor shall perform personnel monitoring during active abatement using the NIOSH 7072 method and shall be responsible for:
 - 1) Monitoring the level of worker protection needed during the abatement process;
 - 2) Evaluating, modifying and improving any engineering and work practice control(s) as needed;
 - 3) Evaluating each employee's personal quality of work and any need for additional worker training or safety instruction;
 - 4) Providing the Owner results of all personnel monitoring tests within 10 days of testing; and
 - 5) Providing half-face APR respirators with HEPA filters unless said monitoring test results dictate differently. OSHA guidelines shall be used to determine respirator PEL protection factors.
- e. Protective Clothing Equipment must be provided to all workers to help assure that lead dust is contained to the work areas. The following must be supplied/enforced by the Deleading Contractor:
 - 1) Full body protective clothing and shoe covers of appropriate sizes on a daily basis or as needed.
 - 2) Clean changing areas separated from the dirty/contaminated clothes storage area.
 - 3) Water and wash facilities for washing of hands and face and shower facilities if deemed necessary by the Owner's Lead Advisor.
 - 4) Instructing worker on proper maintenance of clothing and equipment.
 - 5) Proper disposal of disposable clothing and proper permanent work clothes.
 - 6) Enforcing the removal of protective clothing at the end of each work day and before eating, drinking and smoking.
 - 7) Enforcement of the removal of protective shoe covers before leaving work area.
3. Contractor/Worker Daily Safe-Work Procedures
 - a. Daily Start-Up:
 - 1) Workers to put on protective gear prior to entering work areas.
 - 2) All garment seams to be sealed with duct tape.
 - 3) All non-working garments must be stored in designated changing area.
 - 4) Respirators, as required, must be properly fitted before entering work area. Perform qualitative fit test.
 - b. Temporary depart:
 - 1) All protective clothing to be HEPA vacuumed while still being worn.
 - 2) All shoe covers to be removed and left in the work area (immediate departure upon removing).
 - 3) Remove all protective gear in designated "contaminated" changing area before eating, drinking, and smoking or before leaving work site.
 - 4) Wash hands and face.
 - 5) Clean respirators.
 - c. Daily Shut-Down:
 - 1) Dispose of protective clothing with abatement waste by sealing in a 6 mil poly bag.
 - 2) Laundered clothes must be placed in closed container.
 - 3) Wash hands and face.
 - 4) Shower if facilities allow and circumstances dictate.
 - 5) Clean all protective gear (respirators included).

4. Tenant's Safety: Temporary relocation of the tenants is necessary if the lead paint surface is broken. Temporary relocation of the tenants and their belongings is the responsibility of the Owner. However, the Contractor has the joint responsibility to administer and enforce the following safety practices on behalf of the occupants:
 - a. Adults
 - 1) NO OCCUPANT is allowed to enter the work area during paint removal and initial clean-up. A three day clean-up and settlement period may be imposed depending upon the abatement procedures used, at the discretion of the Owner or their Lead Consultant.
 - 2) the Owner shall notify all occupants in writing when they are allowed to return to their post-abated residence. Contractor shall abide by these notices.
 - 3) Every resident who has received prior notice of abatement is responsible for placing all personal items (clothing, dishes, linens, etc.) in closed, easy to handle containers; and move such items to the center of each room as requested.
 - 4) As long as visible dust remains, occupants may not occupy dwelling, and all surfaces within the dwelling must be re-washed with trisodium phosphate and HEPA vacuumed by deleading contractor.
 - 5) Persons reoccupying dwellings following abatement are required to report any visible dust or debris to the Owner immediately for additional Contractor clean-up.
 - b. Pregnant Women and Children
 - 1) Absolutely no pregnant women nor children under the age of twelve years of age may be allowed in the building while any part of the abatement process is going on.

END OF SECTION 02 83 00 00



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SECTION 02 83 19 00 - LEAD-BASED PAINT REMEDIATION

1.1 GENERAL

A. Description Of Work

1. This specification covers the removal and disposal of lead-based or lead-containing paint. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Definitions

1. Action Level: Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8 hour period in an occupational/industrial environment.
2. Area Sampling: Sampling of lead concentrations within the lead control area and inside the physical boundaries which is representative of the airborne lead concentrations but is not collected in the breathing zone of personnel.
3. Competent Person (CP): As used in this section, refers to a person employed by the Contractor who is trained in the recognition and control of lead hazards in accordance with current federal, State, and local regulations. An industrial hygienist or safety professional certified for comprehensive practice by the American Board of Industrial Hygiene or by the Board of Certified Safety Professionals is the best choice.
4. Contaminated Room: Room for removal of contaminated personal protective equipment (PPE).
5. Decontamination Shower Facility: That facility that encompasses a clean clothing storage room, and a contaminated clothing storage and disposal rooms, with a shower facility in between.
6. Eight-Hour Time Weighted Average (TWA): Airborne concentration of lead to which an employee is exposed, averaged over an 8 hour workday as indicated in 29 CFR 1926.62.
7. High Efficiency Particulate Air (HEPA) Filter Equipment: HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead-contaminated paint dust. A high efficiency particulate filter means 99.97 percent efficient against 0.3 micron or larger size particles.
8. Lead: Metallic lead, inorganic lead compounds, and organic lead soaps.
9. Lead-Based Paint (LBP): Paint or other surface coating that contains lead in excess of 1.0 milligrams per centimeter squared or 0.5 percent by weight.
10. Lead-Based Paint Hazard (LBP Hazard): Any condition that causes exposure to lead from lead-contaminated dust, lead-contaminated soil, lead-based paint that is deteriorated or present in accessible surfaces, friction surfaces, or impact surfaces that would result in adverse human health effects.
11. Lead-Containing Paint (LCP): Lead-based paint or other similar surface coating containing lead or lead compound in excess of 0.06 percent by weight of the total nonvolatile content of the paint.
12. Lead Control Area: An enclosed area or structure, constructed as a temporary containment equipped with HEPA filtered local exhaust, which prevents the spread of lead dust, paint chips, or debris existing as a condition of lead-based paint removal operations. The lead control area is also isolated by physical boundaries to prevent unauthorized entry of personnel.
13. Lead Permissible Exposure Limit (PEL): Fifty micrograms per cubic meter of air as an 8 hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more than eight hours in a work day, the PEL shall be determined by the following formula:
$$\text{PEL (micrograms/cubic meter of air)} = 400/\text{No. hrs. worked per day.}$$
14. Personal Sampling: Sampling of airborne lead concentrations within the breathing zone of an employee to determine the 8 hour time weighted average concentration in accordance with 29 CFR 1926.62. Samples shall be representative of the employees' work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulders, with a radius of 6 to 9 inches (150 to 225 mm) and centered at the nose or mouth of an employee.



15. Physical Boundary: Area physically roped or partitioned off around an enclosed lead control area to limit unauthorized entry of personnel. As used in this section, "inside boundary" shall mean the same as "outside lead control area but inside boundary."

C. Submittals: Submit the following:

1. Product Data:
 - a. Vacuum filters
 - b. Respirators
2. Test Reports
 - a. Sampling results
 - b. Assessment data report
3. Certificates
 - a. Qualifications of CP
 - b. Testing laboratory</SUB> qualifications
 - c. Third party consultant qualifications
 - d. Lead-Based Paint/Lead-Containing Paint Removal Plan including CP approval (signature, date, and certification number)
 - e. Rental equipment notification
 - f. Respiratory protection program
 - g. Hazard communication program
 - h. EPA approved hazardous waste treatment or disposal facility for lead disposal
 - i. Hazardous waste management plan
 - j. Vacuum filters
4. Manufacturer's Instructions
 - a. Chemicals and equipment
 - b. Materials
 - c. Safety data sheets for all chemicals
5. Closeout Submittals
 - a. Completed and signed hazardous waste manifest from treatment or disposal facility
 - b. Certification of medical examinations
 - c. Employee training certification

D. Qualifications Of CP

1. Submit name, address, and telephone number of the CP selected to perform responsibilities specified in paragraph entitled "Competent Person (CP) Responsibilities." Provide previous experience of the CP. Submit proper documentation that the CP is trained and licensed and certified in accordance with Federal, State, and local laws.

E. Third Party Consultant Qualifications

1. Submit the name, address, and telephone number of the third party consultant selected to perform the wipe sampling for determining concentrations of lead in dust or soil sampling. Submit proper documentation that the consultant is trained and certified as an inspector technician or inspector/risk assessor by the USEPA authorized State (or local) certification and accreditation program.

F. Testing Laboratory

1. Submit the name, address, and telephone number of the testing laboratory selected to perform the air and wipe and soil sampling, testing, and reporting of airborne concentrations of lead. Use a laboratory accredited under the EPA National Lead Laboratory Accreditation Program (NLLAP) by either the American Association for Laboratory Accreditation (A2LA) or the American Industrial Hygiene Association (AIHA) and that is successfully participating in the Environmental Lead Proficiency Analytical Testing (ELPAT) program to perform sample analysis.

G. Lead-Based Paint/Lead-Containing Paint Removal Plan (LBP/LCPRP)

1. Submit a detailed job-specific plan of the work procedures to be used in the removal of LBP/LCP. The plan shall include a sketch showing the location, size, and details of lead control areas, location and details of decontamination facilities, viewing ports, and mechanical ventilation system. Include in the plan, eating, drinking, smoking and sanitary procedures, interface of trades, sequencing of lead related work, collected waste water and paint debris disposal plan, air sampling plan, respirators, personal protective equipment, and a detailed description of the method of containment of the operation to ensure that airborne lead concentrations of 30 micrograms per cubic meter of air and baseline lead dust/soil concentrations are not reached or exceeded outside of the lead control area. Include site preparation and cleanup procedures. Include occupational and environmental sampling, training and strategy, sampling methodology, frequency, duration of sampling, and qualifications of sampling personnel in the air sampling portion of the plan.
- H. Occupational And Environmental Sampling Results
 1. Submit occupational and environmental sampling results to the the Owner within three working days of collection, signed by the testing laboratory responsible official, the employee that performed the sampling, and the CP.
 - a. The sampling results shall represent each job classification, or if working conditions are similar to previous jobs by the same employer, provide previously collected exposure data that can be used to estimate worker exposures in accordance with 29 CFR 1926.62. The data shall represent the worker's regular daily exposure to lead.
 - b. Submit worker exposure data conducted during the task based trigger operations of 29 CFR 1926.62.
 - c. The initial monitoring shall determine the requirements for further monitoring and the need to fully implement the control and protective requirements including the compliance program (LBP/LCP) in accordance with 29 CFR 1926.62.
- I. Occupational And Environmental Assessment Data Report:
 1. Some LBP/LCP removal work may not require full implementation of the requirements of 29 CFR 1926.62. Based on the experience of the Contractor and/or the use of a specific process or method for performing the work, the Contractor may be able to provide historic data (previous 12 months) to demonstrate that airborne exposures are controlled below the action level. Such methods or controls shall be fully presented in the LBP/LCPRP. To reduce the full implementation of 29 CFR 1926.62, the Contractor shall provide documentation in an Assessment Data Report.
 2. Submit occupational and environmental assessment report to the the Owner prior to start of work, signed by the testing laboratory responsible official, and the CP.
 - a. Submit a report that supports the determination regarding the reduction of the need to fully implement the requirements of 29 CFR 1926.62 and supporting the LBP/LCP. The exposure assessment shall represent each job classification, or if working conditions are similar to previous jobs by the same employer, provide previously collected exposure data that can be used to estimate worker exposures in accordance with 29 CFR 1926.62. The data shall represent the worker's regular daily exposure to lead for stated work.
 - b. Submit worker exposure data conducted during the task based trigger operations of 29 CFR 1926.62 with a complete process description in supporting a negative assessment.
 - c. The initial assessment shall determine the requirement for further monitoring and the need to fully implement the control and protective requirements including the compliance program (LBP/LCPRP) in accordance with 29 CFR 1926.62.
- J. Quality Assurance
 1. Medical Examinations: Initial medical surveillance as required by 29 CFR 1926.62 shall be made available to all employees exposed to lead at any time (1 day) above the action level. Full medical surveillance shall be made available to all employees on an annual basis who are or may be exposed to lead in excess of the action level for more than 30 days a year or as required by 29 CFR 1926.62. Adequate records shall show that employees meet the medical surveillance requirements of 29 CFR 1926.33, 29 CFR 1926.62, and 29 CFR 1926.103.

- a. Medical Records: Maintain complete and accurate medical records of employees for a period of at least 30 years or for the duration of employment plus 30 years, whichever is longer.
 - b. Medical Surveillance: Provide medical surveillance to all personnel exposed to lead as indicated in 29 CFR 1926.62.
2. Competent Person (CP) Responsibilities
 - a. Certify training as meeting all federal, State, and local requirements.
 - b. Review and approve lead-based paint/lead-containing paint removal plan for conformance to the applicable referenced standards.
 - c. Continuously inspect lead-based paint removal work for conformance with the approved plan.
 - d. Perform air and wipe sampling.
 - e. Ensure work is performed in strict accordance with specifications at all times.
 - f. Control work to prevent hazardous exposure to human beings and to the environment at all times.
 - g. Certify the conditions of the work as called for elsewhere in this specification.
3. Training: Train each employee performing paint removal, disposal, and air sampling operations prior to the time of initial job assignment and annually thereafter, in accordance with 29 CFR 1926.21, 29 CFR 1926.62, and State and local regulations.
 - a. Training Certification: Submit a certificate for each employee, signed and dated by the approved training source, stating that the employee has received the required lead training.
4. Respiratory Protection Program
 - a. Furnish each employee required to wear a negative pressure respirator or other appropriate type with a respirator fit test at the time of initial fitting and at least annually thereafter as required by 29 CFR 1926.62.
 - b. Establish and implement a respiratory protection program as required by ANSI Z88.2, 29 CFR 1926.103, 29 CFR 1926.62, and 29 CFR 1926.55.
5. Hazard Communication Program: Establish and implement a Hazard Communication Program as required by 29 CFR 1926.59.
6. Hazardous Waste Management: The Hazardous Waste Management Plan shall comply with applicable requirements of federal, State, and local hazardous waste regulations and address:
 - a. Identification and classification of hazardous wastes associated with the work.
 - b. Estimated quantities of wastes to be generated and disposed of.
 - c. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and operator and a 24-hour point of contact. Furnish two copies of EPA, or State and local hazardous waste permit applications or permits or manifests, as required, and EPA Identification numbers.
 - d. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.
 - e. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
 - f. Spill prevention, containment, and cleanup contingency measures including a health and safety plan to be implemented in accordance with 29 CFR 1926.65.
 - g. Work plan and schedule for waste containment, removal and disposal. Wastes shall be cleaned up and containerized daily.
 - h. Unit cost for hazardous waste disposal according to this plan.
7. Environmental, Safety and Health Compliance: In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of Federal, State, and local authorities regarding removing, handling, storing, transporting, and disposing of lead waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1926.62. Submit matters regarding interpretation of standards to the the Owner for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirement shall apply.

8. Pre-Construction Conference: Along with the CP, meet with the the Owner to discuss in detail the hazardous waste management plan and the lead-based paint/lead-containing paint removal plan, including work procedures and precautions for the removal plan.

K. Equipment

1. Respirators: Furnish appropriate respirators approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, for use in atmospheres containing lead dust. Respirators shall comply with the requirements of 29 CFR 1926.62.
2. Special Protective Clothing: Furnish personnel who will be exposed to lead-contaminated dust with proper disposable uncontaminated, reusable protective whole body clothing, head covering, gloves, and foot coverings as required by 29 CFR 1926.62. Furnish proper disposable plastic or rubber gloves to protect hands. Reduce the level of protection only after obtaining approval from the CP.
3. Rental Equipment Notification: If rental equipment is to be used during lead-based paint handling and disposal, notify the rental agency in writing concerning the intended use of the equipment. Furnish a copy of the written notification to the the Owner.
4. Vacuum Filters: UL 586 labeled HEPA filters.
5. Equipment for Owner's Personnel: Furnish the the Owner with two complete sets of personal protective equipment (PPE) daily, as required herein, for entry into and inspection of the paint removal work within the lead controlled area. Personal protective equipment shall include disposable whole body covering, including appropriate foot, head, and hand protection. PPE shall remain the property of the Contractor. Respiratory protection for the the Owner will be provided by the Owner.

L. Removal

1. Title to Materials: Materials resulting from demolition work, except as specified otherwise, shall become the property of the Contractor and shall be disposed of in accordance with Division 2 Section "Selective Structure Demolition", "Structure Demolition", except as specified herein.

1.2 PRODUCT

A. Chemicals

1. Submit applicable Safety Data Sheets for all chemicals used in paint removal work. Use the least toxic product approved by the the Owner.

B. Materials

1. The soluble metal content and the total metal content shall not exceed values which would cause a material to be classified as a hazardous waste.

1.3 EXECUTION

A. Protection

1. Notification: Notify the the Owner 20 days prior to the start of any paint removal work.
2. Lead Control Area Requirements
 - a. If LBP will be removed by means which will not likely create airborne, lead-containing dust (such as careful wet scraping or chemical stripping), establish a lead control area by situating critical barriers and physical boundaries around the area or structure where LBP/LCP removal operations will be performed.
 - b. If removal practice will create airborne, lead-containing dust (such as sanding, abrasive blasting, thermal cutting, demolition, or needle gun use), utilize full containment procedures - Contain removal operations by the use of critical barriers and HEPA filtered exhaust **OR** a negative pressure enclosure system with decontamination facilities and with HEPA filtered exhaust if required by the CP, **as directed**. For containment areas larger than 1,000 square feet (100 square meters) install a minimum of two 18 inch (450 mm) square viewing

- ports. Locate ports to provide a view of the required work from the exterior of the enclosed contaminated area. Glaze ports with laminated safety glass.
3. Protection of Existing Work to Remain: Perform paint removal work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition or better.
 4. Boundary Requirements: Provide physical boundaries around the lead control area by roping off the area designated in the work plan or providing curtains, portable partitions or other enclosures to ensure that airborne concentrations of lead will not reach 30 micrograms per cubic meter of air outside of the lead control area.
 - a. Physical Boundary: Provide physical boundaries around the lead control area by roping off the area designated in the work plan or providing curtains, portable partitions or other enclosures to ensure that airborne concentrations of lead will not reach 30 micrograms per cubic meter of air outside of the lead control area.
 - b. Warning Signs: Provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs shall comply with the requirements of 29 CFR 1926.62.
 5. Furnishings:
 - a. The Owner will remove furniture and equipment from the building before lead-based paint removal work begins.
OR
Furniture and equipment will remain in the building. Protect and cover furnishings or remove furnishings from the work area and store in a location approved by the the Owner.
OR
Existing furniture and equipment is lead contaminated, decontaminate, dispose of as lead contaminated waste.
 6. Heating, Ventilating and Air Conditioning (HVAC) Systems: Shut down, lock out, and isolate HVAC systems that supply, exhaust, or pass through the lead control areas. Seal intake and exhaust vents in the lead control area with 6 mil (0.15 mm) plastic sheet and tape. Seal seams in HVAC components that pass through the lead control area. Provide temporary HVAC system for areas in which HVAC has been shut down outside the lead control area.
 7. Decontamination Shower Facility: Provide clean and contaminated change rooms and shower facilities in accordance with this specification and 29 CFR 1926.62.
 8. Eye Wash Station: Where eyes may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes shall be provided within the work area.
 9. Mechanical Ventilation System
 - a. Use adequate ventilation to control personnel exposure to lead in accordance with 29 CFR 1926.62.
 - b. To the extent feasible, use fixed local exhaust ventilation connected to HEPA filters or other collection systems, approved by the CP. Local exhaust ventilation systems shall be designed, constructed, installed, and maintained in accordance with ANSI Z9.2.
 - c. Vent local exhaust outside the building only and away from building ventilation intakes.
 - d. Use locally exhausted, power actuated, paint removal tools.
 10. Personnel Protection: Personnel shall wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking or application of cosmetics is not permitted in the lead control area. No one will be permitted in the lead control area unless they have been appropriately trained and provided with protective equipment.
- B. Work Procedures: Perform removal of lead-based paint in accordance with approved lead-based paint/lead-containing paint removal plan. Use procedures and equipment required to limit occupational and environmental exposure to lead when lead-based paint is removed in accordance with 29 CFR 1926.62, except as specified herein. Dispose of removed paint chips and associated waste in compliance with Environmental Protection Agency (EPA), federal, State, and local requirements.
1. Personnel Exiting Procedures: Whenever personnel exit the lead-controlled area, they shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn during the work day:

- a. Vacuum themselves off.
 - b. Remove protective clothing in the contaminated change room, and place them in an approved impermeable disposal bag.
 - c. Shower **OR** Wash hands and face at the site, **as directed**, don appropriate disposable or uncontaminated reusable clothing; move to an appropriate facility; shower.
 - d. Change to clean clothes prior to leaving the physical boundary designated around the lead control area.
2. Air and Wipe Sampling
 - a. Air sample for lead in accordance with 29 CFR 1926.62 and as specified herein. Air and wipe sampling shall be directed or performed by the CP.
 - 1) The CP shall be on the job site directing the air and non-clearance wipe sampling and inspecting the lead-based paint removal work to ensure that the requirements of the contract have been satisfied during the entire lead-based paint removal operation.
 - 2) Collect personal air samples on employees who are anticipated to have the greatest risk of exposure as determined by the CP. In addition, collect air samples on at least 25 percent of the work crew or a minimum of two employees, whichever is greater, during each work shift.
 - 3) Submit results of air samples, signed by the CP, within 72 hours after the air samples are taken. Notify the the Owner immediately of exposure to lead at or in excess of the action level of 30 micrograms per cubic meter of air outside of the lead control area.
 - 4) For high profile, sensitive work such as present in family housing, child care facilities, administrative buildings, kitchens, barracks, etc., surface dust sampling to determine clearance (i.e., that the work has not contaminated surfaces within and adjacent to the control area) should be performed by a third party to reduce a conflict of interest. Samples must be conducted by an individual not paid or employed or otherwise compensated by the LBP/LCP removal Contractor. State or local regulations may require third party testing if the LBP/LCP removal operation is considered a lead hazard reduction activity.
 - 5) Before any work begins, collect and analyze baseline or soil wipe samples in accordance with methods defined in federal, State, and local standards inside and outside of the physical boundary to assess the degree of dust contamination in the facility prior to lead-based paint removal.
 - b. Air Sampling During Paint Removal Work: Conduct area air sampling daily, on each shift in which lead-based paint removal operations are performed, in areas immediately adjacent to the lead control area. Sufficient area monitoring shall be conducted to ensure unprotected personnel are not exposed at or above 30 micrograms per cubic meter of air. If 30 micrograms per cubic meter of air is reached or exceeded, stop work, correct the condition(s) causing the increased levels. Notify the the Owner immediately. Determine if condition(s) require any further change in work methods. Removal work shall resume only after approval is given by the CP and the the Owner. For outdoor operations, at least one sample on each shift shall be taken on the downwind side of the lead control area.
3. Lead-Based Paint Removal
 - a. Manual or power sanding of interior and exterior surfaces is not permitted. Provide methodology for removing LBP in work plan. Remove paint within the areas designated on the drawings in order to completely expose the substrate. Take whatever precautions necessary to minimize damage to the underlying substrate.
 - b. Avoid flash rusting or deterioration of the substrate. Provide surface preparations for painting in accord with Division 7.
 - c. Provide methodology for removing LBP/LCP removal processes to minimize contamination of work areas outside the control area with lead-contaminated dust or other lead-contaminated debris/waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of lead. Describe this LBP/LCP removal process in the LBP/LCPRP.



- d. Indoor Lead Paint Removal: Perform manual **OR** mechanical **OR** thermal **OR** chemical, **as directed**, paint removal in lead control areas using enclosures, barriers, or containments and powered locally exhausted paint removal tools. Collect residue and/or debris for disposal in accordance with federal, State, and local requirements.
 - e. Outdoor Lead Paint Removal: Perform outdoor removal as indicated in federal, State, and local regulations and in the LBP/CPRP. The worksite preparation (barriers or containments) shall be job dependent and presented in the LBP/LCPRP.
 - f. Sampling After Paint Removal: After the visual inspection, conduct soil sampling if bare soil is present during external removal operations and collect air samples inside and outside the lead control area to determine the airborne levels of lead inside and outside the work area. Collect wipe samples according to the HUD protocol contained in HUD Guidelines to determine the lead content of settled dust and dirt in micrograms per square foot (square meter) of surface area and parts per million (ppm) or micrograms per gram ($\mu\text{g/g}$) for soil.
4. Cleanup and Disposal
- a. Cleanup: Maintain surfaces of the lead control area free of accumulations of paint chips and dust. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use compressed air to clean up the area. At the end of each shift and when the paint removal operation has been completed, clean the area of visible lead paint contamination by vacuuming with a HEPA filtered vacuum cleaner, wet mopping the area and wet wiping the area as indicated by the CP. Reclean areas showing dust or residual paint chips or debris. After visible dust, chips and debris is removed, wet wipe and HEPA vacuum all surfaces in the work area. If adjacent areas become contaminated at any time during the work, clean, visually inspect, and then wipe sample all contaminated areas. The CP shall then certify in writing that the area has been cleaned of lead contamination before restarting work.
 - b. Clearance Certification
 - 1) The CP shall certify in writing that the final air samples collected inside and outside the lead control area are less than 30 micrograms per cubic meter of air; the respiratory protection used for the employees was adequate; the work procedures were performed in accordance with 29 CFR 1926.62 and 40 CFR 745; and that there were no visible accumulations of material and dust containing lead left in the work site. Do not remove the lead control area or roped off boundary and warning signs prior to the the Owner's acknowledgement of receipt of the CP certification.
 - 2) A third party consultant shall certify surface wipe sample results collected inside and outside the work area are less than 100 micrograms per square foot (0.1 square meter) on uncarpeted floors, less than 500 micrograms per square foot (0.1 square meter) on interior window sills and less than 800 micrograms per square foot (0.1 square meter) on window troughs **OR** not significantly greater than the initial surface loading determined prior to work, **as directed**.
 - 3) For exterior paint removal work, soil samples taken at the exterior of the work site shall be used to determine if soil lead levels had increased at a statistically significant level (significant at the 95 percent confidence limit) from the soil lead levels prior to the work. If soil lead levels do show a statistically significant increase above any applicable Federal or State standard for lead in soil, the soil shall be remediated back to the pre-work level.
 - c. Testing of Lead-Based Paint Residue and Used Abrasive: Test paint residue and used abrasive in accordance with 40 CFR 261 for hazardous waste.
 - d. Disposal
 - 1) Collect lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing which may produce airborne concentrations of lead particles. Label the containers in accordance with 29 CFR 1926.62 and 40 CFR 261. Dispose of lead-contaminated waste material at an EPA or State approved hazardous waste treatment, storage, or disposal facility off Owner's property.

- 2) Store waste materials in U.S. Department of Transportation (49 CFR 178) approved 55 gallon (208 liter) drums. Properly label each drum to identify the type of waste (49 CFR 172) and the date the drum was filled. The the Owner or an authorized representative will assign an area for interim storage of waste-containing drums. Do not store hazardous waste drums in interim storage longer than 90 calendar days from the date affixed to each drum.
- 3) Handle, store, transport, and dispose lead or lead-contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.
- 4) All material, whether hazardous or non-hazardous shall be disposed in accordance with laws and provisions and Federal, State, or local regulations. Ensure waste is properly characterized. The result of each waste characterization (TCLP for RCRA materials) will dictate disposal requirements.
5. Disposal Documentation: Submit written evidence that the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead disposal by the EPA and State or local regulatory agencies. Submit one copy of the completed manifest, signed and dated by the initial transporter in accordance with 40 CFR 262.
6. Payment for Hazardous Waste: Payment for disposal of hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility certifying the amount of lead-containing materials delivered is returned and a copy is furnished to the Owner.

END OF SECTION 02 83 19 00



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SECTION 02 83 19 00a - XRF TESTING FOR LEAD-BASED PAINT

1.1 DESCRIPTION OF WORK

- A. This specification covers the furnishing and installation of materials for XRF testing for lead-based paint. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

1.2 SUMMARY

- A. The Contractor shall perform work in accordance with the latest HUD Guidelines, in accordance with all applicable regulations of the Environmental Protection Agency (EPA), Occupational Safety & Health Agency (OSHA) and any applicable State or Local standards that may be more stringent than the Federal Standards except, as such guidelines are modified by the Owner in writing in this contract or any contract pursuant to this contract.
- B. Workmanship required in the execution of the work herein specified shall be of good quality and subject to the approval of the the Owner.

1.3 SUBMITTALS

- A. Notification Before Start of Work
 - 1. The Contractor shall send notices to the Project Superintendent, Residents, and the Department of Planning and Development 48 hours before the scheduled start of work. The Contractor shall make three (3) attempts to gain entry to each apartment, with proper 48 hour notification to the resident each time.
 - 2. The Contractor shall begin work no later than 48 hours after receiving a work proceed order.
- B. Copies of the submissions listed below must be tendered with the bid:
 - 1. Ability to perform XRF testing and paint chip sampling by submitting evidence of the successful completion of lead inspector training by all staff to be assigned to the job including inspector technicians. Training must be provided through a State approved EPA-Model program. All staff assigned to the Contract must also demonstrate training in the use of the XRF testing machines to be dedicated to this contract. The serial number of such XRF machine shall be provided to the the Owner.
 - a. Contractor or Subcontractor performing the work must have at least 3 years of satisfactory experience (documented) in performing XRF testing for a City, State or Federal Agency.
 - 2. Laboratory certification by the State Department of Health (or other responsible agency) and by the USEPA through the EPA's National Lead Laboratory Accreditation Program ("NLLAP"), or as an alternative having accreditation application pending before NLLAP, and having acceptable performance on five consecutive rounds of the EPA, Environmental Laboratory Proficiency Analytical Testing (ELPAT) program, including the most recent round; evidence of such accreditation must be provided. Indicate if the laboratory is an independent entity from the Contractor.
 - 3. If a subcontractor will be used for any of the laboratory work of this contract, evidence of certification stated above must also be provided for the subcontractor.

- C. XRF Testing Report Format

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- a. All XRF report must be made after a formal submittal and approval by the Owner.
- b. A faxed summary report must be provided to the the Owner within 48 hours after completion of testing for a work Authorization. For XRF testing requiring confirmation by laboratory analysis of paint chip samples, the faxed summary report must be provided within 48 hours after the the Owner gives approval for testing of the collected paint chip samples.
- c. A detailed report must be provided to the the Owner within 5 business days after completion of the testing.

1.4 QUALITY ASSURANCE

- A. The work shall consist of furnishing all labor, material, insurance and all other incidental items required to do the following:
 - 1. XRF Testing
 - a. Random or comprehensive testing of various components in single family housing units, multi-family housing units, common areas and exterior sites, using any of the approved X-ray Fluorescence ("XRF") machines, to determine if the lead-based paint concentration is within permissible limits.
Note: Testing may be for entire apartments or selected rooms or components within the apartment.
 - b. The permissible limit shall be defined as a final reading showing a lead concentration of less than 1.0 mg/cm².
 - c. Refer to the Manufacturer's manual, as well as the "XRF Performance Characteristic Sheet" when determining calibration check tolerance, and other instrument specific information. Use the adjusted "XRF Performance Characteristic Sheets" in this contract when determining the inconclusive range.
 - d. In addition to the manufacturer's recommended warm up and quality control procedures, a set of three nominal XRF calibration check readings must be taken before the inspection begins and after the inspection has been completed in a particular unit, or every 4 hours, whichever occurs first. All reference material values and calibration check readings must be included in the report provided to the Owner.
 - e. Do not use the XRF to test highly curved or ornate surfaces, or surfaces inaccessible to the XRF, due to poor reliability of results. For such surfaces, laboratory analysis of paint chips must be done.
 - f. Only one XRF reading is required per testing combination. A unique testing combination is characterized by the room equivalent, the component, the substrate and the visible color of the paint. However, testing combinations with different colors on the same component and substrate may be combined into a single component type.
 - g. All inconclusive results must be treated according to the inspection rules using multi-family inspection or single family inspection rules as appropriate.
 - h. XRF field data sheets shall be filled out as they appear on completed Form 7.1("Single-Family Housing LBP Testing Data Sheet") and 7.5 ("Multifamily Housing LBP Testing Data Sheet") in HUD Guidelines.
 - i. Room equivalents or sections thereof that are not accessible for testing (i.e. locked bedrooms) shall be noted in the final report to the Owner.
 - 2. Laboratory testing of paint chips.
 - a. Collection of paint chips from various painted components for laboratory analysis due to XRF substrate corrected inconclusive and/or positive readings as directed by the the Owner.

- b. Laboratory preparation and testing by Flame Atomic Absorption Spectrometry (FAAS) or Graphite Furnace Atomic Absorption Spectrometry (GFAAS) to determine if the lead paint concentration is within permissible limits.
 - c. The permissible limit shall be defined as a lead concentration less than 0.5% by weight.
 - d. Collect paint chips in accordance with ASTM ES28-94.
 - e. Prepare paint chips in the laboratory for testing in accordance with ASTM ES37-94.
 - f. Repair and repaint areas from which paint chips have been collected, to match adjacent areas, unless notified by the the Owner in writing to utilize a temporary covering for the tested surfaces. The Contractor shall provide water based latex paint for this purpose. Colors shall be limited to white and off-white; and other colors if provided by the tenant.
 - g. Only one paint chip is required per testing combination. A unique testing combination is characterized by the room equivalent, the component, the substrate, and the visible color of the paint. However, testing combinations with different colors on the same component and substrate may be combined into a single component type.
 - h. Field data sheets and signed chain of custodies must be attached to the final report to the Owner.
- B. Occupied Residences
 - 1. Some of the work of this contract will be in occupied apartments. The Contractor shall perform all of the work of this contract with the least inconvenience to the tenants.
 - 2. The Contractor shall take all necessary precautions to protect the property of the the Owner, its residents and the public. The contractor must repair any damaged property, whether of the the Owner, its residents, or the public, and restore such property to its original condition. If the damage is beyond repair, the Contractor shall replace it with new, that in the judgement of the the Owner, match the existing materials and are of equal quality and workmanship. All such repairs shall be at the Contractor's expense.
- C. Applicable Regulations
 - 1. ASTM Standards
 - a. ASTM E 1583 on evaluating laboratories used to determine lead levels;
 - b. ASTM E 1605 on terminology;
 - c. ASTM E 1613 on determining lead by atomic emission or atomic absorption spectroscopy;
 - d. ASTM E 1645 on laboratory preparation of paint-chip samples;
 - e. ASTM E 1775 on-site extraction and field portable stripping voltammetry analysis for lead;
 - f. ASTM PS 53 on identifying and managing lead in facilities;
 - g. ASTM PS 87 on ultrasonic extraction for later analysis for lead;
 - h. ASTM PS 88 on determining lead by portable electro analysis
 - 2. OSHA Standards (without limitation), include:
 - a. 29 CFR 1926.20 - General safety and health provisions;
 - b. 29 CFR 1926.21 - Safety training and education;
 - c. 29 CFR 1925.25 - Housekeeping;
 - d. 29 CFR 1926.28 - Personal protective equipment;
 - e. 29 CFR 1926.51(f) - Washing facilities;
 - f. 29 CFR 1926.55 - Gases, vapors, fumes, dusts, and mists;
 - g. 29 CFR 1926.57 - Ventilations;
 - h. 29 CFR 1926.59 - Hazardous Communication Standards;
 - i. 29 CFR 1926.10 - Respiratory protection; and
 - j. 29 CFR 1926.62 - Lead in Construction
 - 3. The Contractor must comply with all applicable requirements of the Resource Conservation & Recovery Act (RCRA) of 1976 as amended in 1980 and 1984 by the Hazardous & Solid Waste Amendments (HSWA).

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4. The Contractor must follow the XRF Performance Characteristic Sheet (PCS) for all inspection activities. XRF PCSs are available from the National Lead Information Center Clearinghouse or through the HUD website at <http://www.hud.gov/offices/lead/lbp/hudguidelines/allpcs.pdf>.

1.5 PRODUCTS

- A. XRF Instruments and Testing Protocols
 1. The Contractor shall use XRF instruments that are approved by the Owner.
 2. XRFs must be used in accordance with the manufacturer's instructions and the XRF Performance Characteristic Sheet. If discrepancies exist between the XRF Performance Characteristic Sheet, the HUD Guidelines and the manufacturer's instructions, the most stringent guidelines should be followed.

1.6 EXECUTION

- A. Inspection and Testing
 1. **Single Family Testing Rules**
 - a. If the housing development has less
 - 1) than 10 units built between 1960-1970 or
 - 2) 20 units built before 1960 or
 - 3) the random testing rules in a multi-family development are not being used then single family testing rules must be followed.
 - b. List all testing combinations (see HUD Guidelines Table for an example) in all interior rooms, on all exterior building surfaces, and on surfaces in other exterior areas, such as fences, playground equipment, and garages. The "SingleFamily Housing LBP Testing Data Sheet" (see HUD Guidelines) or a comparable data collection instrument may be used for this purpose.
 - 1) Test all room equivalents inside and outside the dwelling unit. The final report must include a final determination of the presence or absence of lead-based paint on each testing combination in each room equivalent.
 - 2) Inspect each testing combination in each room equivalent, unless similar building component types with identical substrates (such as windows) are all found to contain lead-based paint in the first five interior room equivalents. In that case, testing of that component type in the remaining room equivalents may be discontinued, if and only if the Owner agrees beforehand to such a discontinuation. The inspector should then conclude that similar building component types in the rest of the dwelling unit also contain lead-based paint.
 - 3) Painted furniture that is physically attached to the unit (for example, a desk or dresser that is built-in) should be included in the inspection as a testing combination.
 - 4) Results of an inspection may be summarized by classifying component types across room equivalents if patterns or trends are supported by the data.
 - 5) All substrates across all room equivalents should be grouped into one of the six substrate categories (brick, concrete, drywall, metal, plaster, or wood).
 - c. Number and Location of XRF Readings
 - 1) XRF testing is required for at least one location per layers of paint should be included and the XRF probe testing combination, except for interior and exterior faceplate should be able to lie flat against the surface walls, where four readings should be taken, one on of the test location each wall.
 - 2) For interior and exterior walls: take at least four readings (one of ea. wall). If there are more than four walls test the four largest walls, calculate the average of the

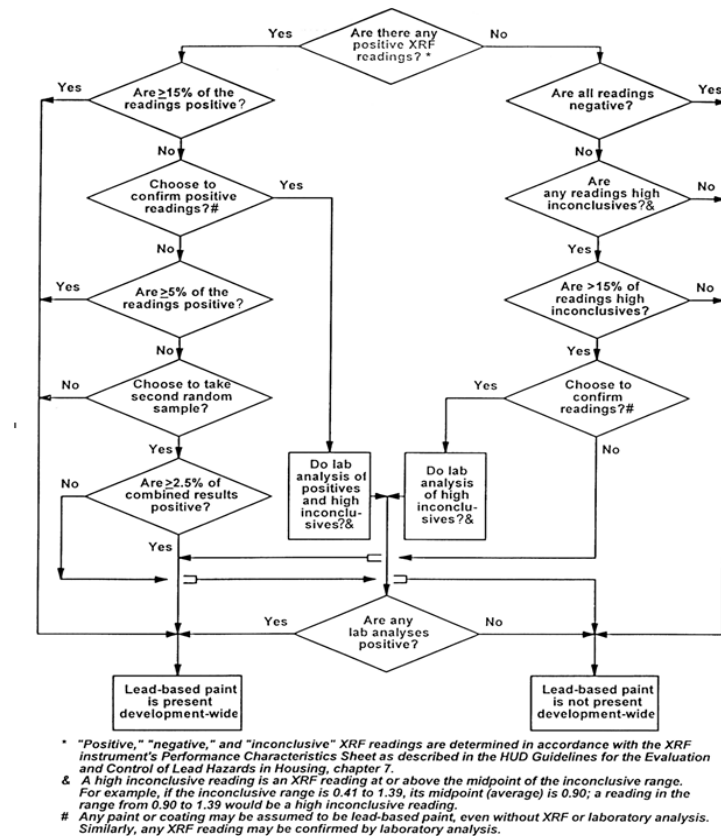
readings, round the result to same number of decimal places as the XRF instrument displays, and classify the remaining walls with the same painting history as the tested walls, based on this rounded average. When the remaining walls in a room equivalent clearly do not have the same painting history as that of the tested walls, test and classify the remaining walls individually.

- 3) Select areas of paint which are most likely to have old paint or coatings, where areas of paint appear thickest. Avoid testing where paint has worn away, chipped; or over pipes, electrical surfaces, nails, and any other possible interferences.
- 4) A numbering system, floor plan, sketch or other system may be used to document which testing combinations were tested and sufficiently detailed enough for another individual to find them.
 - a) Side Identification Identify perimeter wall sides with letters A, B, C, and D (or numbers or Roman numerals). Side A for single-family housing is the street side for the address. Side A in multi-family housing is the apartment entry door side. Side B, C, and D are identified clockwise from Side A as one faces the dwelling; thus Wall B is to the left, Wall C is across from Side A, and Side D is to the right of Side A. Each room equivalent's side identification follows the scheme for the whole housing unit. Because a room can have two or more entries, sides should not be allocated based on the entry point. For example, giving a closet a side allocation based on how the room is entered would make it difficult for another person to make an easy identification, especially if the room had two closets and two entryways.
 - b) Room Equivalent Identification Room equivalents should be identified by both a number and a use pattern (for example, Room 5-Kitchen). Room 1 can always be the first room, at the A-D junction at the entryway, or it can be the exterior. Rooms are consecutively numbered clockwise. If multiple closets exist, they are given the side allocation: for example, Room 3, Side C Closet. The exterior is always assigned a separate room equivalent identifier.
 - c) Sides in a Room Sides in an interior room equivalent follow the overall housing unit side allocation. Therefore, when standing in any four-sided room facing Side C, the room's Side A will always be to the rear, Side B will be to the left, and Side D will be to the right.
 - d) Building Component Identification Individual building components are first identified by their room number and side allocation (for example, the radiator in Room 1, Side B is easily identified). If multiple similar component types are in a room (for example, three windows), they are differentiated from each other by side allocation. If multiple components are on the same wall side, they are differentiated by being numbered left to right when facing the components. For example, three windows on Wall D are identified as windows D1, D2, and D3, left to right. If window D3 has the only old original sash, it is considered a separate testing combination from the other two windows. Codes or abbreviations for building components and/or locations may be used in order to shorten the time needed for data entry. If codes or abbreviations are used, the inspection records and the inspection report must include a table showing their meaning.
- d. XRF Instrument Reading Time
 - 1) The recommended time to open an XRF instrument's shutter to obtain a single XRF result for a testing location depends on the specific XRF instrument model and the mode in which the instrument is operating. Follow manufacturer's instructions per HUD Guidelines.
- e. XRF Calibration Check Readings
 - 1) Follow manufacturer's instructions per HUD Guidelines.



- f. Substrate Correction
 - 1) The XRF measurements, corrected for substrate contribution, if required by the Performance Characteristic Sheet ("PCS") for the particular type of instrument being used, should be sorted by the inspector by component type into the following categories:
 - a) Positive- A positive XRF reading in accordance with the XRF's Performance Characteristic Sheet.
 - b) Negative- A negative XRF reading in accordance with the XRF's Performance Characteristic Sheet.
 - c) High Inconclusive- An inconclusive XRF reading equal to or greater than the midpoint of the XRF's inconclusive range, in accordance with the XRF's Performance Characteristic Sheet.

- g. The following Decision analyses will be used to determine which components are positive, negative or inconclusive:



- 1)
- 2) All inconclusive results must be confirmed with laboratory analysis, or as an alternative must be classified as positive. the Owner may also wish to confirm positive XRF results with laboratory analysis. Therefore the Contractor must make a field determination of which XRF readings falls in the inconclusive or positive ranges and take paint chip samples during the XRF testing for possible laboratory analysis. If the majority of XRF readings are positive in the first few units, the inspector must consult with the Owner on whether to continue taking paint chip samples. Only the Owner may determine whether to submit collected paint chip samples for laboratory analysis or to classify the element as positive.

2. Multi-family Housing Testing Rules (Random Sampling)

- a. In order to use the Multi-family housing testing rules, there must multi-family housing is defined as any group of more than four units that are similar in construction from unit to unit
- b. Determine the number of randomly selected units to be tested in accordance with Table 7.3, below. Chapter 7 of the HUD Guidelines also describes how to select the units randomly. If a unit or units which were selected as part of the original random sample cannot be entered for a particular reason, a replacement unit(s) must be randomly selected in accordance with the HUD Guidelines.

**Table 7.3 Number of Units to be Tested in Multi-family
Building or Developments***

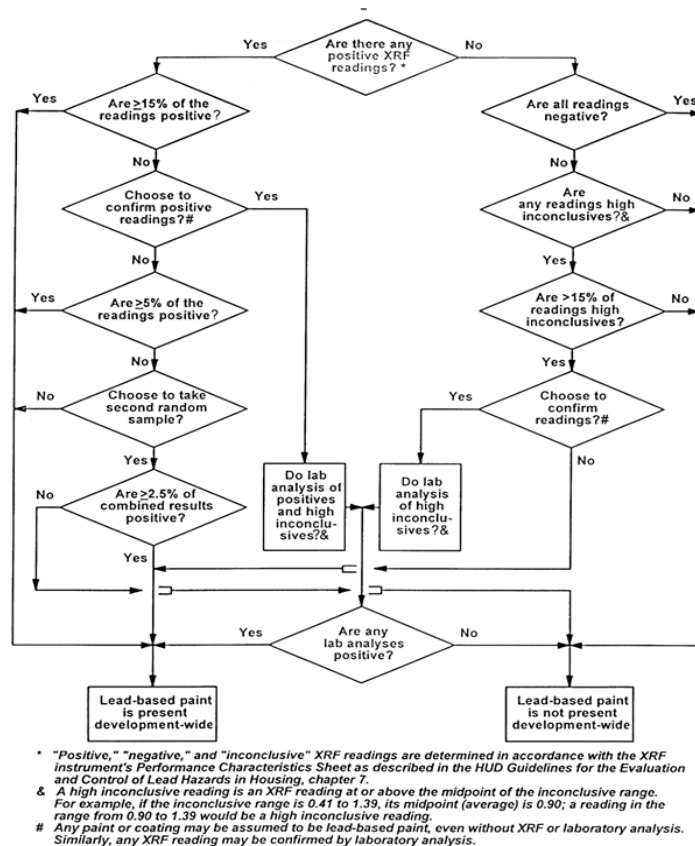
Number of Similar Units, Similar Common Areas, or Similar Exterior Sites	Pre-1960 or Unknown-Age Building or Development: Number of Units to Test *	1960-1977 Building or Development: Number of Units to Test *
1-10	All	All
11-13	All	10
14	All	11
15	All	12
16-17	All	13
18	All	14
19	All	15
20	All	16
21-26	20	16
27	21	17
28	22	18
29	23	18
30	23	19
31	24	19
32	25	19
33-34	26	19
35	27	19
36	28	19
37	29	19
38-39	30	20
40-48	31	21
49-50	31	22
51	32	22
52-53	33	22
54	34	22
55-56	35	22
57-58	36	22
59	37	23
60-69	38	23
70-73	38	24
74-75	39	24
76-77	40	24

Number of Similar Units, Similar Common Areas, or Similar Exterior Sites	Pre-1960 or Unknown-Age Building or Development: Number of Units to Test *	1960-1977 Building or Development: Number of Units to Test *
78-79	41	24
80-88	42	24
89-95	42	25
96-97	43	25
98-99	44	25
100-109	45	25
110-117	45	26
118-119	46	26
120-138	47	26
139-157	48	26
158-159	49	26
160-177	49	27
178-197	50	27
198-218	51	27
219-258	52	27
259-279	53	27
280-299	53	28
300-379	54	28
380-499	55	28
500-776	56	28
777-939	57	28
940-1004	57	29
1005-1022	58	29
1023-1032	59	29
1033-1039	59	30
1500	87	44
2000	116	58
2500	145	73
3000	174	87
3500	203	102
4000	232	116

* For brevity, "Number of Units" and "Number of Units to Test" are used, but the number to test is the same for similar units, similar common areas, and similar exterior sites.

- c. An assessment on each tested component must note four attributes, also called a testing combination.
 - 1) The room equivalent (where the testing took place i.e. bedroom, bathroom, etc.)
 - 2) The component type (door, wall #1 - upper left, etc.)
 - 3) The substrate (brick, wood, concrete, drywall, plaster or metal).
 - 4) The color of the paint.
- d. These attributes must be included as part of the report.
- e. For each testing combination, the condition of the painted surfaces should be noted as either intact, fair or poor.
- f. One reading with the X-ray fluorescence (XRF) instrument on each testing combination is all that is required.
- g. At least 40 components of a given type must be tested to obtain the desired level of confidence in the results throughout the multi-family development. If less than 40 components of a given type exist in the buildings to be tested i.e. they are unique components, then the measurement should be taken using single family testing rules (described below). If less than 40 components of a given type exist in the units to be tested, additional components of this type can be identified in other units in the complex and tested to bring the total up to 40 so that multi-family testing rules can be used. The decision of which option the Contractor should use will be made by the the Owner.
- h. To increase the number of tested components of a given type, testing combinations with different colors on the same component and substrate may be combined into a single component type. For example, if "wood doors" is the component type, all wood doors tested for lead-based paint could belong to the same component type, regardless of color.
- i. A component type may be differentiated by color as long as there are 40 tested and there is a good reason for differentiation.
- j. The XRF measurements, corrected for substrate contribution, if required by the Performance Characteristic Sheet ("PCS") for the particular type of instrument being used, should be sorted by the inspector by component type into the following categories:
 - 1) Positive- A positive XRF reading in accordance with the XRF's Performance Characteristic Sheet.
 - 2) Negative- A negative XRF reading in accordance with the XRF's Performance Characteristic Sheet.
 - 3) High Inconclusive- An inconclusive XRF reading equal to or greater than the midpoint of the XRF's inconclusive range, in accordance with the XRF's Performance Characteristic Sheet.

- k. The following Decision analyses will be used to determine which components are positive, negative or inconclusive:



- l. If there are readings on a component type(s) equal to or greater than 1.0 mg/cm² and paint chip samples are submitted to the laboratory, there are two possible results:
- 1) If all lab samples on a component type are below 0.5% lead by weight, the component type can be classified as negative throughout the development.
 - 2) If one or more lab results are positive, (equal to or greater than 0.5% lead by weight for a component) the the Owner will take one of three options:
 - a) Treat the component type as positive throughout the development, or
 - b) Test the component type throughout the development, or
 - c) If 5% or less of the component type are positive, take a second random sample, just testing that component type.
 - 3) If option 2)c) above is selected by the Owner and the combined results of the first and second random sample are less than 2½% positive, the following additional options are available depending on the results.
 - a) If no positives are found in the second sample, no further testing is necessary. Those positives in the first random sample will be monitored/abated (not by this Agreement), but the rest of the component type can be classified as negative.

- b) If positives are found on a component type in the second sample, the the Owner has the option to classify the component type as positive throughout the development or comprehensively test it.
 - c) If the combined results of the two random samples are equal to or greater than 2½%, the the Owner also has the option to comprehensively test the remaining components of that type or classify them as positive.
 - m. Paint Chip Sample Size: The Paint chip samples should be taken from a 4 square inch (25 square centimeter) area that is representative of the paint on the testing combination, as close as possible to any XRF reading locations and, if possible, unobtrusive. This area may be a 2" x 2" (5 x 5 centimeters) square, or a 1" x 4" (2.5 x 10 centimeters) rectangle, or have any other dimensions that equal at least 4 square inches (25 square centimeters). Regardless of shape, the dimensions of the surface area must be accurately measured (to the nearest millimeter or 1/16th of an inch) so that the laboratory results can be reported in mg/cm². Results should be reported as percent by weight if the surface area cannot be measured accurately or if all paint within the sampled area cannot be removed. In these cases, lead should be reported in ppm or percent weight, not in mg/cm². Smaller surface area can be used if acceptable to the laboratory. (See ASTM E 1729). In all cases those who take the samples should consult with the NLLAP recognized laboratory selected regarding the requirements for the submission samples for lead-based paint analysis.
 - n. If the the Owner decides to test in search of these hard-to-find components coated with lead based paint, the inspector must use the single family testing rules described in the previous section.
- 3. **Common Areas and Exterior Sites Testing Rules**
 - a. Similar common areas and similar exterior sites must always be tested, but in some cases they can be sampled in much the same way that dwelling units are. Common areas and building exteriors typically have a similar painting history from one building to the next. In multifamily housing, each common area (such as building lobby, laundry room, or hallway) can be treated as a dwelling unit. If there are multiple similar common areas, they may be grouped for sampling purposes exactly the same way as regular dwelling units. However, dwelling units, common areas and exterior sites cannot be all mixed together in a single group. All testing combinations within each common area or building exteriors selected for testing must be inspected. This includes playground equipment, benches and miscellaneous testing combinations located throughout the development. The specific common areas and building exteriors to test should be randomly selected, in much the same way as specific units are selected using random numbers. The number of common areas to be tested should be taken from table 7.3 (HUD Guidelines). In this instance, common areas and building exteriors can be treated in the same way as housing units (although they are not to be confused with true housing units).
- 4. Unit and Common Area Drawings
 - a. Mark-ups of as built drawings depicting room equivalents that are tested must be provided as part of the report.
 - b. The Contractor should test in a clockwise path starting from the door through the space and room equivalents so that the approximate location of each component tested can be easily established by referencing the room equivalent and sides.
 - c. Each space must have a reference point (side A, B, C, D or wall 1, 2, 3 or 4). The wall with the door should always be referenced as wall 1 or side A. If there is more than one door, wall 1 or side A should be used to refer to the wall with the door through which the room is first entered when moving in a clockwise fashion through the unit.

B. Evaluation of the Inspection by the the Owner



1. The Contractor will be required to carry out retesting at no additional cost to the the Owner, after completion of the Inspection at each the Owner's development as described in the HUD Guidelines, for single family housing, multi-family housing and common areas. The the Owner shall randomly select the testing combinations to be retested and the Contractor shall perform the retesting using the same XRF instrument(s) which was/were used to take the original readings. An the Owner's inspector shall be present to observe all retesting. The retesting shall be limited to ten (10) testing combinations, and if necessary to repeat the retest, the testing combinations randomly selected for repeating the retest shall also be limited to ten.
 2. If the retest tolerance limit computed from the information provided in the "XRF Performance Characteristics Sheet" (see HUD Guidelines) is exceeded, the retest will be repeated as described in the HUD Guidelines for single family, multi-family housing and common areas. If the retest tolerance limit is exceeded again, the the Owner may require the Contractor to retest the entire development at no additional cost to the the Owner, or the the Owner may withhold all payments and terminate its agreement with the Contractor.
- C. Option to do Laboratory Testing only
1. The the Owner may, for a specific testing assignment, request in writing that the Contractor, when utilizing the multi-family housing testing rules for random sampling, or the single family housing testing rules, do all testing through laboratory analysis of paint chips rather than through XRF Spectrum Analyzer testing with laboratory confirmation as needed. Please note that under the single family housing testing rules, only one paint chip must be taken and analyzed for each component type.
- D. Waste Disposal
1. All waste generated must be legally disposed in accordance with Federal, State and Local regulations.

END OF SECTION 02 83 19 00a



02 - Existing Conditions

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SECTION 02 83 19 00b - LEAD DUST WIPE, AIR AND TCLP SAMPLING AND ANALYSIS

DESCRIPTION OF WORK

This specification covers the furnishing and installation of materials for lead dust wipe, air and TCLP sampling and analysis. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

GENERAL

Definitions: Unless otherwise specified the following definitions shall apply:

1. **"Approved"**: shall mean approved by all public agencies having jurisdiction, and the Owner.
2. **"The Owner"**: shall mean the Owner and its designated authorized representatives.
3. **"Contractor"**: shall mean the firm that is awarded this contract and is responsible to ensure compliance with Federal, State and City regulations as well as these Contract documents.
4. **"Development or Project"**: a group of buildings in one or more designated geographical locations, owned or operated by the Owner and referred to by a common name by the Owner.
5. **"Dust Cleaning Firm"**: shall mean the contractor under a separate contract or the Owner responsible for cleaning of lead dust, as directed by the Owner, until the clearance levels are achieved, as defined in the "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, June 1995" or latest edition published by the United States Department of Housing and Urban Development (HUD).
6. **"Equal or Approved Equal"**: shall mean equal in the opinion of the Owner.
7. **"HUD"**: the United States Department of Housing and Urban Development.
8. **"HUD Guidelines"**: shall mean Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing issued by HUD'S Office of Lead-Based Paint Abatement and Poisoning Prevention in June 1995 except as such guidelines are later modified by HUD and/or modified by the Owner in writing pursuant to this contract.
9. **"Inspector"**: an individual who has completed training from an accredited program and been licensed or certified by the appropriate State or local agency to (1) perform inspections to determine and report the presence of lead-based paint on a surface-by-surface basis through on-site testing, (2) report the findings of such an inspection, (3) collect environmental samples for laboratory analysis, (4) perform clearance testing, and (5) document successful compliance with lead-based paint hazard control requirements or standards.
10. **"Lead-Based Paint"**: any paint, varnish, shellac, or other coating that contains lead equal to or greater than 1.0 mg/cm² as measured by XRF or laboratory analysis, or 0.5 percent by weight (5,000 µg/g, 5,000 PPM, or 5,000 mg/kg) as measured by laboratory analysis.
11. **"Lead-Based Paint Hazard"**: a condition in which exposure to lead from lead-contaminated dust, lead-contaminated soil or deteriorated lead-based paint would have an adverse effect on human health (as established by the EPA Administrator under Title IV of the Toxic Substance Control Act). Lead-based paint hazards include for example, deteriorated lead-based paint, leaded dust levels above applicable standards and bare leaded soil above applicable standards.
12. **"Lead-Based Paint Hazard Control"**: activities to control or eliminate lead-based paint hazards, including interim controls and complete abatement.
13. **"Lead-Contaminated Dust"**: surface dust in residences that contain an area or mass concentration of lead in excess of the standard established by the EPA Administrator, pursuant to Title IV of the Toxic Substance Control Act. Until the EPA standards are set, the HUD recommended clearance and risk assessment standards for leaded dust are 40 µg/ft² on floors, 250 µg/ft² on interior window sills, and 800 µg/ft² on window troughs.
14. **"Monitoring"**: shall refer to inspection to ensure compliance with all Federal, State and City Standards or guidelines, and contractual specifications.
15. **"Provide"**: shall mean furnish and install.

16. **"Risk Assessor"**: a certified individual who has completed training with an accredited training program and who has been certified to (1) perform risk assessments, (2) identify acceptable abatement and interim control strategies for reducing identified lead-based paint hazards, (3) perform clearance testing and reevaluations, and (4) document the successful completion of lead-based paint hazard control activities.

Applicable Regulations/References

17. The work conducted shall comply with all applicable Federal, State and City regulations. Applicable guidelines and standards listed in the scope of work include, but are not limited to:

24 CFR Parts 35,36,37 Guidelines for the Evaluation and Control of Lead-Based Paint in Housing (HUD Guidelines June 1995) & 1997 Revisions 29 CFR 1910 29 CFR 1910.1025 29 CFR 1910.134 29 CFR 1910.1200 29 CFR 1910.245 29 CFR 1926 29 CFR 1926.20 29 CFR 1926.21 29 CFR 1926.25 29 CFR 1926.28 29 CFR 1926.51 29 CFR 1926.55 29 CFR 1926.59 29 CFR 1926.62 29 CFR 1926.103 40 CFR 61 Subpart A 40 CFR 241 40 CFR 257 40 CFR 261/262 American National Standards Institute (ANSI) Z87.1 ANSI Z88.2-80 American Society For Testing Materials (ASTM)	HUD Lead-Based Paint Regulations General Industry Standard Lead Standard for General Industry Respiratory Protection Hazard Communication Specification for Accident Prevention Construction Industry Standards General Safety & Health Provisions Safety Training & Education Housekeeping Personal Protective Equipment Washing Facilities Gases, Vapors, Fumes, Dusts & Mists Hazard Communication Standard Construction Industry Lead Standard Respiratory Protection General Provisions Guidelines for the Land Disposal of Solid Waste Criteria for the Land Disposal of Solid Waste Waste Disposal Facilities & Practices Eye Protection Practices for Respiratory Protection All Applicable Standards
18. The contractor shall ensure that any programs, certifications, licenses or other documentation in accordance with the above and/or any other applicable Federal, State, and Local Regulations/Guidelines are provided.

Scope Of Work

19. The work shall consist of furnishing labor, materials, insurance and all other incidental items required to perform the following:
 - a. Dust wipe sampling and analysis
 - 1) Collect dust wipe samples from various horizontal surfaces, such as floors, window sills, window troughs, etc., as directed by the Owner.
 - 2) Dust wipe samples shall be collected in accordance with ASTM ES30-94.
 - 3) Analyze dust wipe sample in the laboratory using Flame Atomic Absorption Spectrometry ("FAAS") or Graphite Furnace Atomic Absorption Spectrometry("GFAAS").
 - 4) Provide result of analysis in micrograms per square foot.

- 5) A faxed summary of results must be provided to the Owner within 24 hours after the Owner authorizes the Contractor to perform the laboratory analysis of the collected dust wipe sample. Contractor shall also have the ability to provide results in 4 hours for clearance, following lead-based paint abatement work, if requested by the Owner. The sampling result must be provided in a form approved by the Owner and must include for each dust wipe sample, the Project, the building address, the sample number, the room or room equivalent, the surface type, dimensions of sample areas, total micrograms, micrograms per square feet, and an indication of pass or fail.
 - 6) Turn-around time for results shall be counted from the time the Contractor performs collection of dust wipe samples to the time the results are actually presented to the Owner. This includes travel time from the site to the laboratory of the Contractor and back to the site.
 - 7) A detailed final report covering the results of all dust wipe samples taken and analyzed must be submitted within 5 days from the time the Owner authorizes the performance of the laboratory analysis. The sampling report must include for each dust wipe sample, the Project, the building address, the sample number, the room or room equivalent, the surface type, dimensions of sample areas, total micrograms, micrograms per square feet, and indicate pass or fail in a form approved by the Owner. Also include in the report the method of analysis, i.e. "FAAS" or "GFAAS", and the detection limits. The laboratory test results in the final report must be signed by the Laboratory Director.
 - 8) The sampling data report must contain all required data fields as specified by the Owner. The sampling data report shall be provided to the Owner on 3.5 inch high density diskettes in ASCII file form. The required data fields will be provided by the Owner to the Contractor.
 - 9) The laboratory used for the analysis of the dust wipe samples must be certified by the State Department of Health (or other responsible agency) and by the USEPA through the EPA's National Lead Laboratory Accreditation Program ("NLLAP"), or as an alternative having accreditation application pending before NLLAP, and having acceptable performance on five consecutive rounds of the EPA, Environmental Laboratory Proficiency Analytical Testing (ELPAT) program, including the most recent round; evidence of such accreditation must be provided. Indicate if the laboratory is an independent entity from the Contractor.
- b. Dust Spiked Samples
- 1) Provide dust spiked samples to the Owner. Dust spiked samples shall be prepared in accordance with the HUD Guidelines.
- NOTE:** These samples are separate from the ones required by the Contractor for its own QA/QC
- 2) Prepare dust spiked samples in a manner such that they are indistinguishable from the field samples.
 - 3) Prepare dust spiked samples using the same lot as that to be used in the field.
 - 4) Dust spiked samples shall be inserted into the sample stream, randomly, by the Owner Inspector.
 - 5) Blind analysis of dust spiked samples must fall within 80%-120% of the true value. If the laboratory fails to obtain readings within these limits, two more spiked samples shall be sent immediately to the lab for analysis.
 - 6) If the two additional spiked samples fail, the sample batch shall be considered invalid, and the Owner may, at its sole discretion, terminate this contract as well as withhold payment for services already rendered.
- c. Air Sampling and Analysis
- 1) Collect area air samples at various locations and various projects for personal exposure assessment as directed by the Owner.
 - 2) Air samples shall be collected in accordance with ASTM E1553-93.
 - 3) Prepare air samples for analysis in accordance with ASTM E33-94
 - 4) Analyze air samples using FAAS or GFAAS.

- 5) All equipment required for personal air sampling, including pumps shall be provided by the Contractor at no extra cost to the Owner.
 - 6) Provide results of air samples in micrograms per cubic meter.
 - 7) A faxed summary of result must be provided to the Owner within 24 hours after the Owner authorizes the Contractor to perform the laboratory analysis of the collected air sample. The sampling result must include for each air sample taken the Project, the building address, the sample number, the room or room equivalent, and the reading.
 - 8) Turn-around time shall start after collection of the air samples, and includes travel time to and from the laboratory.
 - 9) A detailed final report covering the results of all air samples taken and analyzed must be submitted within 5 days from the time the Owner authorizes the performance of the laboratory analysis. The sampling report must include for each air sample, the Project, the building address, the sample number, the room or room equivalent, and the reading. The laboratory report contained in the final report must be signed by the Laboratory Director.
 - 10) The sampling data report must contain all required data fields as specified by the Owner. The sampling data report shall be provided to the Owner on 3.5 inch high density diskettes in ASCII file form. The required data fields will be provided by the Owner to the Contractor.
 - 11) The laboratory used for the analysis of the dust wipe samples must be certified by the State Department of Health (or other responsible agency) and by the USEPA through the EPA's National Lead Laboratory Accreditation Program ("NLLAP"), or as an alternative having accreditation application pending before NLLAP, and having acceptable performance on five consecutive rounds of the EPA, Environmental Laboratory Proficiency Analytical Testing (ELPAT) program, including the most recent round; evidence of such accreditation must be provided. Indicate if the laboratory is an independent entity from the Contractor.
 - 12) Air sampling technician shall be present during the entire shift of the air sampling.
- d. TCLP Sampling and Analysis
- 1) Take core samples of construction waste as directed by the Owner and analyze by TCLP testing to determine if waste is hazardous.
 - 2) Waste shall be classified as hazardous if the concentration of lead is greater than 5 parts per million by TCLP testing.
 - 3) The laboratory used for the analysis of the TCLP samples must be certified by the State Department of Health (or other responsible agency) and by the USEPA through the EPA's National Lead Laboratory Accreditation Program ("NLLAP"), or as an alternative having accreditation application pending before NLLAP, and having acceptable performance on five consecutive rounds of the EPA, Environmental Laboratory Proficiency Analytical Testing (ELPAT) program, including the most recent round; evidence of such accreditation must be provided. Indicate if the laboratory is an independent entity from the Contractor.
 - 4) A faxed summary of result must be provided to the Owner within 48 hours after the Owner authorizes the Contractor to perform the TCLP analysis of the waste. Provide results in parts per million (ppm).
 - 5) Final results provided to the Owner by the Contractor must include written sample preparation procedure and laboratory specific written procedures for performing TCLP, including quality control procedures used for performing the TCLP, and a table listing the sample numbers, description of the construction waste, and the result of the TCLP. The laboratory report contained in the final report must be signed by the Laboratory Director.
 - 6) Final report must also specify detection limits.
 - 7) Final report must be provided within 5 days from the time the authorization to perform the TCLP is given by the Owner.

General Provisions

20. Some of the work of this contract may be in occupied apartments. The Contractor shall perform all of the work of this contract with the least inconvenience to the tenants.
21. The Contractor shall take all necessary precautions to protect the property of the Owner, its residents, and the public. The Contractor must repair any damaged property, whether of the Owner, its residents, or the public, and restore such property to its original condition. If the damage is beyond repair, the Contractor shall replace it with new, that in the judgment of the Owner, match the existing materials and/or of equal quality and workmanship. All such repairs shall be at the Contractor's expense.
22. The Contractor shall develop a work plan to be performed as requested by the Department of Planning and Development. The detailed plan shall include coordination of the monitoring and sampling work with the Contractor in a manner that will be least disruptive to the normal use of the non-work areas in the building. The plan should also include emergency procedures in case of fire.
23. The Contractor shall perform work in accordance with the latest HUD Guidelines, except as such Guidelines are modified by the Owner in writing in this Contract, or any Contract pursuant to this Contract, and in accordance with all applicable Federal, State and Local regulations.
24. The Contractor shall include in the bid price all supplementary miscellaneous items not specified but implied or required in order to complete the work.

Submissions

25. Six (6) copies of the submissions listed below must be submitted to the Owner by the Contractor or Subcontractor performing the Work:
 - a. Ability to perform lead dust wipe sampling by submitting evidence of the successful completion of lead inspector and/or risk assessor training by all staff to be assigned to the job including inspector technicians. As stated previously, training must be provided through an approved program.
 - b. Laboratory certification by the State Department of Health (or other responsible agency) through its ELAP program and by the USEPA through the EPA's National Lead Laboratory Accreditation Program ("NLLAP"), or as an alternative having accreditation application pending before NLLAP and having acceptable performance on five consecutive rounds of the EPA, Environmental Laboratory Proficiency Analytical Testing (ELPAT) program, including the most recent round; evidence of such accreditation must be provided.
 - c. If a subcontractor will be used for any of the laboratory work of this contract, evidence of certification stated in (2) above must also be provided for the subcontractor.

Waste Disposal

26. All waste generated must be legally disposed in accordance with the Federal, State and Local Regulations.

END OF SECTION 02 83 19 00b



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Task	Specification	Specification Description
02 83 19 00	02 83 00 00	Lead Remediation
02 83 19 13	02 83 00 00	Lead Remediation
02 83 19 13	02 83 19 00	Lead-Based Paint Remediation
02 83 19 13	02 83 19 00a	XRF Testing For Lead-Based Paint
02 83 19 13	02 83 19 00b	Lead Dust Wipe, Air And Tcpl Sampling And Analysis
02 83 33 00	02 83 00 00	Lead Remediation
02 83 33 13	02 83 00 00	Lead Remediation
02 83 33 13	02 83 19 00	Lead-Based Paint Remediation
02 83 33 13	02 83 19 00a	XRF Testing For Lead-Based Paint
02 83 33 13	02 83 19 00b	Lead Dust Wipe, Air And Tcpl Sampling And Analysis



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SECTION 02 84 16 00 - HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBS AND MERCURY

1.1 GENERAL

A. Description Of Work

1. This specification covers the furnishing and installation of materials for removal of fluorescent light ballasts/capacitors and fluorescent light tubes. Products shall be as follows or as directed by the the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. Before Start of Work: Submit the following to the Owner's Representative for review. Do not start work until these submittals are returned with Owner's Representative's approval.
 - a. Copy of State or local license for hazardous waste hauler;
 - b. Certification of at least one on-site supervisor which has satisfactorily completed the OSHA 40 Hour Health and Safety Course for Handling Hazardous Materials;
 - c. Certificates of workers which have successfully completed at least the OSHA 40-Hour Health and Safety Course for Hazardous Materials;
 - d. List of employees scheduled to perform this work;
 - e. Schedule of start and finish times and dates for this work;
 - f. Name and address of landfill where these waste materials are to be deposited (include contact person and telephone numbers);
 - g. Safety Data Sheets for all materials requiring removal;
 - h. If contractor introduces any chemical into the work environmental, a SDS for that chemical is required before use;
 - i. Transporter must have notified the EPA and/or the appropriate local government agency in advance of its intentions to transport PCB's, mercury and cadmium, and receive an identification number pursuant to the Toxic Substance Control Act (TSCA); and
 - j. Contingency Plan for handling emergency spills or leaks.

1.2 PRODUCTS

A. Materials

1. Polyethylene Sheet: A single polyethylene film in the largest sheet size possible to minimize seams, 4.0 and 6.0 mil thick, clear, frosted, or black.
2. Duct Tape: Provide duct tape in 3" widths, witty an adhesive which is formulated to stick aggressively to sheet polyethylene.
3. Spray Cement: Provide spray adhesive in aerosol cans which is specifically formulated to stick tenaciously to sheet polyethylene.
4. Disposal Bays: Provide 6 mil thick leak-tight polyethylene bags.
5. Labels: As required by the EPA and OSHA for handling, transportation, and disposal of hazardous waste.
6. **Drums:** Recovery or salvage drums acceptable for disposal of hazardous waste. Prior approval of drums is required. Drums or containers must meet the required OSHA EPA (40 CFR Parts 264265 and 300), and DOT regulations (49 CFR Parts 171-178). Use of damaged drums will not be allowed.

1.3 EXECUTION

**A. General**

1. Where necessary, scaffolding shall be erected to fully access all applicable fluorescent light ballasts/capacitors and tubes. At no time will the ballasts/capacitors and tubes be allowed to drop onto the floor. Contractor must take care to protect from dropping the ballasts/capacitors and fluorescent tubes.
2. Prior to removing ballasts/capacitors and fluorescent tubes, contractor shall ensure that all electrical service to lights has been shut off, and locked out. Temporary lighting shall be erected to adequately illuminate work areas.
3. Depending on height of light fixtures, contractor shall utilize at least a 2-person per team system. The fluorescent light tubes shall be removed and passed to the appropriate number of workers required to lower the tubes to the floor without breaking them.
4. The worker on the floor shall lay the tubes in cardboard boxes large enough to hold a small quantity of tubes. Worker shall take care to not damage the tubes while they are lowered into the box. Once the box is full, it shall be wrapped with two layers of 6 mil thick polyethylene sheeting and sealed with duct tape.
5. Contractor may choose to either remove the fluorescent light ballasts/capacitors in-place or lower the lighting fixtures for easy access. The ballasts/capacitors shall be removed from the fixtures. Electrical wiring leading from the ballasts/capacitors shall be cut away. Ballasts/capacitors shall be placed in 55-gallon drums lined with at least two 6 mil thick polyethylene bags. Be careful not to overfill the drums so that they remain manageable. Once the drums have been filled to the acceptable level, seal the lid onto the top of the drum, and affix appropriate labels. Transport drums via hand dollies.

B. Worker Protection

1. As a minimum, while working with the ballasts/capacitors and light tubes, workers shall utilize impervious gloves adequate for the use with hazardous materials. If light ballasts/capacitors and/or light tubes are damaged, and/or exposure to these materials may reach the OSHA PEL or AGGIH threshold limit value (TLV), the contractor shall be required to provide impervious full body protection and respiratory protection. However, contractor is required to verify the type of protection required prior to working with these materials, and have written approval by Owner's Representative prior to beginning.
2. In addition, workers shall not smoke, drink or eat in these areas during work activities.

C. Storage Of Fluorescent Light Ballasts/Capacitors And Light Tubes

1. Once the containers holding the ballasts/capacitors and light tubes have been filled and sealed, they shall be stored in designated areas as agreed upon by the Owners Representative and Contractor. They shall not be allowed to be stored on-site in transportation vehicles until the time for them to be transported to the hazardous waste incinerators or landfill facility.

END OF SECTION 02 84 16 00



02 - Existing Conditions

Task	Specification	Specification Description
02 86 00 00	02 41 19 00	Selective Demolition



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SECTION 02 87 13 00 - MOLD REMEDIATION

1.1 GENERAL

A. Description Of Work

1. This specification covers the removal and disposal of mold. Products shall be as follows or as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

B. Submittals

1. List of all personnel to be involved in the work with their training and certifications.
2. List of all products and procedures proposed for use in performance of the work.
3. Test reports.
4. Certificates.

C. References

1. U.S. EPA "Mold Remediation in Schools and Commercial Buildings"
2. U.S. EPA "A Brief Guide to Mold, Moisture, and Your Home"

D. Quality Assurance

1. Conform to all Federal, State, and Local regulations which govern the handling and disposal of mold materials.

1.2 PRODUCT - (Not Used)

1.3 EXECUTION

- A. Environmental Assessment:** The presence of mold, water damage, or musty odors shall be addressed immediately. In all instances, any source(s) of water must be stopped and the extent of water damaged determined. Water damaged materials shall be dried and repaired. Mold damaged materials shall be remediated in accordance with this document.

1. **Visual Inspection:** A visual inspection is the most important initial step in identifying a possible contamination problem. The extent of any water damage and mold growth shall be visually assessed. This assessment is important in determining remedial strategies. Ventilation systems shall also be visually checked, particularly for damp filters but also for damp conditions elsewhere in the system and overall cleanliness. Ceiling tiles, gypsum wallboard (sheetrock), cardboard, paper, and other cellulosic surfaces shall be given careful attention during a visual inspection. The use of equipment such as a boroscope, to view spaces in ductwork or behind walls, or a moisture meter, to detect moisture in building materials, may be helpful in identifying hidden sources of fungal growth and the extent of water damage.

2. **Bulk/Surface Sampling**

- a. Bulk or surface sampling is not required to undertake a remediation. Remediation of visually identified fungal contamination shall proceed without further evaluation.
- b. Bulk or surface samples may need to be collected to identify specific fungal contaminants as part of a medical evaluation if occupants are experiencing symptoms which may be related to fungal exposure or to identify the presence or absence of mold if a visual inspection is equivocal (e.g., discoloration, and staining).
- c. An individual trained in appropriate sampling methodology shall perform bulk or surface sampling. Bulk samples shall be collected from visibly moldy surfaces by scraping or cutting materials with a clean tool into a clean plastic bag. Surface samples shall be collected by wiping a measured area with a sterile swab or by stripping the suspect surface

with clear tape. Surface sampling is less destructive than bulk sampling. Other sampling methods may also be available. A laboratory specializing in mycology shall be consulted for specific sampling and delivery instructions.

3. Air Monitoring
 - a. Air sampling for fungi shall not be part of a routine assessment. This is because decisions about appropriate remediation strategies can usually be made on the basis of a visual inspection. In addition, air-sampling methods for some fungi are prone to false negative results and therefore cannot be used to definitively rule out contamination.
 - b. Air monitoring may be necessary if an individual(s) has been diagnosed with a disease that is or may be associated with a fungal exposure (e.g., pulmonary hemorrhage/hemosiderosis, and aspergillosis).
 - c. Air monitoring may be necessary if there is evidence from a visual inspection or bulk sampling that ventilation systems may be contaminated. The purpose of such air monitoring is to assess the extent of contamination throughout a building. It is preferable to conduct sampling while ventilation systems are operating.
 - d. Air monitoring may be necessary if the presence of mold is suspected (e.g., musty odors) but cannot be identified by a visual inspection or bulk sampling (e.g., mold growth behind walls). The purpose of such air monitoring is to determine the location and/or extent of contamination.
 - e. If air monitoring is performed, for comparative purposes, outdoor air samples shall be collected concurrently at an air intake, if possible, and at a location representative of outdoor air. For additional information on air sampling, refer to the American Conference of Governmental Industrial Hygienists' document, "Bioaerosols: Assessment and Control."
 - f. Personnel conducting the sampling shall be trained in proper air sampling methods for microbial contaminants. A laboratory specializing in mycology shall be consulted for specific sampling and shipping instructions.
4. Analysis of Environmental Samples
 - a. Microscopic identification of the spores/colonies requires considerable expertise. These services are not routinely available from commercial laboratories. Documented quality control in the laboratories used for analysis of the bulk/surface and air samples is necessary. The American Industrial Hygiene Association (AIHA) offers accreditation to microbial laboratories (Environmental Microbiology Laboratory Accreditation Program (EMLAP)). Accredited laboratories must participate in quarterly proficiency testing (Environmental Microbiology Proficiency Analytical Testing Program (EMPAT)).
5. Evaluation of bulk/surface and air sampling data shall be performed by an experienced health professional. The presence of few or trace amounts of fungal spores in bulk/surface sampling shall be considered background. Amounts greater than this or the presence of fungal fragments (e.g., hyphae, and conidiophores) may suggest fungal colonization, growth, and/or accumulation at or near the sampled location. Air samples shall be evaluated by means of comparison (i.e., indoors to outdoors) and by fungal type (e.g., genera, and species). In general, the levels and types of fungi found should be similar indoors (in non-problem buildings) as compared to the outdoor air. Differences in the levels or types of fungi found in air samples may indicate that moisture sources and resultant fungal growth may be problematic.

B. Remediation

1. General
 - a. **In all situations, the underlying cause of water accumulation must be rectified or fungal growth will recur.** Any initial water infiltration shall be stopped and cleaned immediately. An immediate response (within 24 to 48 hours) and thorough clean up, drying, and/or removal of water damaged materials will prevent or limit mold growth. If the source of water is elevated humidity, relative humidity shall be maintained at levels below 60% to inhibit mold growth. Emphasis shall be on ensuring proper repairs of the building infrastructure, so that water damage and moisture buildup does not recur.
 - b. Five different levels of abatement are described below. The size of the area impacted by fungal contamination primarily determines the type of remediation. The sizing levels below

are based on professional judgment and practicality; currently there is not adequate data to relate the extent of contamination to frequency or severity of health effects. **The goal of remediation is to remove or clean contaminated materials in a way that prevents the emission of fungi and dust contaminated with fungi from leaving a work area and entering an occupied or non-abatement area, while protecting the health of workers performing the abatement.** The listed remediation methods were designed to achieve this goal, however, due to the general nature of these methods it is the responsibility of the people conducting remediation to ensure the methods enacted are adequate. The listed remediation methods are not meant to exclude other similarly effective methods. Any changes to the remediation methods listed in these guidelines, however, shall be carefully considered prior to implementation.

- c. Non-porous (e.g., metals, glass, and hard plastics) and semi-porous (e.g., wood, and concrete) materials that are structurally sound and are visibly moldy can be cleaned and reused. Cleaning shall be done using a detergent solution. Porous materials such as ceiling tiles and insulation, and wallboards with more than a small area of contamination shall be removed and discarded. Porous materials (e.g., wallboard, and fabrics) that can be cleaned, can be reused, but should be discarded if possible. A professional restoration consultant shall be contacted when restoring porous materials with more than a small area of fungal contamination. All materials to be reused shall be dry and visibly free from mold. Routine inspections shall be conducted to confirm the effectiveness of remediation work.
 - d. The use of gaseous, vapor-phase, or aerosolized biocides for remedial purposes is **not** recommended. The use of biocides in this manner can pose health concerns for people in occupied spaces of the building and for people returning to the treated space if used improperly. Furthermore, the effectiveness of these treatments is unproven and does not address the possible health concerns from the presence of the remaining non-viable mold. For additional information on the use of biocides for remedial purposes, refer to the American Conference of Governmental Industrial Hygienists' document, "Bioaerosols: Assessment and Control."
2. **Level I: Small Isolated Areas** (10 sq. ft or less) - e.g., ceiling tiles, small areas on walls
- a. Remediation can be conducted by regular building maintenance staff. Such persons shall receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).
 - b. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection shall be worn.
 - c. The work area shall be unoccupied. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons recovering from recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity, pneumonitis, and severe allergies).
 - d. Containment of the work area is not necessary. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
 - e. Contaminated materials that cannot be cleaned shall be removed from the building in a sealed plastic bag. There are no special requirements for the disposal of moldy materials.
 - f. The work area and areas used by remedial workers for egress shall be cleaned with a damp cloth and/or mop and a detergent solution.
 - g. All areas shall be left dry and visibly free from contamination and debris.
3. **Level II: Mid-Sized Isolated Areas** (10 - 30 sq. ft.) - e.g., individual wallboard panels.
- a. Remediation can be conducted by regular building maintenance staff. Such persons shall receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).
 - b. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection shall be worn.

- c. The work area shall be unoccupied. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity, pneumonitis, and severe allergies).
- d. The work area shall be covered with a plastic sheet(s) and sealed with tape before remediation, to contain dust/debris.
- e. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
- f. Contaminated materials that cannot be cleaned shall be removed from the building in sealed plastic bags. There are no special requirements for the disposal of moldy materials.
- g. The work area and areas used by remedial workers for egress shall be HEPA vacuumed (a vacuum equipped with a High-Efficiency Particulate Air filter) and cleaned with a damp cloth and/or mop and a detergent solution.
- h. All areas shall be left dry and visibly free from contamination and debris.
- 4. **Level III: Large Isolated Areas** (30 - 100 square feet) - e.g., several wallboard panels.
 - a. A health and safety professional with experience performing microbial investigations shall be consulted prior to remediation activities to provide oversight for the project.
 - b. The following procedures *at a minimum* are recommended:
 - 1) Personnel trained in the handling of hazardous materials and equipped with respiratory protection, (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection shall be worn.
 - 2) The work area and areas directly adjacent shall be covered with a plastic sheet(s) and taped before remediation, to contain dust/debris.
 - 3) Seal ventilation ducts/grills in the work area and areas directly adjacent with plastic sheeting.
 - 4) The work area and areas directly adjacent shall be unoccupied. Further vacating of people from spaces near the work area is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity, pneumonitis, and severe allergies).
 - 5) Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
 - 6) Contaminated materials that cannot be cleaned shall be removed from the building in sealed plastic bags. There are no special requirements for the disposal of moldy materials.
 - 7) The work area and surrounding areas shall be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution.
 - 8) All areas shall be left dry and visibly free from contamination and debris.
 - c. If abatement procedures are expected to generate a lot of dust (e.g., abrasive cleaning of contaminated surfaces, demolition of plaster walls) or the visible concentration of the fungi is heavy (blanket coverage as opposed to patchy), then it is recommended that the remediation procedures for Level IV are followed.
- 5. **Level IV: Extensive Contamination** (greater than 100 contiguous square feet in an area)
 - a. A health and safety professional with experience performing microbial investigations shall be consulted prior to remediation activities to provide oversight for the project. The following procedures are recommended:
 - 1) Personnel trained in the handling of hazardous materials equipped with:
 - a) Full-face respirators with high efficiency particulate air (HEPA) cartridges
 - b) Disposable protective clothing covering both head and shoes
 - c) Gloves
 - 2) Containment of the affected area:

- a) Complete isolation of work area from occupied spaces using plastic sheeting sealed with duct tape (including ventilation ducts/grills, fixtures, and any other openings)
 - b) The use of an exhaust fan with a HEPA filter to generate negative pressurization
 - c) Airlocks and decontamination room
 - 3) Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity, pneumonitis, and severe allergies).
 - 4) Contaminated materials that cannot be cleaned shall be removed from the building in sealed plastic bags. The outside of the bags shall be cleaned with a damp cloth and a detergent solution or HEPA vacuumed in the decontamination chamber prior to their transport to uncontaminated areas of the building. There are no special requirements for the disposal of moldy materials.
 - 5) The contained area and decontamination room shall be HEPA vacuumed and cleaned with a damp cloth and/or mop with a detergent solution and be visibly clean prior to the removal of isolation barriers.
 - 6) Air monitoring shall be conducted prior to occupancy to determine if the area is fit to reoccupy.
6. **Level V: Remediation of HVAC Systems**
 - a. A Small Isolated Area of Contamination (<10 square feet) in the HVAC System
 - 1) Remediation can be conducted by regular building maintenance staff. Such persons shall receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).
 - 2) Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection shall be worn.
 - 3) The HVAC system shall be shut down prior to any remedial activities.
 - 4) The work area shall be covered with a plastic sheet(s) and sealed with tape before remediation, to contain dust/debris.
 - 5) Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
 - 6) Growth supporting materials that are contaminated, such as the paper on the insulation of interior lined ducts and filters, shall be removed. Other contaminated materials that cannot be cleaned shall be removed in sealed plastic bags. There are no special requirements for the disposal of moldy materials.
 - 7) The work area and areas immediately surrounding the work area shall be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution.
 - 8) All areas shall be left dry and visibly free from contamination and debris.
 - 9) A variety of biocides are recommended by HVAC manufacturers for use with HVAC components, such as, cooling coils and condensation pans. HVAC manufacturers shall be consulted for the products they recommend for use in their systems.
 - b. Areas of Contamination (>10 square feet) in the HVAC System: A health and safety professional with experience performing microbial investigations shall be consulted prior to remediation activities to provide oversight for remediation projects involving more than a small isolated area in an HVAC system. The following procedures are recommended:
 - 1) Personnel trained in the handling of hazardous materials equipped with:
 - a) Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended.
 - b) Gloves and eye protection

- c) Full-face respirators with HEPA cartridges and disposable protective clothing covering both head and shoes shall be worn if contamination is greater than 30 square feet.
 - 2) The HVAC system shall be shut down prior to any remedial activities.
 - 3) Containment of the affected area:
 - a) Complete isolation of work area from the other areas of the HVAC system using plastic sheeting sealed with duct tape.
 - b) The use of an exhaust fan with a HEPA filter to generate negative pressurization.
 - c) Airlocks and decontamination room if contamination is greater than 30 square feet.
 - 4) Growth supporting materials that are contaminated, such as the paper on the insulation of interior lined ducts and filters, shall be removed. Other contaminated materials that cannot be cleaned should be removed in sealed plastic bags. When a decontamination chamber is present, the outside of the bags shall be cleaned with a damp cloth and a detergent solution or HEPA vacuumed prior to their transport to uncontaminated areas of the building. There are no special requirements for the disposal of moldy materials.
 - 5) The contained area and decontamination room shall be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution prior to the removal of isolation barriers.
 - 6) All areas shall be left dry and visibly free from contamination and debris.
 - 7) Air monitoring shall be conducted prior to re-occupancy with the HVAC system in operation to determine if the area(s) served by the system are fit to reoccupy.
 - 8) A variety of biocides are recommended by HVAC manufacturers for use with HVAC components, such as, cooling coils and condensation pans. HVAC manufacturers shall be consulted for the products they recommend for use in their systems.
7. Hazard Communication: When fungal growth requiring large-scale remediation is found, the building owner, management, and/or employer shall notify occupants in the affected area(s) of its presence. Notification shall include a description of the remedial measures to be taken and a timetable for completion. Group meetings held before and after remediation with full disclosure of plans and results can be an effective communication mechanism. Individuals with persistent health problems that appear to be related to bioaerosol exposure should see their physicians for a referral to practitioners who are trained in occupational/environmental medicine or related specialties and are knowledgeable about these types of exposures. Individuals seeking medical attention shall be provided with a copy of all inspection results and interpretation to give to their medical practitioners.

END OF SECTION 02 87 13 00



Task	Specification	Specification Description
02 87 13 33	02 87 13 00	Mold Remediation



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SECTION 02 87 16 13 - BIRD EXCREMENT REMOVAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements for bird-excrement removal.

B. Related Requirements:

1. Section 013591 "Historic Treatment Procedures" for general historic treatment requirements.
2. Section 024296 "Historic Removal and Dismantling" for special requirements related to removing items from historic surfaces.

1.2 ALLOWANCES

- A.** See Section 012100 "Allowances" for description of allowances affecting items specified in this Section.

1.3 UNIT PRICES

- A.** See Section 012200 "Unit Prices" for description of unit prices affecting items specified in this Section.

1.4 PRECONSTRUCTION MEETINGS

A. Preconstruction Conference: Conduct conference at [Project site].

1. Review minutes of Preliminary Historic Treatment Conference that pertain to protection of historic areas and surfaces.
2. Review methods and procedures related to excrement removal, including, but not limited to, the following:
 - a. Bird-excrement-removal specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Materials, material application, sequencing, tolerances, and required clearances.
 - c. Fire-protection plan.
 - d. Coordination with building occupants.
 - e. Dust and HVAC control.

1.5 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Preconstruction Test Reports: For removal materials and methods.

B. Qualification Statements: For [bird-excrement-removal specialist][and][industrial hygienist].

1.6 QUALITY ASSURANCE

- A. Bird-Excrement-Removal Specialist Qualifications: A firm that employs personnel experienced and skilled in the processes and operations indicated.
- B. Industrial Hygienist Qualifications: Certified as Industrial Hygienist by the American Board of Industrial Hygiene; having Bachelor's degree in industrial hygiene, public health, biological science, occupational health, or environmental and safety discipline; and experienced in work of types specified.
- C. Regulatory Requirements: Comply with notification regulations of authorities having jurisdiction before beginning excrement-removal work. Comply with collection and disposal regulations of authorities having jurisdiction.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified bird-excrement-removal specialist to perform preconstruction testing on surfaces with accumulations of bird excrement.
 - 1. Use test areas as indicated and representative of proposed materials and existing construction.
 - 2. Propose changes to materials and methods to suit Project.
- B. Preconstruction Testing: Performed by a qualified bird-excrement-removal specialist to demonstrate effects of removal work on substrate appearance and longevity and set quality standards for materials and execution.
 - 1. Bird-Excrement Removal: Remove excrement from an area [**approximately 25 sq. ft.][as indicated]** for each type of [**cornice][coping][floor][and][wall]** substrate material.
 - a. Test chemicals and methods on samples of adjacent building materials for possible adverse reactions. Do not use chemicals and methods known to have deleterious effect.
 - b. Allow a waiting period of not less than seven days after completion of removal work to permit a study of test area for deleterious effects.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Select materials and methods of use based on the following, subject to preconstruction testing:
 - 1. Previous effectiveness in performing the work involved.
 - 2. Minimal possibility of damaging exposed surfaces.
 - 3. Consistency of each application.
 - 4. Uniformity of the resulting overall appearance.
 - 5. Do not use products or tools that could do the following:
 - a. Remove, alter, or harm the present condition or future preservation of existing surfaces, including surrounding surfaces not in contract.
 - b. Leave residue on surfaces.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Comply with temporary barrier and air quality control requirements in Section 015000 "Temporary Facilities and Controls."
- B. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from excrement-removal procedures.
 - 1. Use only proven protection methods, appropriate to each area and surface being protected.
 - 2. Provide barricades, dustproof partitions, and temporary directional signage to exclude public from work areas.
 - 3. Contain dust and debris generated by excrement-removal work and prevent it from reaching the public or adjacent surfaces.
- C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

3.2 BIRD-EXCREMENT REMOVAL

- A. General: **[The Owner will engage][Engage]** a qualified industrial hygienist to perform tests, make recommendations, and observe the Work. Follow procedures required by authorities having jurisdiction and recommended by industrial hygienist.
- B. Removing Bird Excrement: Have bird-excrement-removal Work performed by a qualified bird-excrement-removal specialist. **[Remove exterior bird-excrement accumulations with building windows and other openings in the building closed or sealed off.][Remove interior bird excrement with other parts of the building sealed off from work area and with windows and other openings to exterior areas accessible to the public closed or sealed off.]**
 - 1. Use materials and follow procedures as determined by preconstruction testing.
 - 2. Before removal, treat bird excrement to kill pathogens; dampen excrement to prevent particles becoming airborne.
 - 3. Use only nonmetallic tools, such as plastic spatulas and brushes with natural fiber or nylon bristles.
 - 4. Collect excrement as it is removed, seal it in durable plastic bags, and legally dispose of it off-site.
 - 5. Repeat removal procedure above where required to produce cleaning effect established by preconstruction testing.
- C. Removing Bird-Excrement Stain: Clean as required in Section pertaining to cleaning substrate material from which bird excrement was removed.

END OF SECTION 02 87 16 13



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Task	Specification	Specification Description
02 89 00 00	01 11 19 00	No Specification Required
02 89 00 00	02 83 00 00	Lead Remediation
02 89 00 00	02 83 19 00	Lead-Based Paint Remediation
02 89 00 00	02 83 19 00a	XRF Testing For Lead-Based Paint
02 89 00 00	02 83 19 00b	Lead Dust Wipe, Air And Tcpl Sampling And Analysis
02 90 55 00	01 11 19 00	No Specification Required



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SECTION 03 01 30 00 - MAINTENANCE OF CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bonding agents.
2. Patching mortar.
3. Preplaced concrete materials.
4. Joint filler.
5. Epoxy crack-injection materials.
6. Corrosion-inhibiting materials.
7. Polymer-overlay materials.
8. Polymer-sealer materials.
9. Composite reinforcement materials.

1.2 ALLOWANCES

- A. Allowances for maintenance of cast-in-place concrete are specified in Section 012100 "Allowances."
- B. Field quality-control testing is part of testing and inspecting allowance.

1.3 UNIT PRICES

- A. Work of this Section is affected by unit prices specified in Section 012200 "Unit Prices."
1. Unit prices apply to authorized work covered by **[quantity allowances][estimated quantities]**.
 2. Unit prices apply to authorized additions to and deletions from the Work as authorized by Change Orders.
- B. General: Unit prices include the cost of preparing existing construction to receive the Work indicated **and costs of field quality control required for units of Work completed**.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]**.
1. Review methods and procedures related to concrete work, including, but not limited to, the following:
 - a. Verify concrete-maintenance specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Concrete restoration specialist.
 - c. Materials, material application, sequencing, tolerances, and required clearances.
 - d. Shoring and bracing.
 - e. Quality-control program.
 - f. Coordination with building occupants.

1.5 ACTION SUBMITTALS**A. Product Data:**

1. For each type of product.
 - a. Include construction details, material descriptions, chemical composition, physical properties, test data, and mixing, preparation, project application types consisting of horizontal, vertical or overhead locations and application instructions.

B. Shop Drawings:

1. Shoring and Bracing: Provide Drawings or documentation to ensure that structure and temporary supports withstand the anticipated loads during construction and the effect of demolition on the capacity of the structure. Submit design calculations, sealed by an engineer licensed in state of Project, for shoring and bracing where required by the extent of structural repairs or removal of deteriorated concrete and subsequent replacement.

C. Samples: Cured Samples for each exposed product and for each color and texture specified, [in manufacturer's standard size appropriate for each type of work].**D. Samples for Initial Selection: Cured Samples for each exposed product and for each color and texture.**

1. Include sets of patching-material Samples in the form of briquettes, at least **[3 inches (75 mm) long by 1-1/2 inches (38 mm) wide]** representative of the range of concrete colors on the building. Document each Sample with product, mix, and/or other information necessary to replicate it.
2. Include sets of Samples for epoxy crack-injection adhesive and capping adhesive in the form of injection-treated, whole, dense concrete block or brick units representative of the range of required adhesive colors.
3. Include sets of polymer-overlay Samples in the form of treated cementitious tiles at least **[4 inches (100 mm) long by 4 inches (100 mm) wide]** representative of the range of required colors and textures.
4. Include sets of polymer-sealer Samples in the form of treated cementitious tiles at least **[4 inches (100 mm) long by 4 inches (100 mm) wide]** representative of the range of required colors and textures.
5. Have each set of Samples contain a close color range of at least **[three][six]** Samples of different mixes of materials that match the variations in existing, adjacent concrete when cured and dry.

E. Samples for Verification: Cured Samples for each exposed product and for each color and texture specified.

1. Include Samples of each required type, color, and texture of patching material in the form of patches in drilled holes or sawed joints in sample concrete representative of the range of concrete colors on the building.
2. Include Samples of epoxy crack-injection adhesive in the form of injection-treated, whole, dense concrete block or brick units representative of the range of required adhesive colors.
3. Include Samples of each required type, color, and texture of polymer-overlay material in the form of cementitious tiles at least **[8 inches (200 mm) long by 8 inches (200 mm) wide]**.
4. Include Samples of each required type, color, and texture of polymer-sealer material in the form of cementitious tiles at least **[8 inches (200 mm) long by 8 inches (200 mm) wide]**.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[concrete-maintenance specialist][and][manufacturers]**.
- B. Material Certificates: For each type of **[portland cement][aggregate]** supplied for mixing or adding to products at Project site.
- C. Product Test Reports: For each **[manufactured bonding agent][cementitious patching mortar][joint filler][crack-injection adhesive][polymer overlay][polymer sealer][and][composite structural reinforcement]**, for tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Field quality-control reports.
- E. Quality-Control Program: Submit before work begins.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Each **[manufactured bonding-agent][packaged patching-mortar][joint-filler][crack-injection-adhesive][corrosion-inhibiting-treatment][polymer-overlay][polymer-sealer][and][composite-structural-reinforcement]** manufacturer must employ factory-authorized service representatives who are available for consultation and Project-site inspection and on-site assistance.
- B. Concrete-Maintenance Specialist Qualifications: Engage an experienced concrete-maintenance firm that employs installers and supervisors who are trained and approved by manufacturer to apply **[packaged patching-mortar][crack-injection adhesive][corrosion-inhibiting treatments][polymer overlays][polymer sealers][and][composite structural reinforcement]** when performing the Work of this Section. Firm must have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing or patching new concrete is insufficient experience for concrete-maintenance work.
 - 1. Field Supervision: Concrete-maintenance specialist firm must maintain experienced full-time supervisors on Project site during times that concrete-maintenance work is in progress.
- C. Quality-Control Program: Prepare a written plan for concrete maintenance to systematically demonstrate the ability of personnel to properly perform maintenance work, including each phase or process, protection of surrounding materials during operations, and control of debris and runoff during the Work. Describe in detail materials, methods, equipment, and sequence of operations to be used for each phase of the Work.
- D. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1.8 MOCKUPS

- A. Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Concrete Removal and Patching Mockup: Remove and repair an **[approximately 50 sq. ft. (4.6 sq. m)][approximately 100 sq. in. (645 sq. cm)]** area of **[deteriorated concrete deck][deteriorated concrete wall]**.
 - 2. Floor Joint Repair Mockup: Cut out and reinstall joints in two separate areas [, **each approximately 48 inches (1200 mm) long**][**as indicated on Drawings**].
 - 3. Epoxy Crack Injection Mockup: Perform epoxy crack-injection material in two separate areas [,

- each approximately 48 inches (1200 mm) long][as indicated on Drawings].**
4. Polymer-Overlay Mockup: Apply an **[approximately 50 sq. ft. (4.6 sq. m)]** area of polymer overlay.
 5. Polymer Sealer Mockup: Apply an **[approximately 50 sq. ft. (4.6 sq. m)]** area of polymer sealer.
 6. Composite Structural-Reinforcement Mockup: Apply composite structural reinforcement **[a minimum of 48 inches (1200 mm) long][as indicated on Drawings].**
 7. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 8. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.
- B. Store cementitious materials off the ground, under cover, and in a dry location.
- C. Store aggregates covered and in a dry location; maintain grading and other required characteristics and prevent contamination.

1.10 FIELD CONDITIONS

- A. Environmental Limitations for Epoxies: Do not apply when air and substrate temperatures are outside limits permitted by manufacturer. During hot weather, cool epoxy components before mixing, store mixed products in shade, and cool unused mixed products to retard setting. Do not apply to wet substrates unless approved by manufacturer.
 1. Use only Class A epoxies when substrate temperatures are below or are expected to go below **40 deg F (5 deg C)** within eight hours.
 2. Use only Class A or B epoxies when substrate temperatures are below or are expected to go below **60 deg F (16 deg C)** within eight hours.
 3. Use only Class C epoxies when substrate temperatures are above and are expected to stay above **60 deg F (16 deg C)** for eight hours.
- B. Cold-Weather Requirements for Cementitious Materials:
 1. Do not apply unless concrete surface and air temperatures are above **40 deg F (5 deg C)** and will remain so for at least 48 hours after completion of Work.
 2. Comply with the following procedures:
 - a. When air temperature is below **40 deg F (5 deg C)**, heat patching-material ingredients and existing concrete to produce temperatures between **40 and 90 deg F (5 and 32 deg C)**.
 - b. When mean daily air temperature is between **25 and 40 deg F (minus 4 and plus 5 deg C)**, cover completed Work with weather-resistant insulating blankets for 48 hours after repair or provide enclosure and heat to maintain temperatures above **32 deg F (0 deg C)** within the enclosure for 48 hours after repair.
 - c. When mean daily air temperature is below **25 deg F (minus 4 deg C)**, provide enclosure and heat to maintain temperatures above **32 deg F (0 deg C)** within the enclosure for 48 hours after repair.
- C. Hot-Weather Requirements for Cementitious Materials: Protect repair work when temperature and humidity conditions produce excessive evaporation of water from patching materials. Provide artificial

shade and wind breaks, and use cooled materials as required. Do not apply to substrates with temperatures of **90 deg F (32 deg C)** and above.

- D. Environmental Limitations for High-Molecular-Weight Methacrylate Sealers: Do not apply when concrete surface temperature is below **55 deg F (13 deg C)** or above **[75 deg F (24 deg C)][90 deg F (32 deg C)]**. Apply only to **[dry substrates][substrates that have been dry for at least 72 hours]**.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. For repair products, obtain each color, grade, finish, type, and variety of product from single source and from single manufacturer with resources to provide products of consistent quality in appearance and physical properties.

2.2 BONDING AGENTS

- A. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Manufactured product that consists of water-insensitive epoxy adhesive, portland cement, and water-based solution of corrosion-inhibiting chemicals that forms a protective film on steel reinforcement.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. **[ARDEX Americas]**
- b. **[Dayton Superior Corporation]**
- c. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
- d. **[Kaufman Products, Inc]**
- e. **[MAPEI Corporation]**
- f. **[Master Builders Solutions]**
- g. **[Sika Corporation]**
- h. **[SpecChem, LLC]**
- i. **[Sto Corp.]**

- B. Epoxy Bonding Agent: ASTM C881/C881M **[Type II][Type V]** bonding system, free of VOCs.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. **[Abatron, Inc]**
- b. **[ChemCo Systems, Inc.]**
- c. **[Dayton Superior Corporation]**
- d. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
- e. **[Kaufman Products, Inc]**
- f. **[MAPEI Corporation]**
- g. **[Master Builders Solutions]**
- h. **[Sika Corporation]**

- i. [Sto Corp.]
- j. [US SPEC, Division of US MIX Company]
- k. [Xypex Chemical Corporation]

C. Latex Bonding Agent, Redispersible: Type I, ASTM C1059/C1059M[**for use at nonstructural and interior locations unless otherwise indicated**].

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. [Dayton Superior Corporation]
- b. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
- c. [Kaufman Products, Inc]
- d. [US SPEC, Division of US MIX Company]
- e. [W. R. Meadows, Inc]

D. Latex Bonding Agent, Nonredispersible: Type II, ASTM C1059/C1059M[**for use at structural and exterior locations and where indicated**].

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. [ChemMasters, Inc]
- b. [Dayton Superior Corporation]
- c. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
- d. [Kaufman Products, Inc]
- e. [MAPEI Corporation]
- f. [US SPEC, Division of US MIX Company]
- g. [W. R. Meadows, Inc]

E. Mortar Scrub Coat: Mix consisting of 1 part portland cement and 1 part fine aggregate complying with ASTM C144, except 100 percent passing a **No. 16 (1.18-mm)** sieve.

2.3 PATCHING MORTAR

A. Patching Mortar Requirements:

1. Only use patching mortars that are recommended by manufacturer for each applicable horizontal, vertical, or overhead use orientation.
2. Color and Aggregate Texture: Provide patching mortar and aggregates of colors and sizes necessary to produce patching mortar **[where indicated]** that matches existing, adjacent, and exposed concrete. Blend several aggregates if necessary to achieve suitable matches.
3. Coarse Aggregate for Patching Mortar: ASTM C33/C33M, Size No. 8, Class 5S washed aggregate. Add to patching-mortar mix only as permitted by patching-mortar manufacturer.

- B. Job-Mixed Patching Mortar : 1 part portland cement and 2-1/2 parts fine aggregate complying with ASTM C144, except 100 percent passing a **No. 16 (1.18-mm)** sieve.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[CGM, Incorporated]**
 - b. **[ChemMasters, Inc]**
 - c. **[Dayton Superior Corporation]**
 - d. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - e. **[Kaufman Products, Inc]**
 - f. **[KOSTER American Corporation]**
 - g. **[MAPEI Corporation]**
 - h. **[Master Builders Solutions]**
 - i. **[Sika Corporation]**
 - j. **[Simpson Strong-Tie Co., Inc.]**
 - k. **[Sto Corp.]**
 - l. **[Tnemec Company, Inc.]**
 - m. **[US SPEC, Division of US MIX Company]**
 - n. **[W. R. Meadows, Inc]**
- C. Cementitious Patching Mortar : Packaged, dry mix for repair of concrete.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[CGM, Incorporated]**
 - b. **[ChemMasters, Inc]**
 - c. **[Dayton Superior Corporation]**
 - d. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - e. **[Kaufman Products, Inc]**
 - f. **[KOSTER American Corporation]**
 - g. **[MAPEI Corporation]**
 - h. **[Master Builders Solutions]**
 - i. **[Schonox HPS North America, Inc.]**
 - j. **[Sika Corporation]**
 - k. **[Simpson Strong-Tie Co., Inc.]**
 - l. **[Sto Corp.]**
 - m. **[Tnemec Company, Inc.]**
 - n. **[United Gilsonite Laboratories (UGL)]**
 - o. **[US SPEC, Division of US MIX Company]**
 - p. **[W. R. Meadows, Inc]**
 - q. **[Xypex Chemical Corporation]**
 2. Compressive Strength: Not less than **[4000 psi (27.6 MPa)][5000 psi (34.5 MPa)][6000 psi (41.4 MPa)]** at **[28 days]** when tested in accordance with ASTM C109/C109M.
- D. Rapid-Strengthening, Cementitious Patching Mortar : **[ASTM C928/C928M]** packaged, dry mix for repair of concrete.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ARDEX Americas]**
 - b. **[CGM, Incorporated]**
 - c. **[ChemMasters, Inc]**
 - d. **[Dayton Superior Corporation]**
 - e. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - f. **[Kaufman Products, Inc]**
 - g. **[MAPEI Corporation]**
 - h. **[Master Builders Solutions]**
 - i. **[Schonox HPS North America, Inc.]**
 - j. **[Sika Corporation]**
 - k. **[Simpson Strong-Tie Co., Inc.]**
 - l. **[Sto Corp.]**
 - m. **[US SPEC, Division of US MIX Company]**
 - n. **[W. R. Meadows, Inc]**

 2. Compressive Strength: Not less than **[1000 psi (7.0 MPa)][2000 psi (13.8 MPa)][3000 psi (21.0 MPa)][4000 psi (27.6 MPa)]** within **[three]** hours when tested in accordance with ASTM C109/C109M.
- E. Polymer-Modified, Cementitious Patching Mortar : Packaged, dry mix for repair of concrete and that contains a **[nonredispersible]** latex additive as either a dry powder or a separate liquid that is added during mixing.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[AQUAFIN, Inc]**
 - b. **[ARDEX Americas]**
 - c. **[CGM, Incorporated]**
 - d. **[ChemMasters, Inc]**
 - e. **[Cortec Corporation]**
 - f. **[Dayton Superior Corporation]**
 - g. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - h. **[Kaufman Products, Inc]**
 - i. **[MAPEI Corporation]**
 - j. **[Master Builders Solutions]**
 - k. **[Schonox HPS North America, Inc.]**
 - l. **[Sika Corporation]**
 - m. **[Simpson Strong-Tie Co., Inc.]**
 - n. **[Sto Corp.]**
 - o. **[United Gilsonite Laboratories (UGL)]**
 - p. **[US SPEC, Division of US MIX Company]**
 - q. **[Uzin Utz North America, Inc.]**
 - r. **[W. R. Meadows, Inc]**

2. Compressive Strength: Not less than **[4000 psi (27.6 MPa)][5000 psi (34.5 MPa)][6000 psi (41.4 MPa)]** at **[28 days]** when tested in accordance with ASTM C109/C109M.
- F. Polymer-Modified, Silica-Fume-Enhanced, Cementitious Patching Mortar : Packaged, dry mix for repair of concrete and that contains silica fume complying with ASTM C1240 and a **[nonredispersible]** latex additive as either a dry powder or a separate liquid that is added during mixing.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[AQUAFIN, Inc]**
 - b. **[CGM, Incorporated]**
 - c. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - d. **[MAPEI Corporation]**
 - e. **[Master Builders Solutions]**
 - f. **[Sika Corporation]**
 - g. **[Simpson Strong-Tie Co., Inc.]**
 - h. **[Sto Corp.]**
 - i. **[W. R. Meadows, Inc]**
 2. Compressive Strength: Not less than **[4000 psi (27.6 MPa)][5000 psi (34.5 MPa)][6000 psi (41.4 MPa)]** at **[28 days]** when tested in accordance with ASTM C109/C109M.

2.4 PREPLACED CONCRETE MATERIALS

- A. Preplaced Aggregate: Washed aggregate, ASTM C33/C33M, Class 5S, with **[95 to 100 percent passing a 1-1/2-inch (38-mm) sieve, 40 to 80 percent passing a 1-inch (25-mm) sieve, 20 to 45 percent passing a 3/4-inch (19-mm) sieve, zero to 10 percent passing a 1/2-inch (12.7-mm) sieve, and zero to 2 percent passing a 3/8-inch (9.5-mm) sieve][100 percent passing a 1-1/2-inch (38-mm) sieve, 95 to 100 percent passing a 1-inch (25-mm) sieve, 40 to 80 percent passing a 3/4-inch (19-mm) sieve, zero to 15 percent passing a 1/2-inch (12.7-mm) sieve, and zero to 2 percent passing a 3/8-inch (9.5-mm) sieve]**.
- B. Fine Aggregate for Grout: Fine aggregate in accordance with ASTM C33/C33M, but with 100 percent passing a **No. 8 (2.36-mm)** sieve, 95 to 100 percent passing a **No. 16 (1.18-mm)** sieve, 55 to 80 percent passing a **No. 30 (0.6-mm)** sieve, 30 to 55 percent passing a **No. 50 (0.3-mm)** sieve, 10 to 30 percent passing a **No. 100 (0.15-mm)** sieve, zero to 10 percent passing a **No. 200 (0.075-mm)** sieve, and having a fineness modulus of 1.30 to 2.10.
- C. Grout Fluidifier for Grout: ASTM C937.
- D. Pozzolans for Grout: ASTM C618.

2.5 JOINT FILLER

- A. Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Shore A durometer hardness of at least 80 in accordance with ASTM D2240.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering**

products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [SIMIRON Inc.]
- b. [Abatron, Inc]
- c. [ChemCo Systems, Inc.]
- d. [Dayton Superior Corporation]
- e. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
- f. [Kaufman Products, Inc]
- g. [MAPEI Corporation]
- h. [Master Builders Solutions]
- i. [Metzger/McGuire]
- j. [Sika Corporation]

B. Polyurea Joint Filler: Two-component, semirigid, 100 percent solids, polyurea resin with a Shore A durometer hardness of at least 80 in accordance with ASTM D2240.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [SIMIRON Inc.]
- b. [ARDEX Americas]
- c. [ASTC Global, Inc.]
- d. [ChemCo Systems, Inc.]
- e. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
- f. [HTS Chemical; Hi-Tech Systems]
- g. [Kaufman Products, Inc]
- h. [Master Builders Solutions]
- i. [Metzger/McGuire]
- j. [SpecChem, LLC]
- k. [US SPEC, Division of US MIX Company]

C. Color: [As indicated by manufacturer's designations][Matching existing joint filler][As selected by Architect from full range of industry colors].

2.6 EPOXY CRACK-INJECTION MATERIALS

A. Epoxy Crack-Injection Adhesive: ASTM C881/C881M, bonding system [Type I,][Type IV,][Type IV at structural locations and where indicated, Type I at other locations;] free of VOCs.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Abatron, Inc]
- b. [ChemCo Systems, Inc.]
- c. [Dayton Superior Corporation]
- d. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]

- e. [Fyfe Co. LLC]
- f. [Kaufman Products, Inc]
- g. [MAPEI Corporation]
- h. [Master Builders Solutions]
- i. [Sika Corporation]
- j. [Sto Corp.]
- k. [US SPEC, Division of US MIX Company]
- l. [W. R. Meadows, Inc]

- 2. Capping Adhesive: Product manufactured for use with crack-injection adhesive by same manufacturer.
- 3. Color: Provide epoxy crack-injection adhesive and capping adhesive **[as indicated by manufacturer's designations][that blend with existing, adjacent concrete and do not stain concrete surface][As selected by Architect from full range of industry colors].**

2.7 CORROSION-INHIBITING MATERIALS

- A. Corrosion-Inhibiting Treatment: Waterborne solution of alkaline corrosion-inhibiting chemicals for concrete-surface application that penetrates concrete by diffusion and forms a protective film on steel reinforcement.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. [ARDEX Americas]
 - b. [Cortec Corporation]
 - c. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - d. [MAPEI Corporation]
 - e. [Master Builders Solutions]
 - f. [Sika Corporation]

2.8 POLYMER-OVERLAY MATERIALS

- A. Polymer Overlay: Epoxy adhesive complying with ASTM C881/C881M, bonding system Type III, with surface-applied aggregate for skid resistance; free of VOCs.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. [ChemCo Systems, Inc.]
 - b. [Dayton Superior Corporation]
 - c. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - d. [Kaufman Products, Inc]
 - e. [MAPEI Corporation]
 - f. [Master Builders Solutions]
 - g. [Sika Corporation]
 - h. [Sto Corp.]

i. **[US SPEC, Division of US MIX Company]**

2. Aggregate: ACI 503.3, oven-dried, washed silica sand.
3. Color and Texture: **[As indicated by manufacturer's designations][Matching existing][As selected by Architect from full range of industry colors].**

2.9 POLYMER-SEALER MATERIALS

- A. Epoxy Polymer Sealer: Low-viscosity epoxy, penetrating sealer and crack filler recommended by manufacturer for penetrating and sealing cracks in exterior concrete traffic surfaces; **[free of VOCs][VOC content 100 g/L or less][VOC content 400 g/L or less].**
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[ChemCo Systems, Inc.]**
 - b. **[Dayton Superior Corporation]**
 - c. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - d. **[MAPEI Corporation]**
 - e. **[Master Builders Solutions]**
 - f. **[Sika Corporation]**
 2. Color: **[As indicated by manufacturer's designations][As selected by Architect from full range of industry colors].**
- B. Methacrylate Polymer Sealer: Low-viscosity, high-molecular-weight methacrylate, penetrating sealer and crack filler recommended by manufacturer for penetrating and sealing cracks in exterior concrete traffic surfaces; **[free of VOCs][VOC content 100 g/L or less][VOC content 400 g/L or less].**
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[SIMIRON Inc.]**
 - b. **[Kwik Bond Polymers]**
 - c. **[Master Builders Solutions]**
 - d. **[Sika Corporation]**
 - e. **[Transpo Industries, Inc.]**
 2. Color: **[As indicated by manufacturer's designations][As selected by Architect from full range of industry colors].**

2.10 COMPOSITE REINFORCEMENT MATERIALS

- A. Composite Structural Reinforcement: Manufacturer's system consisting of **[carbon-fiber][or][glass-fiber]** reinforcement in the form of **[tow sheet with field-applied saturant][or][preimpregnated sheet]**

and epoxy primers, fillers, adhesives, saturants, and topcoats, designed for use as externally bonded structural reinforcement for concrete.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. **[Fyfe Co. LLC]**
- b. **[MAPEI Corporation]**
- c. **[Master Builders Solutions]**
- d. **[Schonox HPS North America, Inc.]**
- e. **[Sika Corporation]**

2.11 MISCELLANEOUS MATERIALS

- A. Curing Materials: For ready-mixed concrete or packaged repair materials.
- B. Formwork Materials: Form-facing materials must comply with **ACI 301 (ACI 301M)** requirements.
- C. Water: Potable.
- D. Cleaning Agent: Commercial muriatic acid solution.

2.12 MIXES

- A. General: Mix products, in clean containers, in accordance with manufacturer's written instructions.
 1. Do not add water, thinners, or additives unless recommended by manufacturer.
 2. When practical, use manufacturer's premeasured packages to ensure that materials are mixed in proper proportions. When premeasured packages are not used, measure ingredients using graduated measuring containers; do not estimate quantities or use shovel or trowel as unit of measure.
 3. Do not mix more materials than can be used within time limits recommended by manufacturer. Discard materials that have begun to set.
- B. Mortar Scrub Coat: Mix dry ingredients with enough water to provide consistency of thick cream.
- C. Dry-Pack Mortar: Mix required type(s) of patching-mortar dry ingredients with just enough liquid to form damp cohesive mixture that can be squeezed by hand into a ball but is not plastic.
- D. Concrete Materials: Comply with **[Section 033000 "Cast-in-Place Concrete."]****[Section 033300 "Architectural Concrete."]**
- E. Concrete Mixture Materials: Ready mixed.
 1. ACI Publications: Comply with **ACI 301 (ACI 301M)** unless modified by requirements in the Contract Documents.
 2. Portland Cement: ASTM C150/C150M, Type I, II, or III unless otherwise indicated.
 3. Fly Ash: ASTM C618, Class C or F.
 4. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
 5. Silica Fume: ASTM C1240 amorphous silica.

6. Aggregates: ASTM C330/C330M, nominal maximum aggregate size, gradation and types appropriate for the dimension of the repair area and project application.
7. Air-Entraining Admixture: ASTM C260/C260M.
8. Chemical Admixtures: Certified and as recommended by manufacturer for project applications to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

F. Repair Underlayment:

1. Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from **1/8 inch** and that can be feathered at edges to match adjacent floor elevations.
2. Compressive Strength: Not less than [**4100 psi (29 MPa)**] at 28 days when tested in accordance with ASTM C109/C109M.

G. Repair Overlayment:

1. Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from **1/4 inch (6 mm)** and that can be filled in over a scarified surface to match adjacent floor elevations.
2. Compressive Strength: Not less than [**5000 psi (34.5 MPa)**] at 28 days when tested in accordance with ASTM C109/C109M.

H. Grout for Use with Preplaced Aggregate: Proportion in accordance with ASTM C938. Add grout fluidifier to mixing water followed by portland cement, pozzolan, and fine aggregate.

PART 3 - EXECUTION

3.1 CONCRETE MAINTENANCE

- A. Have concrete-maintenance work performed only by qualified concrete-maintenance specialist.
- B. Comply with manufacturers' written instructions for surface preparation and product application.

3.2 EXAMINATION

- A. Notify Architect seven days in advance of dates when areas of deteriorated or delaminated concrete and deteriorated reinforcing bars will be located.
- B. Locate areas of deteriorated or delaminated concrete using hammer or chain-drag sounding and mark boundaries. Mark areas for removal by simplifying and squaring off boundaries. At columns and walls, make boundaries level and plumb unless otherwise indicated.
- C. Pachometer Testing: Locate at least three reinforcing bars using a pachometer, and drill test holes to determine depth of cover. Calibrate pachometer using depth of cover measurements, and verify depth of cover in removal areas using pachometer.
- D. Perform surveys as the Work progresses to detect hazards resulting from concrete-maintenance work.

3.3 PREPARATION

- A. Ensure that supervisory personnel are on-site and on duty when concrete-maintenance work begins and during its progress.
- B. Protect persons, motor vehicles, surrounding surfaces of building being repaired, building site, plants, and surrounding buildings from harm resulting from concrete-maintenance work.
 - 1. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.
 - 2. Use only proven protection methods appropriate to each area and surface being protected.
 - 3. Provide temporary barricades, barriers, and directional signage to exclude public from areas where concrete-maintenance work is being performed.
 - 4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of concrete-maintenance work.
 - 5. Contain dust and debris generated by concrete-maintenance work and prevent it from reaching the public or adjacent surfaces.
 - 6. Use water-mist sprinkling and other wet methods to control dust only with adequate, approved procedures and equipment that ensure that such water will not create a hazard or adversely affect other building areas or materials.
 - 7. Protect floors and other surfaces along haul routes from damage, wear, and staining.
 - 8. Provide supplemental sound-control treatment to isolate removal and dismantling work from other areas of the building.
 - 9. Protect adjacent surfaces and equipment by covering them with heavy polyethylene film and waterproof masking tape[**or a liquid-strippable masking agent**]. If practical, remove items, store, and reinstall after potentially damaging operations are complete.
 - 10. Neutralize and collect alkaline and acid wastes for disposal off Owner's property.
 - 11. Dispose of debris and runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
- C. Existing Drains: Prior to the start of concrete-maintenance work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin concrete-maintenance work in an area until the drainage system is in working order.
 - 1. Prevent solids, such as aggregate or mortar residue, from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from concrete-maintenance work.
 - 2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.
- D. Preparation for Concrete Removal: Examine construction to be repaired to determine best methods to safely and effectively perform concrete-maintenance work. Examine adjacent work to determine what protective measures will be necessary. Make explorations, probes, and inquiries as necessary to determine condition of construction to be removed in the course of repair.
 - 1. Verify that affected utilities have been disconnected and capped.
 - 2. Inventory and record the condition of items to be removed for reinstallation or salvage.
 - 3. Provide and maintain shoring, bracing, and temporary structural supports as required to preserve stability and prevent unexpected or uncontrolled movement, settlement, or collapse of construction being demolished and construction and finishes to remain. Strengthen or add new supports when required during progress of removal work.
- E. Reinforcing-Bar Preparation: Remove loose and flaking rust from exposed reinforcing bars by [**high-pressure water cleaning**][**abrasive blast cleaning**][**needle scaling**][**or**][**wire brushing**] until only

tightly adhered light rust remains.

1. Where section loss of reinforcing bar is more than 25 percent, or 20 percent in two or more adjacent bars, cut bars and remove and replace as indicated on Drawings.
 2. Remove additional concrete as necessary to provide at least **3/4-inch (19-mm)** clearance at existing and replacement bars.
 3. Splice replacement bars to existing bars in accordance with **ACI 318 (ACI 318M)** by lapping, welding, or using mechanical couplings.
- F. Preparation of Floor Joints for Repair: Saw-cut joints full width to edges and depth of spalls, but not less than **3/4 inch (19 mm)][1 inch (25 mm)][2 inches (50 mm)]** deep. Clean out debris and loose concrete; vacuum or blow clear with compressed air.
- G. Surface Preparation for Corrosion-Inhibiting Treatment: Clean concrete to remove dirt, oils, films, and other materials detrimental to treatment application.
1. Use **[low-pressure water cleaning][detergent scrubbing][or][sand blasting]**.
 2. Allow surface to dry before applying corrosion-inhibiting treatment.
- H. Surface Preparation for Overlays:
1. Remove delaminated material and deteriorated concrete surface material.
 2. Roughen surface of concrete to produce a surface profile matching CSP **[3][4][5][6][7][8][9]** in accordance with ICRI 310.2.
 3. Use **[sand blasting][shot blasting][scarifying][needle scaling][high-pressure water jetting][scabbling][flame blasting][or][milling]**.
 4. Sweep and vacuum roughened surface to remove debris **[followed by low-pressure water cleaning]**.
- I. Acidic Surface Preparation for Sealers: Acid etch surface of concrete to produce a surface profile matching CSP 1 in accordance with ICRI 310.2. **[Prepare surface for acid etching by detergent scrubbing to remove oils and films that may prevent acid penetration.]**
1. Remove excess acid solution, reaction products, and debris by squeegeeing or vacuuming.
 2. Scrub surface with an alkaline detergent, rinse, and squeegee or vacuum.
 3. Check acidity of surface with pH test paper and continue rinsing until pH is acceptable in accordance with sealer manufacturer's written instructions.
 4. When pH is acceptable in accordance with sealer manufacturer's written instructions and surface is clean, vacuum dry.
- J. Nonacidic Surface Preparation for Sealers: Clean concrete to remove dirt, oils, films, and other materials detrimental to sealer application.
1. Use **[shot blasting][low-pressure water cleaning][or][detergent scrubbing]**.
- K. Surface Preparation for Composite Structural Reinforcement: Clean concrete where reinforcement and epoxy patching mortar is to be placed by **[low-pressure water cleaning][or][detergent scrubbing]** to remove dirt, oils, films, and other materials detrimental to epoxy patching mortar.
1. Roughen surface of concrete by sand blasting.
 2. Remove delaminated material and deteriorated concrete surface material.
 3. Sweep and vacuum roughened surface to remove debris **[followed by low-pressure water cleaning]**.

3.4 REMOVAL OF CONCRETE

- A. Do not overload structural elements with debris.
- B. Saw-cut perimeter of areas indicated for removal to a depth of at least **[1/2 inch (13 mm)]**. Make cuts perpendicular to concrete surfaces and no deeper than cover on reinforcement.
- C. Remove deteriorated and delaminated concrete by breaking up and dislodging from reinforcement.
- D. Remove additional concrete if necessary to provide a depth of removal of at least **[1/2 inch (13 mm)]** over entire removal area.
- E. Where half or more of the perimeter of reinforcing bar is exposed, bond between reinforcing bar and surrounding concrete is broken, or reinforcing bar is corroded, remove concrete from entire perimeter of bar and to provide at least **3/4-inch (19-mm)** clearance around bar.
- F. Test areas where concrete has been removed by tapping with hammer, and remove additional concrete until unsound and disbonded concrete is completely removed.
- G. Provide surfaces with a fractured profile of at least **1/8 inch (3 mm)** that are approximately perpendicular or parallel to original concrete surfaces. At columns and walls, make top and bottom surfaces level unless otherwise directed.
- H. Thoroughly clean removal areas of loose concrete, dust, and debris.

3.5 APPLICATION OF BONDING AGENTS

- A. Epoxy-Modified, Cementitious Bonding and Anticorrosion System: Apply to reinforcing bars **[and concrete]** by stiff brush or hopper spray in accordance with manufacturer's written instructions. Apply to reinforcing bars in two coats, allowing first coat to dry two to three hours before applying second coat. Allow to dry before placing patching mortar or concrete.
- B. Epoxy Bonding System: Apply to reinforcing bars **[and concrete]** by brush, roller, or spray in accordance with manufacturer's written instructions, leaving no pinholes or other uncoated areas. **[Apply to reinforcing bars in at least two coats, allowing first coat to dry before applying second coat.]** Place patching mortar or concrete while epoxy is still tacky. If epoxy dries, recoat before placing patching mortar or concrete.
- C. Latex Bonding Agent, Type I: Apply to concrete by brush roller or spray. Allow to dry before placing patching mortar or concrete.
- D. Latex Bonding Agent, Type II: Mix with portland cement and scrub into concrete surface in accordance with manufacturer's written instructions. Place patching mortar or concrete while bonding agent is still wet. If bonding agent dries, recoat before placing patching mortar or concrete.
- E. Mortar Scrub Coat for Job-Mixed Patching Mortar and Concrete: Dampen repair area and surrounding concrete **6 inches (150 mm)** beyond repair area. Remove standing water and apply scrub coat with a brush, scrubbing it into surface and thoroughly coating repair area. If scrub coat dries, recoat before placing patching mortar or concrete.
- F. Slurry Coat for Cementitious Patching Mortar: Wet substrate thoroughly and then remove standing water. Scrub a slurry of neat patching mortar **[mixed with latex bonding agent]** into substrate, filling pores and voids.

3.6 INSTALLATION OF PATCHING MORTAR

- A. Place patching mortar as specified in this article unless otherwise recommended in writing by manufacturer[**or where dry-pack mortar is indicated**].
 - 1. Provide forms where necessary to confine patch to required shape.
 - 2. Wet substrate and forms thoroughly and then remove standing water.
- B. Pretreatment: Apply specified [**bonding agent**][**mortar scrub coat**][**slurry coat**][**bonding agent and slurry coat**].
- C. General Placement: Place patching mortar by troweling toward edges of patch to force intimate contact with edge surfaces. For large patches, fill edges first and then work toward center, always troweling toward edges of patch. At fully exposed reinforcing bars, force patching mortar to fill space behind bars by compacting with trowel from sides of bars.
- D. Vertical Patching: Place material in lifts of not more than [**1 inch (25 mm)**][**1-1/2 inches (38 mm)**][**2 inches (50 mm)**][**3 inches (76 mm)**] or less than [**1/8 inch (3 mm)**][**1/4 inch (6 mm)**]. Do not feather edge.
- E. Overhead Patching: Place material in lifts of not more than [**1 inch (25 mm)**][**1-1/2 inches (38 mm)**][**2 inches (50 mm)**] or less than [**1/8 inch (3 mm)**][**1/4 inch (6 mm)**]. Do not feather edge.
- F. Consolidation: After each lift is placed, consolidate material and screed surface.
- G. Multiple Lifts: Where multiple lifts are used, score surface of lifts to provide a rough surface for placing subsequent lifts. Allow each lift to reach final set before placing subsequent lifts.
- H. Finishing: Allow surfaces of lifts that are to remain exposed to become firm and then finish to a [**smooth surface with a wood or sponge float**][**rough surface with a broom or burlap drag**][**surface matching adjacent concrete**].
- I. Curing: Wet-cure cementitious patching materials, including polymer-modified cementitious patching materials, for not less than seven days by water-fog spray or water-saturated absorptive cover.

3.7 INSTALLATION OF DRY-PACK MORTAR

- A. Use dry-pack mortar for deep cavities[**and where indicated**]. Place as specified in this article unless otherwise recommended in writing by manufacturer.
 - 1. Provide forms where necessary to confine patch to required shape.
 - 2. Wet substrate and forms thoroughly and then remove standing water.
- B. Pretreatment: Apply specified [**bonding agent**][**mortar scrub coat**][**slurry coat**][**bonding agent and slurry coat**].
- C. Place dry-pack mortar into cavity by hand, and compact tightly into place. Do not place more material at a time than can be properly compacted. Continue placing and compacting until patch is approximately level with surrounding surface.
- D. After cavity is filled and patch is compacted, trowel surface to match profile and finish of surrounding concrete. A thin coat of patching mortar may be troweled into the surface of patch to help obtain required finish.

- E. Wet-cure patch for not less than seven days by water-fog spray or water-saturated absorptive cover.

3.8 CONCRETE PLACEMENT

- A. Place concrete in accordance with **[Section 033000 "Cast-in-Place Concrete"]****[Section 033300 "Architectural Concrete"]** and as specified in this article.
- B. Epoxy-Modified Pretreatment: Apply **[epoxy-modified, cementitious bonding and anticorrosion agent]****[epoxy bonding agent]** to reinforcement**[and concrete substrate]**.
- C. Latex Pretreatment: Apply **[latex bonding agent]****[Type I latex bonding agent]****[mortar scrub coat]** to concrete substrate.
- D. Standard Placement: Place concrete by form-and-pump method unless otherwise indicated.
 - 1. Use vibrators to consolidate concrete as it is placed.
 - 2. At unformed surfaces, screed concrete to produce a surface that when finished with patching mortar will match required profile and surrounding concrete.
- E. Form-and-Pump Placement: Place concrete by form-and-pump method where indicated.
 - 1. Design and construct forms to resist pumping pressure in addition to weight of wet concrete. Seal joints and seams in forms and where forms abut existing concrete.
 - 2. Pump concrete into place from bottom to top, releasing air from forms as concrete is introduced. When formed space is full, close air vents and pressurize to **14 psi (96 kPa)**.
- F. Wet-cure concrete for not less than seven days by leaving forms in place or keeping surfaces continuously wet by water-fog spray or water-saturated absorptive cover.
- G. Fill placement cavities with dry-pack mortar and repair voids with patching mortar. Finish to match surrounding concrete.

3.9 GROUTING PREPLACED AGGREGATE CONCRETE

- A. Use grouted preplaced aggregate concrete **[where indicated]****[for column and wall repairs]**. Place as specified in this article.
- B. Design and construct forms to resist pumping pressure in addition to weight of wet grout. Seal joints and seams in forms and where forms abut existing concrete.
- C. Apply **[epoxy-modified cementitious bonding and anticorrosion agent]****[epoxy bonding agent]** to reinforcement**[and concrete substrate]**.
- D. Place aggregate in forms, consolidating aggregate in lifts as it is placed. Pack aggregate into upper areas of forms to achieve intimate contact with concrete surfaces.
- E. Fill forms with water to thoroughly dampen aggregate and substrates. Drain water from forms before placing grout.
- F. Pump grout into place at bottom of preplaced aggregate, forcing grout upward. Release air from forms at top as grout is introduced. When formed space is full and grout flows from air vents, close vents and pressurize to **14 psi (96 kPa)**.

- G. Wet-cure concrete for not less than seven days by leaving forms in place or keeping surfaces continuously wet by water-fog spray or water-saturated absorptive cover.
- H. Repair voids with patching mortar and finish to match surrounding concrete.

3.10 FLOOR-JOINT REPAIR

- A. Cut out deteriorated concrete **[and reconstruct sides of joint with patching mortar]** as indicated on Drawings. Install joint filler in nonmoving floor joints where indicated and as specified in this article.
- B. Depth: Install joint filler to a depth of at least **[3/4 inch (19 mm)][1 inch (25 mm)][2 inches (50 mm)]**. Use fine silica sand no more than **1/4 inch (6 mm)** deep to close base of joint. Do not use sealant backer rods or compressible fillers below joint filler.
- C. Top Surface: Install joint filler so that when cured, it is flush at top surface of adjacent concrete. If necessary, overfill joint and remove excess when filler has cured.

3.11 APPLICATION OF EPOXY CRACK-INJECTION MATERIALS

- A. Clean cracks with oil-free compressed air or low-pressure water to remove loose particles.
- B. Clean areas to receive capping adhesive of oil, dirt, and other substances that would interfere with bond.
- C. Place injection ports as recommended by epoxy manufacturer, spacing no farther apart than thickness of member being injected. Seal injection ports in place with capping adhesive.
- D. Seal cracks at exposed surfaces with a ribbon of capping adhesive at least **1/4 inch (6 mm)** thick by **1 inch (25 mm)** wider than crack.
- E. Inject cracks wider than **0.003 inch (0.075 mm)** to a depth of **8 inches (200 mm)**.
- F. Inject epoxy adhesive, beginning at widest part of crack and working toward narrower parts. Inject adhesive into ports to refusal, capping adjacent ports when they extrude epoxy. Cap injected ports and inject through adjacent ports until crack is filled.
- G. After epoxy adhesive has set, remove injection ports and grind surfaces smooth.

3.12 APPLICATION OF CORROSION-INHIBITING MATERIALS

- A. Apply corrosion-inhibiting treatment to **[surfaces indicated on Drawings, from wall to wall or curb to curb and from joint to joint in the perpendicular direction]**.
- B. Apply by brush, roller, or airless spray in two coats at manufacturer's recommended application rate. Remove film of excess treatment by high-pressure washing before patching treated concrete **[or applying a sealer or overlay]**.

3.13 APPLICATION OF POLYMER-OVERLAY MATERIALS

- A. Apply polymer overlay in accordance with ACI 503.3.

- B. Apply to traffic-bearing surfaces, including parking areas and walks.

3.14 APPLICATION OF POLYMER-SEALER MATERIALS

- A. Apply polymer sealer by brush, roller, or airless spray at manufacturer's recommended application rate.
- B. Apply to traffic-bearing surfaces, including parking areas and walks.

3.15 INSTALLATION OF COMPOSITE REINFORCEMENT MATERIALS

- A. Fiber Tow Sheet and Saturant: Unless otherwise recommended by manufacturer, install as follows:
 - 1. Apply epoxy primer using brush or short nap roller to prepared concrete surfaces in areas where composite structural reinforcement will be applied.
 - 2. After primer has set, patch surface defects with epoxy filler and allow to set before beginning reinforcement application.
 - 3. Apply epoxy saturant to **[fiber tow sheet][or][primed and patched surface]** using roller. Apply fiber tow sheet to primed and patched surface while saturant is still wet, using pressure roller to remove air pockets. Remove paper backing from fiber tow sheet and apply additional epoxy to fully saturate tow sheet.
 - 4. Apply additional layers using same procedure, fully saturating each layer with epoxy.
 - 5. After saturant has cured, apply protective topcoat by **[brush][roller][or][spray]**.
- B. Preimpregnated Fiber Sheet: Unless otherwise recommended by manufacturer, install as follows:
 - 1. Patch surface defects with epoxy mortar and allow to set before beginning reinforcement application.
 - 2. Apply epoxy adhesive to a thickness of **1/16 inch (1.6 mm)** to prepared concrete surfaces.
 - 3. Clean fiber sheet with acetone or other suitable solvent and apply epoxy adhesive to a thickness of **1/16 inch (1.6 mm)**.
 - 4. Apply adhesive-coated fiber sheet to adhesive-coated concrete and roll with a hard rubber roller until fiber sheet is fully embedded in adhesive, air pockets are removed, and adhesive is forced out from beneath fiber sheet at edges.
 - 5. Apply additional layers using same procedure.

3.16 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
 - 1. Packaged, Cementitious Patching-Mortar Application: randomly selected sets of samples for each type of mortar required, tested in accordance with ASTM C928/C928M.
 - 2. Job-Mixed Patching-Mortar Application: As directed by the Owner, randomly selected sets of samples for each type of mortar required, tested for compressive strength in accordance with ASTM C109/C109M.
 - 3. Concrete: As specified in **[Section 033000 "Cast-in-Place Concrete."][Section 033300 "Architectural Concrete."]**
 - 4. Grout for Preplaced Aggregate: Tested for compressive strength in accordance with ASTM C942/C942M.
 - a. Testing Frequency: One sample for each **25 cu. yd. (19 cu. m)** of grout or fraction thereof,

but not less than one sample for each day's work.

5. Joint Filler: Core-drilled samples to verify proper installation.
 - a. Testing Frequency: One sample for each **100 ft. (30 m)** of joint filled.
 - b. Where samples are taken, refill holes with joint filler.
6. Epoxy Crack-Injection Materials: Core-drilled samples to verify proper installation.
 - a. Testing Frequency: [**Three samples from mockup and**]one sample for each **100 ft. (30 m)** of crack injected.
 - b. Where samples are taken, refill holes with epoxy mortar.
7. Product will be considered defective if it does not pass tests and inspections.

C. Manufacturers Field Service: Engage manufacturers' factory-authorized service representatives for consultation and Project-site inspection and to provide on-site assistance when requested by Architect.

1. Have manufacturers' factory-authorized service representatives perform the following number of Project-site inspections to observe progress and quality of the Work, distributed over the period of product installation, regardless of on-site assistance requested by Architect:
 - a. Bonding-Agent and Packaged Patching-Mortar Installation: [**Three**] inspections.
 - b. Joint-Filler Installation: [**Two**] inspections.
 - c. Crack-Injection-Adhesive Preparation and Installation: [**Four**] inspections.
 - d. Corrosion-Inhibiting Treatment Installation: [**Two**] inspections.
 - e. Polymer-Overlay Installation: [**Two**] inspections.
 - f. Polymer Sealer: [**Two**] inspections.
 - g. Composite-Structural Reinforcement: [**Three**] inspections.

D. Prepare test and inspection reports.

3.17 CONCRETE MAINTENANCE SCHEDULE

A. Garage Level 1 Entrance Ramp: Perform the following as indicated on Drawings:

1. Removal of deteriorated concrete and subsequent replacement and patching.
2. Floor-joint repair.
3. Epoxy crack-injection materials.
4. Corrosion-inhibiting materials.
5. Polymer-overlay materials.
6. Polymer-sealer materials.
7. Composite reinforcement on underside of slab.

B. Elevated Warehouse Floors: Perform the following as indicated on Drawings:

1. Removal of deteriorated concrete and subsequent replacement and patching.
2. Floor-joint repair.
3. Epoxy crack-injection materials.
4. Corrosion-inhibiting materials.
5. Polymer-overlay materials.
6. Polymer-sealer materials.
7. Composite reinforcement on underside of slab.

C. Concrete Walls and Floor in Salt Dome: Perform the following as indicated on Drawings:

1. Removal of deteriorated concrete and subsequent replacement and patching.
2. Floor-joint repair.
3. Epoxy crack-injection materials.
4. Corrosion-inhibiting materials.
5. Polymer-overlay materials.
6. Polymer-sealer materials.
7. Composite reinforcement of columns.

END OF SECTION 03 01 30 00



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Task	Specification	Specification Description
03 01 30 51	03 01 30 00	Maintenance of Cast-in-Place Concrete



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SECTION 03 01 30 71 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Modified bituminous sheet waterproofing.
2. Blindsight sheet waterproofing.
3. Accessory waterproofing system materials.
4. Protection course.
5. Molded-sheet drainage panels.
6. Insulation drainage panels.
7. Electronic leak-detection (ELD) materials.
8. Plaza-deck pavers.

B. Related Requirements:

1. Section 072100 "Thermal Insulation" for below-grade foundation insulation.
2. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
3. Section 079513.16 "Exterior Expansion Joint Cover Assemblies" for exterior-wall expansion-joint assemblies that interface with waterproofing.
4. Section 079513.19 "Parking Deck Expansion Joint Cover Assemblies" for deck expansion-joint assemblies that interface with waterproofing.
5. Section 334600 "Subdrainage" for molded-sheet drainage panels.

1.2 DEFINITIONS

- A. Compatible: Material that will not adversely affect adjacent materials, is chemically compatible with adjacent materials, and where required for bond, achieves adhesive compatibility with adjacent materials.
- B. Chemical Compatibility: Material that will not break down, deteriorate, degrade, or prematurely fail when in contact with another material. Material that will not cause chemical breakdown, deterioration, degradation, staining, or premature failure of another material.
- C. Adhesive Compatibility: Material that will develop bond strength or provide a suitable surface for another material to develop bond strength complying with requirements when in contact with another material.

1.3 COORDINATION

- A. Coordinate Work under this Section with adjacent concrete foundation work, including fill[, **other waterproofing systems**] [, **under-slab vapor retarders**] [, **under-slab insulation**] [**and**] [**subdrainage systems**].
- B. Coordinate requirements for concrete formwork to provide suitable substrate for waterproofing and to minimize penetrations through waterproofing.

- C. Coordinate formwork and form bracing requirements for blindside sheet waterproofing. Coordinate restrictions on use of form ties and other components as necessary to eliminate or minimize penetrations through blindside sheet waterproofing.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]** <Insert location>.
 - 1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.
 - 2. Review transitions within waterproofing system and between waterproofing and adjacent air barrier.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include manufacturer's written installation instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, expansion joints, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, air barrier, and other termination conditions.
 - 1. Include setting drawings that indicate layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.
- C. Samples: For the following materials:
 - 1. 8-by-8-inch (200-by-200-mm) square of waterproofing and flashing sheet.
 - 2. 4-by-4-inch (100-by-100-mm) square of drainage panel.
 - 3. Plaza-deck paver, **[4-by-4-inch (100-by-100-mm) square]** **[full sized]**, in each color and texture required[, **including paver pedestal assembly**].
- D. Sustainable Design Submittals:
 - 1. <Double click to insert sustainable design text for moisture control>

1.6 INFORMATIONAL SUBMITTALS

- A. Research Reports: For modified bituminous sheet waterproofing/termite barrier, showing compliance with ICC-ES AC308.
- B. Field quality control reports.
- C. Qualification Statements: For Installer.
- D. Sample warranties.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and **[certified]** **[approved]** by waterproofing manufacturer.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals and to set quality standards for installation.
1. Build mockups for each typical waterproofing installation including **[pavers and]** accessories to demonstrate surface preparation, crack and joint treatments, inside and outside corner treatments, and protection.
 - a. Size: **[100 sq. ft. (9.3 sq. m) in area]** **[As indicated on Drawings]**.
 - b. Description: Each type of **[wall]** **[deck]** **[and]** **[plaza]** **<Insert description>** installation.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to frozen, damp, or wet substrates.
1. Do not apply waterproofing when snow, rain, fog, or mist is present.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.10 WARRANTY

- A. Manufacturer's Special Warranty:
1. Waterproofing Warranty: Manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
 - a. Warranty Period: **[Three]** **[Five]** **<Insert number>** years from date of Substantial Completion.
 2. Termite Barrier Warranty: Manufacturer agrees to furnish replacement waterproofing termite barrier material and accessories for waterproofing termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.
 - a. Warranty Period: Ten years from date of Substantial Completion.
- B. Installer's Special Warranty: Specified form, **[on warranty form at end of this Section]**, signed by Installer, covering Work of this Section, for warranty period of **[two]** **<Insert number>** years.

1. Warranty includes removing and reinstalling protection board, drainage panels, insulation, **[and] [plaza-deck pavers][, including paver pedestal assembly].**

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Waterproofing System: Obtain waterproofing materials **[and] [protection course] [molded-sheet drainage panels] [insulation drainage panels]** from **[same manufacturer as waterproofing membrane] [or] [manufacturer approved by waterproofing membrane manufacturer].**
- B. Plaza-Deck Paving: Obtain plaza-deck pavers **[and paver pedestal assembly]** from single source from single manufacturer for consistent quality in appearance and physical properties.

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet Waterproofing: Minimum 60-mil (1.5-mm) nominal thickness, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated on one side to a 4-mil- (0.10-mm-) thick, polyethylene-film reinforcement, and with release liner on adhesive side[; **formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction**].
 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 2. Physical Properties:
 - a. Tensile Strength, Membrane: 250 psi (1.7 MPa) minimum; ASTM D412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D1970/D1970M.
 - d. Puncture Resistance: 40 lbf (180 N) minimum; ASTM E154/E154M.
 - e. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D570.
 - f. Water Vapor Permeance: 0.05 perm (2.9 ng/Pa x s x sq. m) maximum; ASTM E96/E96M, Water Method.
 - g. Hydrostatic-Head Resistance: **[200 ft. (60 m)] <Insert dimension>** minimum; ASTM D5385/D5385M.
3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.
- B. Modified Bituminous Sheet Waterproofing, Foil Faced: Minimum 60-mil (1.5-mm) nominal thickness, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt integrally bonded to a 4-mil (0.1-mm) aluminum backing, and with release liner on adhesive side.
 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 2. Physical Properties:
 - a. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D5147/D5147M.
 - b. Puncture Resistance: 40 lbf (180 N) minimum; ASTM E154/E154M.
 - c. Water Vapor Permeance: 0.05 perm (2.9 ng/Pa x s x sq. m) maximum; ASTM E96/E96M, Water Method.

- d. Hydrostatic-Head Resistance: [171 ft. (52 m)] <Insert dimension> minimum; ASTM D751.
3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.
- C. Modified Bituminous Sheet Waterproofing, Fabric Reinforced: Minimum 60-mil (1.5-mm) nominal thickness, self-adhering sheet consisting of rubberized-asphalt membrane with embedded fabric reinforcement, and with release liner on adhesive side.
 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 2. Physical Properties:
 - a. Pliability: No cracks when bent 180 degrees over a 1-inch (25-mm) mandrel at minus 25 deg F (minus 32 deg C); ASTM D146/D146M.
 - b. Puncture Resistance: [40 lbf (180 N)] [100 lbf (445 N)] minimum; ASTM E154/E154M.
 - c. Water Vapor Permeance: 0.05 perm (2.9 ng/Pa x s x sq. m) maximum; ASTM E96/E96M, Water Method.
 3. Sheet Strips: Self-adhering, reinforced, rubberized-asphalt strips of same material and thickness as sheet waterproofing.
- D. Modified Bituminous Sheet Waterproofing/Termite Barrier: Minimum 68-mil (1.7-mm) nominal thickness, self-adhering sheet consisting of 64 mils (1.6 mm) of rubberized asphalt laminated on one side to a 4-mil- (0.10-mm-) thick, polyethylene-film reinforcement and with release liner on adhesive side; **formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction**.
 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 2. Physical Properties:
 - a. Tensile Strength, Composite Membrane: 325 psi (2.44 MPa) minimum; ASTM D412, Die C, modified.
 - b. Low-Temperature Flexibility: Pass at minus 25 deg F (minus 32 deg C); ASTM D146/D146M.
 - c. Puncture Resistance: 50 lbf (182 N) minimum; ASTM E154/E154M.
 - d. Water Absorption: 0.1 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D570.
 - e. Water Vapor Permeance: 0.05 perm (0.44 ng/Pa x s x sq. m) maximum; ASTM E96/E96M, Method B.
 - f. Hydrostatic-Head Resistance: 231 ft. (70 m) minimum; ASTM D5385/D5385M.
 - g. Resistance to Termite Penetration: Comply with ICC-ES AC380.
 3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.
- E. Modified Bituminous Deck-Paving Sheet Waterproofing: Minimum 65-mil (1.6-mm) nominal thickness, self-adhering sheets designed to be overlaid with asphalt paving; consisting of rubberized-asphalt membrane with woven or nonwoven fabric reinforcement laminated to one surface or embedded within the membrane, and with release liner on adhesive side.
 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 2. Physical Properties:
 - a. Tensile Strength, Membrane: [50 lbf/in. (8.75 kN/m)] <Insert value> minimum; ASTM D882.

- b. Pliability: Unaffected when bent 180 degrees over a 1/4-inch (6.4-mm) mandrel at minus 15 deg F (minus 26 deg C); ASTM D146/D146M.
 - c. Puncture Resistance: **[40 lbf (180 N)] [100 lbf (445 N)] [200 lbf (890 N)]** minimum; ASTM E154/E154M.
3. Sheet Strips: Self-adhering, reinforced, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.3 BLINDSIDE SHEET WATERPROOFING

- A. Blindside Sheet Waterproofing for Vertical Applications: Uniform, flexible, multilayered-composite sheet membrane that forms a permanent bond with fresh concrete placed against it; complete with accessories and preformed shapes for an unbroken waterproofing assembly; with the physical properties as specified below:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Physical Properties:
 - a. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D1970/D1970M.
 - b. Peel Adhesion to Concrete: 5 lbf/in. (875 N/m) minimum; ASTM D903, modified.
 - c. Lap Adhesion: 5 lbf/in. (875 N/m) minimum; ASTM D1876, modified.
 - d. Hydrostatic-Head Resistance: 230 ft. (70 m); ASTM D5385/D5385M, modified.
 - e. Puncture Resistance: 100 lbf (445 N) minimum; ASTM E154/E154M.
 - f. Water Vapor Permeance: 0.1 perm (6 ng/Pa x s x sq. m) maximum; ASTM E96/E96M, Water Method.
 - g. Ultimate Elongation: 335 percent minimum; ASTM D412, modified.

- B. Blindside Sheet Waterproofing for Horizontal Applications: Uniform, flexible, multilayered-composite sheet membrane that forms a permanent bond with fresh concrete placed against it; complete with accessories and preformed shapes for an unbroken waterproofing assembly; with the physical properties as specified below:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Physical Properties:
 - a. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D1970/D1970M.
 - b. Peel Adhesion to Concrete: 5 lbf/in. (875 N/m) minimum; ASTM D903, modified.
 - c. Lap Adhesion: 5 lbf/in. (875 N/m) minimum; ASTM D1876, modified.
 - d. Hydrostatic-Head Resistance: 230 ft. (70 m); ASTM D5385/D5385M, modified.
 - e. Puncture Resistance: 200 lbf (890 N) minimum; ASTM E154/E154M.
 - f. Water Vapor Permeance: 0.1 perm (6 ng/Pa x s x sq. m) maximum; ASTM E96/E96M, Water Method.
 - g. Ultimate Elongation: 335 percent minimum; ASTM D412, modified.

- C. Mastic, Adhesives, and Detail Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.

2.4 ACCESSORY WATERPROOFING SYSTEM MATERIALS

- A. General: Accessory materials as recommended in writing by waterproofing manufacturer for intended use and compatibility with one another and with sheet waterproofing.

1. Furnish liquid-type accessory materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid **[waterborne]** **[solvent-borne]** primer as recommended in writing for substrate by sheet waterproofing material manufacturer.
- C. Surface Conditioner: Liquid, waterborne surface conditioner as recommended in writing for substrate by waterproofing manufacturer.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity as recommended in writing for substrate by waterproofing manufacturer.
- E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating as recommended in writing for substrate by waterproofing manufacturer.
- F. Metal Termination Bars: Manufacturer's standard aluminum or stainless steel bars, approximately 1 by 1/8 inch (25 by 3 mm), predrilled at 9-inch (229-mm) centers.
- G. Joint Sealant: **[Single-component]** **[Multicomponent]** polyurethane sealant, compatible with waterproofing; **[ASTM C920, Type M, Class 25 or greater; Grade NS for sloping and vertical applications and Grade P for deck applications; Use NT exposure]** **[as specified in Section 079200 "Joint Sealants"]** **<Insert requirement>**; and as recommended in writing by waterproofing manufacturer for substrate and joint conditions.
- H. Backer Rod: Closed-cell polyethylene foam.

2.5 PROTECTION COURSE

- A. Protection Course, Asphaltic: ASTM D6506/D6506M; semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
 1. Thickness: Nominal **[1/8 inch (3 mm)]** **[1/4 inch (6 mm)]** **[1/8 inch (3 mm) for vertical applications; 1/4 inch (6 mm) elsewhere]**.
- B. Protection Course, Extruded-Polystyrene Board Insulation, Faced: Fan folded, faced on **[one side]** **[or]** **[both sides]** with plastic film, nominal thickness 1/4 inch (6 mm), with compressive strength of not less than 8 psi (55 kPa) when tested in accordance with ASTM D1621, and maximum water absorption by volume of 0.6 percent when tested in accordance with ASTM C272/C272M.
- C. Protection Course, Extruded-Polystyrene Board Insulation, Unfaced: ASTM C578, Type X, 1/2 inch (13 mm) thick.
- D. Protection Course, Molded-Polystyrene Board Insulation: ASTM C578, Type I, 0.90 lb/cu. ft. (15 kg/cu. m) minimum density, 1-inch (25-mm) minimum thickness.

2.6 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panels with Polymeric Film: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21 mm) sieve laminated to one side of the

core and a polymeric film bonded to the other side; and with a vertical flow rate through the core of **[9 to 21 gpm per ft. (112 to 261 L/min. per m)] <Insert values>**.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

- B. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panels: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21 mm) sieve laminated to one side of the core, without a polymeric film bonded to the other side; and with a vertical flow rate through the core of **[9 to 21 gpm per ft. (112 to 261 L/min. per m)] <Insert values>**.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

- C. Woven-Geotextile-Faced, Molded-Sheet Drainage Panels with Polymeric Film: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a woven-geotextile facing with an apparent opening size not exceeding No. 40 (0.43 mm) sieve, laminated to one side of the core and a polymeric film bonded to the other side; and with a horizontal flow rate through the core of not less than **[2.8 gpm per ft. (35 L/min. per m)] <Insert value>**.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

- D. Woven-Geotextile-Faced, Molded-Sheet Drainage Panels: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a woven-geotextile facing with an apparent opening size not exceeding No. 40 (0.43 mm) sieve, laminated to one side of the core, without a polymeric film bonded to the other side; and with a horizontal flow rate through the core of not less than **[2.8 gpm per ft. (35 L/min. per m)] <Insert value>**.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

- E. Molded-Sheet Collector-Panel System with Polymeric Film: Composite subsurface collector-panel system by same manufacturer as primary molded-sheet drainage panels; consisting of a high-profile, studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven-geotextile facing with an apparent opening size not exceeding No. 40 (0.425 mm) sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate through the core of **[9 to 17 gpm per ft. (112 to 211 L/min. per m)] <Insert values>** and a minimum horizontal, in-plane flow rate **[as indicated on Drawings] <Insert requirement>**. Provide system with manufacturer's outlets, connectors, tapes, and other accessories to connect primary molded-sheet drainage panels with piped subdrainage system.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

- F. Molded-Sheet Collector-Panel System Wrapped with Geotextile: Composite subsurface collector-panel system by same manufacturer as primary molded-sheet drainage panels; consisting of a high-profile, studded, nonbiodegradable, molded-plastic-sheet drainage core; wrapped with a nonwoven-geotextile facing with an apparent opening size not exceeding No. 40 (0.425 mm) sieve; and with a vertical flow rate through the core of **[21 to 97 gpm per ft. (261 to 1197 L/min. per m)] <Insert values>** and a minimum horizontal, in-plane flow rate **[as indicated on Drawings] [of 21 gpm per ft. (261 L/min. per m)] <Insert requirement>**. Provide system with manufacturer's outlets, connectors, tapes, and other accessories to connect primary molded-sheet drainage panels with piped subdrainage system.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

2.7 INSULATION DRAINAGE PANELS

- A. Unfaced, Wall-Insulation Drainage Panels, Type IV: ASTM C578, Type IV, 25 psi (173 kPa) minimum compressive strength; unfaced extruded-polystyrene board insulation; fabricated with shiplap or channel edges and with one side having grooved drainage channels.
 - 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Geotextile-Faced, Wall-Insulation Drainage Panels, Type IV: ASTM C578, Type IV, 25 psi (173 kPa) minimum compressive strength extruded-polystyrene board insulation, fabricated with tongue-and-groove edges and with one side having grooved drainage channels faced with nonwoven geotextile filter fabric.
 - 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- C. Unfaced, Wall-Insulation Drainage Panels, Type VI: ASTM C578, Type VI, 40 psi (276 kPa) minimum compressive strength; unfaced extruded-polystyrene board insulation; fabricated with shiplap or channel edges and with one side having grooved drainage channels.
 - 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- D. Geotextile-Faced, Wall-Insulation Drainage Panels, Type VI: ASTM C578, Type VI, 40 psi (276 kPa) minimum compressive strength extruded-polystyrene board insulation, fabricated with tongue-and-groove edges and with one side having grooved drainage channels faced with nonwoven geotextile filter fabric.
 - 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- E. Unfaced, Plaza-Deck, Insulation Drainage Panels, Type VI: ASTM C578, Type VI, 40 psi (276 kPa) minimum compressive strength; unfaced extruded-polystyrene board insulation, fabricated with shiplapped, channel, or tongue-and-groove edges and with one side having ribbed drainage channels.
 - 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- F. Geotextile-Faced, Plaza-Deck, Insulation Drainage Panels, Type VI: ASTM C578, Type VI, 40 psi (276 kPa) minimum compressive strength extruded-polystyrene board insulation, fabricated with tongue-and-groove edges, with one side having grooved drainage channels, and faced with manufacturer's standard, nonwoven geotextile filter fabric.
 - 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- G. Unfaced, Plaza-Deck, Insulation Drainage Panels, Type VII: ASTM C578, Type VII, 60 psi (414 kPa) minimum compressive strength; unfaced extruded-polystyrene board insulation, fabricated with shiplapped, channel, or tongue-and-groove edges and with one side having ribbed drainage channels.
 - 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- H. Geotextile-Faced, Plaza-Deck, Insulation Drainage Panels, Type VII: ASTM C578, Type VII, 60 psi (414 kPa) minimum compressive strength extruded-polystyrene board insulation, fabricated with tongue-and-groove edges, with one side having grooved drainage channels, and faced with manufacturer's standard, nonwoven geotextile filter fabric.
 - 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

2.8 ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Conductive Medium: Electrically conductive material specifically designed to enable ELD testing procedures as approved in writing by waterproofing membrane manufacturer.
 - 1. Conductive medium to be located directly under waterproofing membrane in accordance with ASTM D7877 and ASTM D8231.
- B. Moisture-Monitoring System: Permanently embedded, continuously monitored moisture-detection system.
 - 1. Sensors measuring moisture content to be placed within waterproofing system and connected to a monitoring program, with a notification indicating location of breach.

2.9 PLAZA-DECK PAVERS

- A. Plaza-Deck Pavers: **[Brick] [Concrete] [Asphalt-block]** pavers specified in Section 321400 "Unit Paving."
- B. Stone Plaza-Deck Pavers: **[Granite] [Limestone] [Marble] <Insert type>** pavers specified in Section 321400 "Unit Paving."
- C. Concrete Plaza-Deck Pavers: Solid, hydraulically pressed, standard-weight concrete units, **[square edged] [with top edges beveled 3/16 inch (5 mm)]**, manufactured for use as plaza-deck pavers; **[7500 psi (52 MPa)] [6500 psi (45 MPa)] <Insert value>** minimum compressive strength when tested in accordance with ASTM C140/C140M; absorption not greater than 5 percent when tested in accordance with ASTM C140/C140M; and no breakage and maximum 1 percent mass loss, freeze-thaw resistance, when tested in accordance with ASTM C67/C67M.
 - 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 - 2. Thickness: **[2 inches (51 mm)] [2-3/8 inches (60 mm)] <Insert dimension>**.
 - 3. Face Size: **[12 inches (305 mm) square] [12 by 24 inches (305 by 610 mm)] [18 inches (457 mm) square] [24 inches (610 mm) square] [As indicated] <Insert dimension(s) and shape>**.
 - 4. Color and Texture: **[As indicated by manufacturer's designations] [Match Architect's sample] [As selected by Architect from manufacturer's full range] <Insert requirement>**.
- D. Plaza-Deck Paver Metal Straps: Securement strapping fabricated from stainless steel, a minimum of 3 inches (75 mm) wide by 0.031 inch (0.8 mm) thick with stainless steel anchors.
- E. Paver Pedestals: Paver-support assembly, **[standard with paver manufacturer] [or] [as named below]**, including **[fixed-height] [adjustable or stackable]** pedestals, shims, and spacer tabs for joint spacing of **[1/8 inch (3 mm)] [3/16 inch (5 mm)] [1/8 to 3/16 inch (3 to 5 mm)]**.
 - 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 - 2. Fill: As recommended in writing by pedestal manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of waterproofing.
 - 1. Verify that concrete has cured and aged for minimum time recommended in writing by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by waterproofing manufacturer. Test for capillary moisture by plastic sheet method in accordance with ASTM D4263.
 - 3. Verify that compacted subgrade is dry, smooth, sound, and ready to receive waterproofing sheet.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean, prepare, and treat substrates in accordance with waterproofing manufacturer's written installation instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections.
- E. Fill form tie holes, honeycomb, aggregate pockets, holes, and other voids.
- F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks in accordance with ASTM D4258.
 - 1. Install sheet strips of width in accordance with waterproofing manufacturer's written installation instructions and center over treated construction and contraction joints and cracks exceeding a width of **[1/16 inch (1.6 mm)] [or] [1/8 inch (3 mm) for modified bituminous deck-paving waterproofing]**.
- G. Bridge and cover isolation joints, expansion joints, and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths in accordance with waterproofing manufacturer's written installation instructions.
 - 1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
- H. Corners: Prepare, prime, and treat inside and outside corners in accordance with waterproofing manufacturer's written installation instructions.
 - 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch (19-mm) fillets of liquid membrane on horizontal inside corners and as follows:

- a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.
 - b. At plaza-deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.
- I. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions.

3.3 INSTALLATION OF ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Install conductive medium directly under waterproofing membrane in accordance with ASTM D7877 and ASTM D8231.
- B. Install sensors, connections, and accessory items required for complete continuously monitored moisture-detection system in accordance with waterproofing manufacturer's written installation instructions.

3.4 INSTALLATION OF MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Install modified bituminous sheets in accordance with waterproofing manufacturer's written installation instructions.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F (16 deg C).
- D. Two-Ply Application: Install sheets to form a membrane with lap widths not less than 50 percent of sheet widths, to provide a minimum of two thicknesses of sheet membrane over areas to receive waterproofing.
- E. Horizontal Application: Apply sheets from low to high points of decks to ensure that laps shed water.
- F. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.
- G. Seal edges of sheet waterproofing terminations with **[mastic] [termination bar and sealant]**.
- H. Install sheet waterproofing and accessory materials to tie into adjacent waterproofing.
- I. Roll waterproofing membrane to firmly adhere to substrate. Roll seams and terminations.
- J. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches (150 mm) beyond repaired areas in all directions.

- K. Immediately install protection course with butted joints over waterproofing membrane.
 - 1. **[Molded-sheet drainage panels] [Insulation drainage panels]** may be used in place of a separate protection course to vertical applications when approved by waterproofing manufacturer and installed immediately.

3.5 INSTALLATION OF MODIFIED BITUMINOUS DECK-PAVING SHEET WATERPROOFING

- A. Install modified bituminous deck-paving sheets in accordance with waterproofing manufacturer's written installation instructions.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over areas to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum side-lap widths and 6-inch (150-mm) end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.
- D. Apply sheet waterproofing from low to high points of decks to ensure that laps shed water.
- E. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.
- F. Seal edges of sheet waterproofing terminations with mastic.
- G. Install sheet waterproofing and accessory materials to tie into adjacent waterproofing.
- H. Repair tears, voids, and lapped seams in waterproofing that do not comply with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches (150 mm) beyond repaired areas in all directions.

3.6 INSTALLATION OF BLINDSIDE SHEET WATERPROOFING

- A. Install blindside sheet waterproofing in accordance with waterproofing manufacturer's written installation instructions.
- B. Place and secure molded-sheet drainage panels over substrate. Lap edges and ends of geotextile to maintain continuity.
- C. Vertical Applications: Install sheet with face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by membrane manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation. Mechanically fasten to substrate.
 - 1. Securely fasten top termination of membrane with continuous metal termination bar anchored into substrate and cover with detail tape.
 - 2. Ensure transition with other waterproofing membrane.
- D. Horizontal Applications: Install sheet with face against substrate. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by waterproofing manufacturer. Overlap and seal seams, and stagger and tape end laps to ensure watertight installation.

- E. Corners: Seal lapped terminations and cut edges of sheet waterproofing at inside and outside corners with detail tape.
- F. Seal penetrations through sheet waterproofing to provide watertight seal with detail tape patches or wraps and a liquid-membrane troweling.
- G. Install sheet waterproofing and accessory materials to produce a continuous watertight tie into adjacent waterproofing.
- H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Tape perimeter of damaged or nonconforming area extending 6 inches (150 mm) beyond repaired areas in all directions. Apply a patch of sheet waterproofing and firmly secure with detail tape.

3.7 INSTALLATION OF PROTECTION COURSE

- A. Cover waterproofing with protection course with butted joints before membrane is subject to **[backfilling] [construction or vehicular traffic]**.
 - 1. For horizontal applications, install protection course loose laid over fully cured membrane.
 - 2. For vertical applications, set protection course in nominally cured membrane, which will act as an adhesive. If membrane cures before application of protection course, use adhesive.

3.8 INSTALLATION OF MOLDED-SHEET DRAINAGE PANELS

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, in accordance with manufacturer's written installation instructions. Use adhesive or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - 1. For vertical applications, install **[board insulation] [protection course]** before installing drainage panels.

3.9 INSTALLATION OF INSULATION DRAINAGE PANELS

- A. Install insulation drainage panels over waterproofed surfaces. Cut and fit to within 3/4 inch (19 mm) of projections and penetrations.
- B. Ensure that drainage channels are aligned vertically and free of obstructions.
- C. On vertical surfaces, set insulation drainage panels in adhesive or tape applied in accordance with manufacturer's written installation instructions.
- D. On horizontal surfaces, loosely lay insulation drainage panels in accordance with manufacturer's written installation instructions. Stagger end joints and tightly abut insulation units.

3.10 INSTALLATION OF PLAZA-DECK PAVERS

- A. Install pavers in accordance with manufacturer's written installation instructions.

- B. Install paver pedestals and accessories to required elevations in accordance with manufacturer's written installation instructions. Adjust for final level and slope of paved surfaces.
- C. **[Loosely lay pavers on pedestals] [Seat pavers on pedestals and install bolted plate in accordance with manufacturer's written installation instructions]**, maintaining a uniform open joint width as recommended in writing by paver manufacturer. Tightly seat pavers against spacers to eliminate lateral movement or drift of paving assembly. Align joint patterns parallel in each direction.
 - 1. Lay out pavers to avoid less-than-half-width pavers at perimeter or other terminations.
- D. Install pavers to vary no more than 1/16 inch (1.6 mm) in elevation between adjacent pavers and no more than 1/16 inch (1.6 mm) from surface plane elevation of individual paver.
- E. Limit variation in paving installation to within **[1/4 inch in 10 ft. (6 mm in 3 m)]** <Insert dimensions> of surface plane in any direction; noncumulative.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage] [Engage]** a qualified testing agency to perform tests and inspections.
- B. Perform the following tests before overlying construction is placed:
 - 1. ELD Testing: Testing agency surveys entire horizontal waterproofed area and flashings to locate discontinuities in the system assembly using ELD in accordance with ASTM D7877 and ASTM D8231.
 - a. After testing, repair areas of discontinuities, repeat tests, and make further repairs until waterproofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
 - 2. Flood Testing: Flood test each completed horizontal waterproofed area for leaks, in accordance with recommendations in ASTM D5957. Install temporary containment assemblies, plug, or dam drains, and flood with potable water.
 - a. Flood to an average depth of **[2-1/2 inches (63 mm)]** <Insert depth> with a minimum depth of **[1 inch (25 mm)]** <Insert depth> and not exceeding a depth of **[4 inches (100 mm)]** <Insert depth>. Maintain 2 inches (50 mm) of clearance from top of base flashing.
 - b. Flood each area for **[24] [48] [72]** hours.
 - c. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - d. Testing agency to prepare survey report indicating locations of initial leaks, if any, and final survey report.
- C. Manufacturer's Field Service: Engage a **[full-time]** site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components; and to furnish daily reports to Architect.

1. Final Inspection: Arrange for waterproofing system manufacturer's technical personnel to inspect system installation on completion, in presence of Architect, and to prepare inspection report.
2. Notify Architect[**and Owner**] 48 hours in advance of date and time of inspection.
3. Repair or remove and replace components of waterproofing system where inspections indicate that they do not comply with specified requirements.

D. Additional Tests and Inspections:

1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.
2. Waterproofing system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.12 PROTECTION, REPAIR, AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- D. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- E. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 03 01 30 71



Task	Specification	Specification Description
03 01 30 71	01 11 19 00	No Specification Required
03 01 30 71	03 01 30 00	Maintenance of Cast-in-Place Concrete
03 01 30 72	03 01 30 00	Maintenance of Cast-in-Place Concrete
03 05 13 00	03 30 00 00	Cast-In-Place Concrete



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SECTION 03 10 00 00 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Form-facing materials.
2. Form liners.
3. Insulating concrete forms.
4. Waterstops.

B. Related Requirements:

1. Section 321313 "Concrete Paving" for formwork related to concrete pavement and walks.
2. Section 321316 "Decorative Concrete Paving" for formwork related to decorative concrete pavement and walks.

1.2 DEFINITIONS

- A. Form-Facing Material: The temporary form materials that come in direct contact with the concrete as part of the formwork components in supporting the concrete while the concrete is setting and gaining sufficient strength to be self-supporting. The most common materials are steel, aluminum, and wood.
- B. Form Lining: Materials used to line the concreting face of formwork to impart a smooth or patterned finish to the concrete surface, to absorb moisture from the concrete, or to apply a set-retarding chemical to the formed surface of the concrete.
- C. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **[Project site]**.

1. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction, movement, contraction, and isolation joints
 - c. Forms and form-removal limitations.
 - d. Shoring and reshoring procedures.
 - e. Anchor rod and anchorage device installation tolerances.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.
 2. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
- C. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.
1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
 2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with **ACI 301 (ACI 301M)**.
 3. Indicate location of waterstops.
 4. Indicate form liner layout and form line termination details.
 5. Indicate proposed schedule and sequence of stripping of forms, shoring removal, and reshoring installation and removal.
 6. Indicate layout of insulating concrete forms, dimensions, course heights, form types, and details.
- D. Samples:
1. For waterstops.
 2. For Form Liners: **12- by 12-inch (305- by 305-mm)** sample, indicating texture.

1.5 INFORMATIONAL SUBMITTALS

- A. Research Reports: For insulating concrete forms indicating compliance with ICC's Acceptance Criteria AC308.
- B. Field quality-control reports.
- C. Minutes of preinstallation conference.
- D. Qualification Statements: For testing and inspection agency.

1.6 QUALITY ASSURANCE

- A. Testing and Inspection Agency Qualifications: An independent agency, [**acceptable to authorities having jurisdiction,**] qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
- B. Mockups: As directed by the Owner, formed surfaces to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.
 1. Build panel approximately [**100 sq. ft. (9.3 sq. m)**] in the location indicated or, if not indicated, as directed by the Owner.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Form Liners: Store form liners under cover to protect from sunlight.

- B. Insulating Concrete Forms: Store forms off ground and under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.
- C. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with **ACI 301 (ACI 301M)**, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
 - 1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
 - 2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.
 - a. For architectural concrete specified in Section 033300 "Architectural Concrete," limit deflection of form-facing material, studs, and walers to 0.0025 times their respective clear spans (L/400).
- B. Design, engineer, erect, shore, brace, and maintain insulating concrete forms in accordance with **ACI 301 (ACI 301M)**, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
 - 1. Design cross ties to transfer the effects of the following loads to the cast-in-place concrete core:
 - a. Wind Loads: As indicated on Drawings.
 - 1) Horizontal Deflection Limit: Not more than **[1/240][1/360][1/600][1/720]** of the wall height.

2.2 FORM-FACING MATERIALS

- A. As-Cast Surface Form-Facing Material:
 - 1. Provide continuous, true, and smooth concrete surfaces.
 - 2. Furnish in largest practicable sizes to minimize number of joints.
 - 3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-in-Place Concrete, and as follows:
 - a. Plywood, metal, or other approved panel materials.
 - b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - 1) APA HDO (high-density overlay).
 - 2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
 - 3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.

4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.

- B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
 - 1. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces **[with gradual or abrupt irregularities][without spiral or vertical seams]** not exceeding specified formwork surface class.
 - 1. Provide forms with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation, with **[straight][or][tapered]** end forms.
- E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

2.3 FORM LINERS

- A. Form Liners: Architectural finish pattern on the concrete surface can be achieved by attaching form liners to the inside faces of form-facing materials.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Architectural Polymers, Inc.]**
 - b. **[Fitzgerald Formliners]**
 - c. **[Sika Corporation]**
 - d. **[Spec Formliners, Inc.]**
 - 2. Face Pattern:
[Smooth][Ribbed][Textured][Reveal][Geometric][Stone][Brick][Block][Rock][Wood][Custom].

2.4 INSULATING CONCRETE FORMS

- A. Insulating Concrete Forms: Concrete-forming system complying with ASTM E2634, consisting of two panels of insulation connected with cross ties.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Alleguard (formerly Amvic Building System)]**
 - b. **[BuildBlock Building Systems, LLC]**
 - c. **[Fox Blocks; Airlite Plastics Co.]**

- d. [Nudura Corporation]
 - e. [Nudura, part of Tremco CPG]
2. Insulation: ASTM C578, Type II, expanded polystyrene.
- a. Thickness: Not less than **[2-1/2 inches (64 mm)]** each face.
 - b. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1) Flame-Spread Index: 25 or less.
 - 2) Smoke-Developed Index: 450 or less.
3. Cross Ties: Polypropylene, with integral reinforcement supports, designed to allow passage of concrete during placement.
4. Core Thickness: **[4 inches (100 mm)][6 inches (150 mm)][8 inches (201 mm)][10 inches (254 mm)][12 inches (305 mm)]**.

2.5 WATERSTOPS

- A. Flexible Rubber Waterstops: U.S. Army Corps of Engineers' CE CRD-C 513, **[with factory-installed metal eyelets,** for embedding in concrete to prevent passage of fluids through joints, with factory-fabricated corners, intersections, and directional changes.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Williams Products, Inc.]**
 - 2. Profile: **[Flat dumbbell with center bulb][Flat dumbbell without center bulb][Ribbed with center bulb][Ribbed without center bulb][As indicated].**
 - 3. Dimensions: **[4 by 3/16 inch thick (100 by 4.8 mm thick)][6 by 3/8 inch thick (150 by 10 mm thick)][9 by 3/8 inch thick (225 by 10 mm thick)];** nontapered.
- B. Chemically Resistant Flexible Waterstops: Thermoplastic elastomer rubber waterstops **[with factory-installed metal eyelets]**, for embedding in concrete to prevent passage of fluids through joints; resistant to oils, solvents, and chemicals, with factory-fabricated corners, intersections, and directional changes.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[J P Specialties, Inc.]**
 - b. **[Sika Corporation]**
 - 2. Profile: **[Flat dumbbell with center bulb][Flat dumbbell without center bulb][Ribbed with center bulb][Ribbed without center bulb][As indicated].**
 - 3. Dimensions: **[4 by 3/16 inch thick (100 by 4.8 mm thick)][6 by 3/16 inch thick (150 by 4.8 mm thick)][6 by 3/8 inch thick (150 by 10 mm thick)][9 by 3/16 inch thick**

(225 by 4.8 mm thick)][9 by 3/8 inch thick (225 by 10 mm thick)]; nontapered.

- C. Flexible PVC Waterstops: U.S. Army Corps of Engineers' CE CRD-C 572, **[with factory-installed metal eyelets,]** for embedding in concrete to prevent passage of fluids through joints, with factory-fabricated corners, intersections, and directional changes.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[BoMetals, Inc.]**
 - b. **[Sika Corporation]**
 - c. **[Vinylex Waterstop & Accessories]**
 2. Profile: **[Flat dumbbell with center bulb][Flat dumbbell without center bulb][Ribbed with center bulb][Ribbed without center bulb][As indicated].**
 3. Dimensions: **[4 by 3/16 inch thick (100 by 4.8 mm thick)][6 by 3/8 inch thick (150 by 10 mm thick)][9 by 3/8 inch thick (225 by 10 mm thick)]; nontapered.**
- D. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, **3/4 by 1 inch (19 by 25 mm).**
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Carlisle Coatings & Waterproofing Inc]**
 - b. **[CETCO is a subsidiary of Minerals Technologies Inc.]**
 - c. **[Concrete Sealants Inc.]**
 - d. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - e. **[J P Specialties, Inc.]**
 - f. **[Sika Corporation]**
- E. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, **3/8 by 3/4 inch (10 by 19 mm).**
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[CETCO is a subsidiary of Minerals Technologies Inc.]**
 - b. **[GCP Applied Technologies Inc.]**
 - c. **[Kryton International, Inc.]**
 - d. **[OCM, Inc.]**
 - e. **[Sika Corporation]**

2.6 RELATED MATERIALS

- A. Reglets: Fabricate reglets of not less than **0.022-inch- (0.55-mm-)** thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- B. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than **0.034 inch (0.85 mm)** thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, **3/4 by 3/4 inch (19 by 19 mm)**, minimum.
- D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
 - 2. Form release agent for form liners to be acceptable to form liner manufacturer.
- F. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that leave no corrodible metal closer than **1 inch (25 mm)** to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, leave holes no larger than **1 inch (25 mm)** in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.
- G. Sealant: One-part moisture cure silicone sealant used with form liners.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

- A. Comply with **ACI 301 (ACI 301M)**.
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of **ACI 117 (ACI 117M)** and to comply with the Surface Finish designations specified in Section 033000 "Cast-in-Place Concrete" for as-cast finishes[.] **and Section 033300 "Architectural Concrete."**
- C. Limit concrete surface irregularities as follows:
 - 1. Surface Finish-1.0: **ACI 117 (ACI 117M)** Class D, **1 inch (25 mm)**.
 - 2. Surface Finish-2.0: **ACI 117 (ACI 117M)** Class B, **1/4 inch (6 mm)**.
 - 3. Surface Finish-3.0: **ACI 117 (ACI 117M)** Class A, **1/8 inch (3.0 mm)**.
- D. Construct forms tight enough to prevent loss of concrete mortar.
 - 1. Minimize joints.
 - 2. Exposed Concrete: Symmetrically align joints in forms.

- E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
 - 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
 - 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 - 3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- F. Do not use rust-stained, steel, form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
 - 1. Provide and secure units to support screed strips
 - 2. Use strike-off templates or compacting-type screeds.
- H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
 - 1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 - 2. Locate temporary openings in forms at inconspicuous locations.
- I. **[Chamfer][Do not chamfer]** exterior corners and edges of permanently exposed concrete.
- J. At construction joints, overlap forms onto previously placed concrete not less than **12 inches (305 mm)**.
- K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
 - 1. Determine sizes and locations from trades providing such items.
- L. Form Liners: Install per manufacturer's written installation instructions and recommended tolerances.
- M. Construction and Movement Joints:
 - 1. Construct joints true to line with faces perpendicular to surface plane of concrete.
 - 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as directed by the Owner.
 - 3. Place joints perpendicular to main reinforcement.
 - 4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
 - a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 6. Space vertical joints in walls **[as indicated on Drawings]**.
 - a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
- N. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
 - 1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.

2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- O. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- P. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- Q. Coat contact surfaces of forms with form-release agent, in accordance with manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
 5. Clean embedded items immediately prior to concrete placement.

3.3 INSTALLATION OF WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm.
 1. Install in longest lengths practicable.
 2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
 3. Allow clearance between waterstop and reinforcing steel of not less than 2 times the largest concrete aggregate size specified in Section 033000 "Cast-in-Place Concrete."
 4. Secure waterstops in correct position at **12 inches (305 mm)** o.c.
 5. Field fabricate joints in accordance with manufacturer's written instructions using heat welding.
 - a. Miter corners, intersections, and directional changes in waterstops.
 - b. Align center bulbs.
 6. Clean waterstops immediately prior to placement of concrete.
 7. Support and protect exposed waterstops during progress of the Work.
- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated on Drawings, in accordance with manufacturer's written instructions, by adhesive bonding, mechanically fastening, and firmly pressing into place.
 1. Install in longest lengths practicable.
 2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
 3. Protect exposed waterstops during progress of the Work.

3.4 INSTALLATION OF INSULATING CONCRETE FORMS

- A. Comply with **ACI 301 (ACI 301M)** and manufacturer's written instructions.
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of **ACI 117 (ACI 117M)**.
- C. Install forms in running bond pattern.
 - 1. Align joints.
 - 2. Align furring strips.
- D. Construct forms tight to prevent loss of concrete mortar.
- E. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
 - 1. Determine sizes and locations from trades providing such items.
- F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
 - 1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 - 2. Close temporary ports and openings with tight fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- G. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- H. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- I. Shore insulating concrete forms to ensure stability and to resist stressing imposed by construction loads.

3.5 REMOVING AND REUSING FORMS

- A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than **50 deg F (10 deg C)** for **[24]** hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved[**at least 70 percent of**] its 28-day design compressive strength.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work.
 - 1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
 - 2. Apply new form-release agent.

- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
 - 1. Align and secure joints to avoid offsets.
 - 2. Do not use patched forms for exposed concrete surfaces unless approved by the Owner.

3.6 INSTALLATION OF SHORING AND RESHORING

- A. Comply with **ACI 318 (ACI 318M)** and **ACI 301 (ACI 301M)** for design, installation, and removal of shoring and reshoring.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.7 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a **[special inspector][and][qualified testing and inspecting agency]** to perform field tests and inspections and prepare test reports.
- B. Testing Agency: **[the Owner][Engage]** a qualified testing agency to perform tests and inspections.
- C. Inspections:
 - 1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
 - 2. Inspect insulating concrete forms for shape, location, and dimensions of the concrete member being formed.
- D. Prepare test and inspection reports.

END OF SECTION 03 10 00 00

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Task	Specification	Specification Description
03 11 00 00	03 10 00 00	Concrete Forming and Accessories
03 11 13 00	01 11 19 00	No Specification Required
03 11 13 00	03 10 00 00	Concrete Forming and Accessories
03 11 13 00	03 30 00 00	Cast-In-Place Concrete



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SECTION 03 11 16 00 - ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Form-facing materials.
2. Concrete materials.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for concrete that apply to architectural concrete.
2. Section 033543 "Polished Concrete Finishing" for concrete polishing.

1.2 DEFINITIONS

- A. Aggregate Exposure: Projection of coarse aggregate from matrix or mortar after completion of exposure operations.
- B. Cast-in-Place Architectural Concrete: Concrete that is exposed to view, is designated as architectural concrete, and that requires special concrete materials, formwork, placement, or finishes to obtain specified architectural appearance.
- C. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- D. Design Reference Sample: Sample designated, as directed by the Owner in the Contract Documents that reflects acceptable surface quality and appearance of cast-in-place architectural concrete.
- E. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **[Project site]**.

1. Require representatives of each entity directly concerned with cast-in-place architectural concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Cast-in-place architectural concrete Subcontractor.
2. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction joints, control joints, isolation joints, and joint-filler strips.

- c. Reinforcement accessory installation.
- d. Cold- and hot-weather concreting procedures.
- e. Concrete finishes and finishing.
- f. Curing procedures.
- g. Forms and form-removal limitations.
- h. Shoring and reshoring procedures.
- i. Concrete repair procedures.
- j. Protection of cast-in-place architectural concrete.
- k. Initial curing and field curing of field test cylinders (ASTM C31/C31M).
- l. Protection of field-cured field test cylinders.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following:

- 1. Form-facing panels.
- 2. Form liners.
- 3. Form joint tape.
- 4. Form joint sealant.
- 5. Wood sealer.
- 6. Form-release agent.
- 7. Surface retarder.
- 8. Form ties.
- 9. Bar supports.
- 10. Portland cement.
- 11. Fly ash.
- 12. Slag cement.
- 13. Blended hydraulic cement.
- 14. Natural or other pozzolans.
- 15. Silica fume.
- 16. Performance-based hydraulic cement.
- 17. Aggregates.
- 18. Admixtures:
 - a. Include limitations of use.
- 19. Color pigments.
- 20. Repair materials.

B. Sustainable Design Submittals:

- 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- 2. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
- 3. Health Product Declaration (HPD): Provide documentation confirming product compliance with one of the following:
 - a. Inventory or HPD to at least 0.01 percent by weight with no GreenScreen LT-1 or GHS Category 1 hazards.
 - b. Inventory or HPD to at least 0.01 percent by weight, with at least 75 percent assessed using GreenScreen Benchmark assessment.
 - c. Third-party-verified Declare product label, designated "Red List Free."

- d. Material Health Certificate or Cradle to Cradle certification with minimum Bronze level of Material Health.
- C. Design Mixtures: For each concrete mixture, include the following:
- 1. Mixture identification.
 - 2. Minimum 28-day compressive strength.
 - 3. Durability exposure class.
 - 4. Maximum w/cm.
 - 5. Calculated equilibrium unit weight, for lightweight concrete.
 - 6. Slump limit.
 - 7. Air content.
 - 8. Nominal maximum aggregate size.
 - 9. Steel-fiber reinforcement content.
 - 10. Synthetic microfiber content.
 - 11. Amounts of mixing water to be withheld for later addition at Project site if permitted.
 - 12. Intended placement method.
 - 13. Alternative design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- D. Shop Drawings:
- 1. Formwork: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.
 - a. Show formwork construction, including form-liner layout, form-liner termination details, dimensioned locations of form-facing material joints, rustications, construction and contraction joints, form joint-sealant details, form-tie locations and patterns, inserts and embedments, cutouts, cleanout panels, and other items that visually affect cast-in-place architectural concrete.
 - 1) Included separate layout for formwork used in **[field sample panels][and][mockups]**.
 - 2) Indicate proposed schedule and sequence of stripping of forms, shoring removal, and reshoring installation and removal.
 - 3) Location of construction joints as directed by the Owner.
- E. Samples: For each of the following materials:
- 1. Form-facing panels.
 - 2. Form ties.
 - 3. Form liners, **12-by-12-inch (305-by-305-mm)** Sample, indicating texture.
 - 4. Manufacturer's standard colors for color pigment.
 - 5. Exposed aggregates.
 - 6. Chamfers and rustications.
- F. Samples for Verification: Architectural concrete Samples, cast vertically, approximately **18 by 18 by 2 inches (450 by 450 by 50 mm)**, of finishes, colors, and textures to match design reference sample. Include Sample sets showing the full range of variations expected in these characteristics.
- G. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:
- 1. Concrete Class designation.
 - 2. Location within Project.
 - 3. Exposure Class designation.

4. Formed Surface Finish designation and final finish.
5. Curing process.

H. Placement Schedule: Submit before start of placement operations.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.

B. Material Certificates: For each of the following:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Repair materials.

C. Material Test Reports: For the following, by a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Silica fume.
6. Performance-based hydraulic cement.
7. Aggregates[: **Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity**].

D. Research Reports: For concrete admixtures in accordance with ICC AC198.

E. Preconstruction Test Reports: For each mix design.

F. Concrete Repair: Submit a written, detailed description of materials, methods, equipment, and sequence of operations to be used for repairing architectural concrete, including protection of surrounding materials and Project site.

1. If materials and methods other than those indicated are proposed for any repairs to architectural concrete, add a written description of such materials and methods, including evidence of successful use on comparable projects, and demonstrations to show their effectiveness for this Project and Installer's ability to use such materials and methods properly.

G. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete

Production Facilities."

- B. Installer Qualifications: An experienced cast-in-place architectural concrete installer, as evidenced by not less than five consecutive years' experience, specializing in installing cast-in-place architectural concrete similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
1. Provide written evidence of qualifications and experience.
 2. Include locations, descriptions, and photographs of completed projects, substantiating the quality of the installer's experience, as directed by the Owner.
- C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Technical Manager.
1. Personnel performing laboratory tests to be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Level I.
 2. Testing agency laboratory supervisor to be an ACI-certified Concrete Laboratory Testing Technician, Level II.
- D. Field Sample Panels: After approval of verification sample and before casting architectural concrete, produce field sample panels to demonstrate the approved range of selections made under Sample submittals. Produce a minimum of three sets of full-scale panels, cast vertically, approximately **48 by 48 by 6 inches (1200 by 1200 by 150 mm)** minimum, to demonstrate the expected range of finish, color, and texture variations.
1. Locate panels as indicated or, if not indicated, as directed by the Owner.
 2. Demonstrate methods of curing, aggregate exposure, wood sealers, and coatings, as applicable.
 3. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate materials and techniques proposed for repair of tie holes and surface blemishes to match adjacent undamaged surfaces, as directed by the Owner.
 4. Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
 5. Demolish and remove field sample panels when directed.
- E. Mockups: Before casting architectural concrete, build mockups, using the same procedures, equipment, materials, finishing procedures, and curing procedures that will be used for producing architectural concrete, to verify selections made under Sample submittals and to demonstrate typical joints, surface finish, color, texture, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in the location and of the size indicated or, if not indicated, as directed by the Owner.
 2. Build mockups of typical wall of cast-in-place architectural concrete as shown on Drawings, including vertical and horizontal rustication joints, and any sculptured features.
 3. Construct mockups to include at least two lifts having heights equal to those anticipated for construction.
 4. Demonstrate curing, cleaning, and protecting of cast-in-place architectural concrete, finishes, and contraction joints, as applicable.
 5. Damage part of the exposed-face surface for each finish, color, and texture, and demonstrate materials and techniques proposed for repair to match adjacent undamaged surfaces, as directed by the Owner.
 6. Demonstrate materials and techniques proposed for repair of tie holes and surface blemishes to match adjacent undamaged surfaces, as directed by the Owner.
 7. Approval of mockups before casting architectural concrete, as directed by the Owner.
 8. Subject to compliance with requirements, approved mockups may become part of the completed

Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.
 - 1. Include the following information in each test report:
 - a. Admixture dosage rates.
 - b. Slump.
 - c. Air content.
 - d. Seven-day compressive strength.
 - e. 28-day compressive strength.
 - f. Permeability.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM C94/C94M and **ACI 301 (ACI 301M)**.

1.9 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with Section 033000 "Cast-in-Place Concrete."
- B. Hot-Weather Placement: Comply with Section 033000 "Cast-in-Place Concrete."

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with **ACI 301 (ACI 301M)** unless modified by requirements in the Contract Documents.

2.2 FORM-FACING MATERIALS

- A. Comply with Section 031000 "Concrete Forming and Accessories" for formwork and other form-facing material requirements, and as specified in this Section.
- B. Source Limitations: Obtain each type of form-facing material from single source from single manufacturer.
- C. Form-Facing Panels:
 - 1. Finishes: **[As cast][or][exposed aggregate]**.
 - a. Steel- and glass-fiber-reinforced plastic, or other approved nonabsorptive panel materials that provide continuous, true, and smooth architectural concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

- b. Exterior-grade plywood panels, nonabsorptive, that will provide continuous, true, and smooth architectural concrete surfaces, **[high-density overlay, Class 1, or better][medium-density overlay, Class 1, or better, mill-applied release agent and edge sealed]**, complying with DOC PS 1[, or Finnish phenolic overlaid birch plywood].
- D. Form Liners: Units of face design, texture, arrangement, and configuration **[indicated][to match design reference sample]**. Furnish with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent surface treatments and finishes of concrete.
- E. Rustication Strips: Metal[, **dressed wood**,] or rigid plastic, with sides beveled and back kerfed; nonstaining; in longest practicable lengths.
- F. Chamfer Strips: Metal, rigid plastic, elastomeric rubber, or dressed wood, **3/4 by 3/4 inch (19 by 19 mm)**, minimum; nonstaining; in longest practicable lengths.
- G. Form Joint Tape: Compressible foam tape; pressure sensitive; AAMA 800; minimum **1/4 inch (6 mm)** thick.
- H. Form Joint Sealant: Elastomeric sealant complying with ASTM C920, Type M or Type S, Grade NS, that adheres to form joint substrates, does not stain, does not adversely affect concrete surfaces, and does not impair subsequent treatments and finishes of concrete surfaces.
- I. Wood Sealer: Penetrating, clear, polyurethane wood sealer formulated to reduce absorption of bleed water and prevent migration of set-retarding chemicals from wood and does not stain, does not adversely affect concrete surfaces, and does not impair subsequent treatments and finishes of concrete surfaces.
- J. Form-Release Agent: Commercially formulated, colorless form-release agent that does not bond with, stain, or adversely affect architectural concrete surfaces and will not impair subsequent treatments and finishes of architectural concrete surfaces.
 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
 2. Form-release agent for form liners to be acceptable to form-liner manufacturer.
- K. Surface Retarder: Water-soluble chemical liquid set retarder, for application on form-facing materials, capable of temporarily delaying final hardening of newly placed architectural concrete surface to depth of aggregate exposure specified.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - b. **[Master Builders Solutions]**
 - c. **[W. R. Meadows, Inc]**
 2. Source Limitations: Obtain surface retarder from single source from single manufacturer.
- L. Form Ties: Factory-fabricated, **[glass-fiber-reinforced plastic][internally disconnecting][or][removable]** ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 1. Furnish ties **[with tapered tie cone spreaders]** that, when removed, will leave holes no larger

than **[3/4 inch (19 mm)][1 inch (25 mm)][1-1/4 inches (32 mm)][1-1/2 inches (38 mm)]** in diameter on architectural concrete surface.

2. Furnish internally disconnecting ties that will leave no metal closer than **1-1/2 inches (38 mm)**, **after exposing aggregate**,] from architectural concrete surface.
3. Furnish glass-fiber-reinforced plastic ties, not less than **1/2 inch (13 mm)** and not more than **1 inch (25 mm)** in diameter, of color, as directed by the Owner
4. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire fabric in place.
 1. Manufacture bar supports in accordance with CRSI's "Manual of Standard Practice."
 2. Where legs of wire bar supports contact forms, use **[gray, all-plastic][CRSI Class 1, gray, plastic-protected][or][CRSI Class 2, stainless steel]** bar supports.

2.4 CONCRETE MATERIALS

- A. Regional Materials: Concrete shall be manufactured within **100 miles (160 km)** of Project site from aggregates **[and cementitious materials]** that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- B. Indigenous Materials: Concrete shall be manufactured within **500 miles (800 km)** of Project site from aggregates **[and cementitious materials]** that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- C. Cementitious Materials:
 1. Portland Cement: ASTM C150/C150M, **[Type I][Type II][Type III], [gray][white]**.
 2. Pozzolans: **[ASTM C618, Class C][ASTM C618, Class F][ASTM C618, Class N][Not allowed]**.
 3. Slag Cement: **[ASTM C989/C989M, Grade 100 or Grade 120][Not allowed]**.
 4. Silica Fume: **[ASTM C1240][Not allowed]**.
- D. Normal-Weight Aggregates: ASTM C33/C33M, **[Class 5S][Class 5M][Class 1N]** coarse aggregate or better, graded. Provide aggregates from single source from single manufacturer.
 1. Alkali-Silica Reaction: Comply with one of the following:
 - a. Expansion Result of Aggregate: Not more than 0.04 percent at one year when tested in accordance with ASTM C1293.
 - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at 16 days when tested in accordance with ASTM C1567.
 - c. Alkali Content in Concrete: Not more than **4 lb./cu. yd. (2.37 kg/cu. m)** for moderately reactive aggregate or **3 lb./cu. yd. (1.78 kg/cu. m)** for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with **ACI 301 (ACI 301M)**.
 2. Maximum Coarse-Aggregate Size: **[1 inch (25 mm)][3/4 inch (19 mm)][1/2 inch (13 mm)][3/8 inch (10 mm)]**.
 3. Gradation: **[Uniformly][Gap]** graded.

- E. Normal-Weight Fine Aggregate: **[ASTM C33/C33M][or][ASTM C144]**, manufactured or natural sand, free of materials with deleterious reactivity to alkali in cement, from same source for entire Project.
- F. Air-Entraining Admixture: As specified in Section 033000 "Cast-in-Place Concrete."
- G. Chemical Admixtures: As specified in Section 033000 "Cast-in-Place Concrete," and certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
- H. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, **[free of carbon black,]** nonfading, and resistant to lime and other alkalis.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Alabama Pigments Company, LLC]**
 - b. **[Bon Tool Co.]**
 - c. **[Brickform; a division of Solomon Colors]**
 - d. **[Butterfield Color, Inc.]**
 - e. **[Dynamic Color Solutions, Inc]**
 - f. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - g. **[Hoover Color Corporation]**
 - h. **[Lambert Corporation]**
 - i. **[Lanxess Corporation]**
 - j. **[Master Builders Solutions]**
 - k. **[Matcrete Inc.]**
 - l. **[NewLook International, Inc.]**
 - m. **[Proline Concrete Tools, Inc.]**
 - n. **[QC Construction Products]**
 - o. **[Scofield, a Business Unit of Sika Corporation]**
 - p. **[Solomon Colors Inc.]**
 - q. **[Stampcrete International, Ltd]**
 - r. **[SureCrete Design Products, a Fenix Group SPC Company]**
 - s. **[Venator Materials PLC]**
 - 2. Source Limitations: Obtain color pigment from single source from single manufacturer.
 - 3. Color: **[As indicated by manufacturer's designation][as directed by the Owner].**
- I. Water and Water Used to Make Ice: ASTM C94/C94M, potable **[or][complying with ASTM C1602/C1602M, including all limits listed in Table 2 and requirements of paragraph 5.4].**

2.5 CURING MATERIALS

- A. Comply with Section 0330000 "Cast-in-Place Concrete."
 - 1. For integrally colored concrete, curing materials to be approved by color pigment manufacturer.
 - 2. For concrete indicated to be sealed, curing materials to be compatible with sealer.

2.6 REPAIR MATERIALS

- A. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- B. Epoxy Bonding Adhesive: ASTM C881/C881M two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements.
 - 1. **[Types I and II, non-load bearing][Types IV and V, load bearing]**, for bonding hardened or freshly mixed concrete to hardened concrete.

2.7 CONCRETE MIXTURES, GENERAL

- A. Obtain each color, size, type, and variety of concrete mixture from single manufacturer with resources to provide cast-in-place architectural concrete of consistent quality in appearance and physical properties.
- B. Prepare design mixtures for each type and strength of cast-in-place architectural concrete proportioned on basis of laboratory trial mixture or field test data, or both, in accordance with **ACI 301 (ACI 301M)**.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs, based on laboratory trial mixtures.
- C. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash or Other Pozzolans: 25 percent by mass.
 - 2. Slag Cement: 50 percent by mass.
 - 3. Silica Fume: 10 percent by mass.
 - 4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
 - 5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
- D. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
- E. Color Pigment: Add color pigment to concrete mixture in accordance with manufacturer's written instructions and to result in hardened concrete color consistent with approved **[design reference sample][field sample panels][mockups]**.

2.8 CONCRETE MIXTURES

- A. Class:
 - 1. Normal-Weight Concrete: **[K]**.
 - 2. Exposure Class: **ACI 318 (ACI 318M) [F0][F1][F2][F3][S0][S1][S2][S3][W0][W1][C0][C1][C2]**.
 - 3. Minimum Compressive Strength: **[5000 psi (34.5 MPa)][4500 psi (31 MPa)][4000 psi (27.6 MPa)][3500 psi (24.1 MPa)][3000 psi (20.7 MPa)][As indicated]** at 28 days.
 - 4. Maximum w/cm: 0.46.
 - 5. Slump Limit: **[3 inches (75 mm), plus or minus 1 inch (25 mm)][4 inches (100 mm), plus or minus 1 inch (25 mm)][8 inches (200 mm), plus or minus 1 inch (25 mm)]** for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing

- admixture or plasticizing admixture at Project site].**
6. Slump Flow Limit: **[22 inches (550 mm), plus or minus 1.5 inches (40 mm)][30 inches (762 mm), plus or minus 2.5 inches (65 mm)].**
 7. Air Content:
 - a. Exposure Class F1: **[5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch (25-mm) nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch (38-mm) nominal maximum aggregate size].**
 - b. Exposure Classes F2 and F3: **[6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size][6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch (25-mm) nominal maximum aggregate size][5.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch (38-mm) nominal maximum aggregate size].**
 8. Limit water-soluble, chloride-ion content in hardened concrete to **[1.00][0.30][0.15]** percent by weight of cement.

2.9 CONCRETE MIXING

A. Architectural Concrete:

1. **[Ready mixed][or][project-site mixed].** Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M[**and ASTM C1116/C1116M**], and furnish batch ticket information.
 - a. Clean equipment used to mix and deliver cast-in-place architectural concrete to prevent contamination from other concrete.
 - b. For mixer capacity of **1 cu. yd. (0.76 cu. m)** or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
 - c. For mixer capacity larger than **1 cu. yd. (0.76 cu. m)**, increase mixing time by 15 seconds for each additional **1 cu. yd. (0.76 cu. m)**.
 - d. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

- A. Comply with Section 031000 "Concrete Forming and Accessories" for formwork, embedded items, and shoring and reshoring, and as specified in this Section.
- B. Limit deflection of form-facing panels to not exceed **ACI 301 (ACI 301M)** requirements.
- C. Limit cast-in-place architectural concrete surface irregularities, as follows:
 1. Surface Finish-1.0: **ACI 117 (ACI 117M)** Class D, **1 inch (25 mm)**.
 2. Surface Finish-2.0: **ACI 117 (ACI 117M)** Class B, **1/4 inch (6 mm)**.
 3. Surface Finish-3.0: **ACI 117 (ACI 117M)** Class A, **1/8 inch (3.0 mm)**.

- D. Construct forms to result in cast-in-place architectural concrete that complies with **ACI 117 (ACI 117M)**.
- E. Seal form joints, chamfers, rustication joints, and penetrations at form ties with form joint tape or form joint sealant to prevent cement paste leakage.
 - 1. Provide closure backing materials if indented rustication is used over a ribbed form line, and seal joint between rustication strip and form with joint sealant.
- F. **[Chamfer][Do not chamfer]** exterior corners and edges of cast-in-place architectural concrete.
- G. Coat contact surfaces of wood rustications and chamfer strips with wood sealer before placing reinforcement, anchoring devices, and embedded items.
- H. Coat contact surfaces of forms with form-release agent, in accordance with manufacturer's written instructions, before placing reinforcement, anchoring devices, and embedded items.
- I. Coat contact surfaces of forms with surface retarder, in accordance with manufacturer's written instructions, before placing reinforcement, anchoring devices, and embedded items.
- J. Place form liners accurately to provide finished surface texture indicated.
 - 1. Provide solid backing and attach securely to prevent deflection and maintain stability of liners during concreting.
 - 2. Secure form liners in place using fasteners that will not transfer impressions onto surface of concrete.
 - 3. Prevent form liners from sagging and stretching in hot weather.
 - 4. Seal joints of form liners and form-liner accessories to prevent mortar leaks.
 - 5. Coat form liner with form-release agent.

3.2 INSTALLATION OF REINFORCEMENT AND ACCESSORIES

- A. Comply with Section 032000 "Concrete Reinforcing" for fabricating and installing steel reinforcement and accessories.

3.3 REMOVING AND REUSING FORMS

- A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than **50 deg F (10 deg C)** for **[24]** hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
 - 1. Schedule form removal to maintain surface appearance that matches approved **[design reference sample][field sample panels][mockups]**.
 - 2. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved **[at least 70 percent of]** its 28-day design compressive strength.
 - 3. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
 - 4. Cut off and grind glass-fiber-reinforced plastic form ties flush with surface of concrete.
- B. Clean and repair surfaces of forms to be reused in the Work.

1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
 2. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
1. Align and secure joints to avoid offsets.
 2. Do not use patched forms for cast-in-place architectural concrete surfaces.

3.4 JOINTS

- A. Construction Joints: Install construction joints true to line, with faces perpendicular to surface plane of cast-in-place architectural concrete, so strength and appearance of concrete are not impaired, at locations indicated as directed by the Owner.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.
 2. Form keyed joints as indicated. [**Embed keys at least 1-1/2 inches (38 mm) into concrete.**] Align construction joint within rustications attached to form-facing material.
 3. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at top of footings or floor slabs.
 5. Space vertical joints in walls [**as indicated on Drawings**]. Unless otherwise indicated on Drawings, locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 6. Use [**bonding agent**] [**epoxy-bonding adhesive**] at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- B. Contraction Joints: Form weakened-plane contraction joints true to line, with faces perpendicular to surface plane of cast-in-place architectural concrete, so strength and appearance of concrete are not impaired, at locations indicated on Drawings, as directed by the Owner.

3.5 CONCRETE PLACEMENT

- A. Comply with Section 033000 "Cast-in-Place Concrete."

3.6 FINISHING FORMED SURFACES

- A. Comply with Section 033000 "Cast-in-Place Concrete."
- B. Architectural Concrete Finish: Match design reference sample, identified and described as indicated, as directed by the Owner.
- C. As-Cast Surface Finishes: Comply with Section 033000 "Cast-in-Place Concrete" for the following:
1. **ACI 301 (ACI 301M)** Surface Finish-1.0 (SF-1.0).
 2. **ACI 301 (ACI 301M)** Surface Finish-2.0 (SF-2.0).
 3. **ACI 301 (ACI 301M)** Surface Finish-3.0 (SF-3.0).
- D. Final Concrete Finish: Comply with Section 033000 "Cast-in-Place Concrete" for the following:

1. Smooth-rubbed finish.
2. Grout-cleaned rubbed finish.
3. Cork-floated finish.
4. Abrasive-blast finish.
5. Scrubbed finish.
6. High-pressure water-jet finish.
7. Bushhammer finish.

- E. Form-Liner Finish: Produce a textured surface free of pockets, streaks, and honeycombs, and of uniform appearance, color, and texture.
- F. Maintain uniformity of architectural concrete finishes over construction joints unless otherwise indicated.

3.7 CONCRETE CURING

- A. Comply with Section 033000 "Cast-in-Place Concrete" using identical curing procedures to that used for **[field sample panels][mockups]**.

3.8 REPAIR

- A. Comply with **ACI 301 (ACI 301M)**.
- B. Repair damaged finished surfaces of cast-in-place architectural concrete when repairing, as directed by the Owner.
- C. Match repairs to color, texture, and uniformity of surrounding surfaces and to repairs on approved **[field sample panels][mockups]**.
- D. Remove and replace cast-in-place architectural concrete that cannot be repaired, as directed by the Owner.

3.9 FIELD QUALITY CONTROL

- A. Comply with Section 033000 "Cast-in-Place Concrete."

3.10 CLEANING

- A. Clean cast-in-place architectural concrete surfaces after finish treatment to remove stains, markings, dust, and debris.
- B. Wash and rinse surfaces in accordance with concrete finish applicator's written instructions.
1. Protect other Work from staining or damage due to cleaning operations.
 2. Do not use cleaning materials or processes that could change the appearance of cast-in-place architectural concrete finishes.

3.11 PROTECTION

- A. Protect corners, edges, and surfaces of cast-in-place architectural concrete from damage; use guards

and barricades.

- B. Protect cast-in-place architectural concrete from staining, laitance, and contamination during remainder of construction period.

3.12 FINAL ACCEPTANCE

- A. Final acceptance of completed architectural concrete Work by comparing approved [**design reference sample**][**field sample panels**][**mockups**] with installed Work, when viewed at a distance of [**20 feet (6 m)**], as directed by the Owner.

END OF SECTION 03 11 16 00

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Task	Specification	Specification Description
03 11 16 00	03 10 00 00	Concrete Forming and Accessories
03 11 16 13	03 10 00 00	Concrete Forming and Accessories
03 11 16 13	03 30 00 00	Cast-In-Place Concrete
03 11 16 13	03 11 16 00	Architectural Concrete
03 11 23 00	01 11 19 00	No Specification Required
03 11 23 00	03 10 00 00	Concrete Forming and Accessories
03 11 23 00	03 30 00 00	Cast-In-Place Concrete
03 15 00 00	03 10 00 00	Concrete Forming and Accessories
03 15 13 00	03 10 00 00	Concrete Forming and Accessories
03 15 13 13	03 10 00 00	Concrete Forming and Accessories
03 15 13 13	03 30 00 00	Cast-In-Place Concrete
03 15 13 16	03 10 00 00	Concrete Forming and Accessories
03 15 13 16	03 30 00 00	Cast-In-Place Concrete
03 15 16 00	03 10 00 00	Concrete Forming and Accessories
03 15 16 00	03 30 00 00	Cast-In-Place Concrete
03 15 19 00	03 10 00 00	Concrete Forming and Accessories
03 15 19 00	05 50 00 00	Metal Fabrications



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SECTION 03 20 00 00 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

B. Related Requirements:

1. Section 033816 "Unbonded Post-Tensioned Concrete" for reinforcing related to post-tensioned concrete.
2. Section 034100 "Precast Structural Concrete" for reinforcing used in precast structural concrete.
3. Section 034500 "Precast Architectural Concrete" for reinforcing used in precast architectural concrete.
4. Section 321313 "Concrete Paving" for reinforcing related to concrete pavement and walks.
5. Section 321316 "Decorative Concrete Paving" for reinforcing related to decorative concrete pavement and walks.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **[Project site]**.

1. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction contraction and isolation joints.
 - c. Steel-reinforcement installation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Epoxy repair coating.
3. Zinc repair material.
4. Bar supports.
5. Mechanical splice couplers.
6. Structural thermal break insulated connection system.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.

3. Environmental Product Declaration (EPD): For each product.
4. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
5. Environmental Product Declaration: For each product.
6. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
7. Environmental Product Declaration: For each product.
8. Environmental Product Declaration: For each product.
9. Third-Party Certifications: For each product.
10. Third-Party Certified Life Cycle Assessment: For each product.
11. Type III Environmental Product Declaration (EPD): For each product.
12. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
13. Manufacturer Inventory: For each product, provide manufacturer's manifest of ingredients.

C. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
3. For structural thermal break insulated connection system, indicate general configuration, insulation dimensions, tension bars, compression pads, shear bars, and dimensions.

D. Delegated Design Submittal: For structural thermal break insulated connection system, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For **[delegated design engineer][testing and inspection agency]**.

B. Delegated Design Engineer Qualifications: Include the following:

1. Experience providing delegated design engineering services of the type indicated.
2. Documentation that delegated design engineer is licensed in the **[jurisdiction][state]** in which Project is located.

C. Welding certificates.

1. Reinforcement To Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M.

D. Material Certificates: For each of the following, signed by manufacturers:

1. Epoxy-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."
2. Dual-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."

E. Material Test Reports: For the following, from a qualified testing agency:

1. Steel Reinforcement:
 - a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.

- 2. Mechanical splice couplers.
- F. Field quality-control reports.
- G. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, [**acceptable to authorities having jurisdiction,**] qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.
- C. Mockups: Reinforcing for cast-concrete formed surfaces, to demonstrate tolerances and standard of workmanship.
 - 1. Build panel approximately [**100 sq. ft. (9.3 sq. m) for formed surface**] in the location indicated on Drawings or, if not indicated, as directed by the Owner.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage [**and to avoid damaging coatings on steel reinforcement**].
 - 1. Store reinforcement to avoid contact with earth.
 - 2. Do not allow epoxy-coated reinforcement to be stored outdoors for more than 60 days without being stored under an opaque covering.
 - 3. Do not allow dual-coated reinforcement to be stored outdoors for more than 60 days without being stored under an opaque covering.
 - 4. Do not allow stainless steel reinforcement to come into contact with uncoated reinforcement.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design structural thermal break insulated connection system, including attachment to building construction.
- B. Structural Performance of Structural Thermal Break Insulating Connection System: Structural thermal break insulated connection system to withstand the following loads and stresses:
 - 1. Dead Loads: As indicated on Drawings.
 - a. Shear Load: As indicated on Drawings.
 - b. Bending Moment: As indicated on Drawings.
 - 2. Live Loads: As indicated on Drawings.

- a. Shear Load: As indicated on Drawings.
- b. Bending Moment: As indicated on Drawings.

- C. Seismic Performance of Structural Thermal Break Insulated Connection System: Structural thermal break Insulated connection system to withstand the effects of earthquake motions determined according to [ASCE/SEI 7].

2.2 STEEL REINFORCEMENT

- A. Recycled Content: Provide manufacturer documentation for recycled content, indicating postconsumer and preconsumer recycled content.
 - 1. Regional Materials: Steel shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
 - 2. Regional Materials: Steel shall be manufactured within **500 miles (800 km)** of Project site.
 - 3. Regional Materials: Steel shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
 - 4. Indigenous Materials: Steel shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 - 5. Regional Materials: Steel shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- B. Reinforcing Bars: ASTM A615/A615M, [Grade 60 (Grade 420)][Grade 75 (Grade 520)][Grade 80 (Grade 550)][Grade 100 (Grade 690)], deformed.
- C. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- D. Headed-Steel Reinforcing Bars: ASTM A970/A970M.
- E. Galvanized Reinforcing Bars:
 - 1. Steel Bars: [ASTM A615/A615M, Grade 60 (Grade 420)][ASTM A615/A615M, Grade 75 (Grade 520)][ASTM A615/A615M, Grade 80 (Grade 550)][ASTM A615/A615M, Grade 100 (Grade 690)][ASTM A706/A706M], deformed bars.
 - 2. Zinc Coating: ASTM A767/A767M, [Class I][Class II] zinc coated after fabrication and bending.
- F. Epoxy-Coated Reinforcing Bars:
 - 1. Steel Bars: [ASTM A615/A615M, Grade 60 (Grade 420)][ASTM A615/A615M, Grade 75 (Grade 520)][ASTM A615/A615M, Grade 80 (Grade 550)][ASTM A615/A615M, Grade 100 (Grade 690)][ASTM A706/A706M], deformed bars.
 - 2. Epoxy Coating: [ASTM A775/A775M][or][ASTM A934/A934M] with less than 2 percent damaged coating in each 12-inch (305-mm) bar length.
- G. Dual-Coated Reinforcing Bars: ASTM A1055/A1055M.
 - 1. Steel Bars: [ASTM A615/A615M, Grade 60 (Grade 420)][ASTM A615/A615M, Grade 75 (Grade 520)][ASTM A615/A615M, Grade 80 (Grade 550)][ASTM A615/A615M, Grade 100 (Grade 690)]

- (Grade 690)][ASTM A706/A706M], deformed bars.
- 2. Zinc Coating: ASTM A1055/A1055M [Type I][Type II].
- 3. Epoxy Coating: [ASTM A775/A775M][or][ASTM A934/A934M] with less than 2 percent damaged coating in each 12-inch (300-mm) bar length.
- H. Stainless Steel Reinforcing Bars: ASTM A955/A955M, [Grade 60 (Grade 420)][Grade 75 (Grade 520)], [Type 304][Type 316L], deformed.
- I. Steel Bar Mats: ASTM A184/A184M, fabricated from [ASTM A615/A615M, Grade 60 (Grade 420)][ASTM A615/A615M, Grade 40 (Grade 280)][ASTM A706/A706M], deformed bars, assembled with clips.
- J. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- K. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.
- L. Galvanized-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from galvanized-steel wire into flat sheets.
- M. Epoxy-Coated Welded-Wire Reinforcement: ASTM A884/A884M, Class A coated, Type 1, [plain][deformed] steel.

2.3 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A615/A615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.
- B. Epoxy-Coated Joint Dowel Bars: ASTM A615/A615M, Grade 60 (Grade 420), plain-steel bars, ASTM A775/A775M epoxy coated.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
 - 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
 - b. For epoxy-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
 - c. For dual-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
 - d. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
 - e. For stainless steel reinforcement, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
- D. Mechanical Splice Couplers: ACI 318 (ACI 318M) [Type 1][Type 2], same material of reinforcing bar being spliced; [compression-only type][tension-compression type][dowel-bar type][mechanical-lap type].
- E. Structural Thermal Break Insulated Connection System:

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Halfen USA, Inc.]**
2. Tension Rods: **[Carbon steel with crimped Type 316 stainless steel rods][Carbon steel, welded with ASTM A276/A276M, Type 316 stainless steel].**
3. Shear Reinforcement Rods: **[ASTM A276/A276M, Type 316 stainless steel tube][Carbon steel, welded with ASTM A276/A276M, Type 316 stainless steel bar].**
4. Pressure pads: ASTM A276/A276M, Type 316 stainless steel.
5. Insulation body: Polystyrene.

F. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than **0.0508 inch (1.2908 mm)** in diameter.

1. Finish: **[Plain][Galvanized][ASTM A884/A884M, Class A, Type 1, epoxy coated, with less than 2 percent damaged coating in each 12-inch (305-mm) wire length].**

G. Stainless Steel Tie Wire: ASTM A1022/A1022M, not less than **0.0508 inch (1.2908 mm)** in diameter.

H. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A775/A775M.

I. Zinc Repair Material: ASTM A780/A780M.

2.4 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:

1. Do not cut or puncture vapor retarder.
2. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than **1 inch (25 mm)**, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with **ACI 318 (ACI 318M)**.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or **24 inches (610 mm)**, whichever is greater.
 2. Stagger splices in accordance with **ACI 318 (ACI 318M)**.
 3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
 4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.
- G. Install structural thermal break insulated connection system in accordance with manufacturer's instructions.
- H. Install welded-wire reinforcement in longest practicable lengths.
1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
 - a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed **12 inches (305 mm)**.
 2. Lap edges and ends of adjoining sheets at least one wire spacing plus **2 inches (50 mm)** for plain wire and **8 inches (200 mm)** for deformed wire.
 3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
 4. Lace overlaps with wire.
- I. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating in accordance with ASTM D3963/D3963M.
- J. Dual-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating in accordance with ASTM D3963/D3963M.
- K. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material in accordance with ASTM A780/A780M.

3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as directed by the Owner.
1. Place joints perpendicular to main reinforcement.
 2. Continue reinforcement across construction joints unless otherwise indicated.
 3. Do not continue reinforcement through sides of strip placements of floors and slabs.
- B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.4 INSTALLATION TOLERANCES

- A. Comply with **ACI 117 (ACI 117M)**.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a **[special inspector][and][qualified testing and inspecting agency]** to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
1. Steel-reinforcement placement.
 2. Steel-reinforcement mechanical splice couplers.
 3. Steel-reinforcement welding.
- D. Manufacturer's Inspections: Engage manufacturer of structural thermal break insulated connection system to inspect completed installations prior to placement of concrete, and to provide written report that installation complies with manufacturer's written instructions.

END OF SECTION 03 20 00 00



Task	Specification	Specification Description
03 21 00 00	03 20 00 00	Concrete Reinforcing
03 21 11 00	03 20 00 00	Concrete Reinforcing
03 21 11 00	03 30 00 00	Cast-In-Place Concrete
03 21 13 00	03 20 00 00	Concrete Reinforcing
03 21 16 00	03 20 00 00	Concrete Reinforcing
03 21 16 00	03 30 00 00	Cast-In-Place Concrete
03 22 00 00	03 20 00 00	Concrete Reinforcing
03 22 11 00	03 20 00 00	Concrete Reinforcing
03 22 11 00	03 30 00 00	Cast-In-Place Concrete
03 22 13 00	03 20 00 00	Concrete Reinforcing
03 22 13 00	03 30 00 00	Cast-In-Place Concrete
03 22 16 00	03 20 00 00	Concrete Reinforcing
03 22 16 00	03 30 00 00	Cast-In-Place Concrete



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SECTION 03 30 00 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete standards.
2. Concrete materials.
3. Admixtures.
4. Fiber reinforcement.
5. Vapor retarders.
6. Floor and slab treatments.
7. Liquid floor treatments.
8. Curing materials.
9. Accessories.
10. Repair materials.
11. Concrete mixture materials.
12. Concrete mixture class types.
13. Concrete mixing.

B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
3. Section 033300 "Architectural Concrete" for general building applications of specially finished formed concrete.
4. Section 033543 "Polished Concrete Finishing" for concrete floors scheduled to receive a polished concrete finish.
5. Section 035300 "Concrete Topping" for concrete floor toppings.
6. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.
7. Section 321313 "Concrete Paving" for concrete pavement and walks.
8. Section 321316 "Decorative Concrete Paving" for decorative concrete pavement and walks.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement or blended hydraulic cement alone or in combination with one or more of the following:

1. Fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cementitious Materials (w/cm) Ratio: The ratio by weight of mixing water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **[Project site]**.

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for inspections and acceptance testing of concrete at Project site.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete Subcontractor.
 - e. Special concrete finish Subcontractor.
2. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction joints, control joints, isolation joints, and joint-filler strips.
 - c. Semirigid joint fillers.
 - d. Vapor-retarder installation.
 - e. Anchor rod and anchorage device installation tolerances.
 - f. Cold- and hot-weather concreting procedures.
 - g. Concrete finishes and finishing.
 - h. Curing procedures.
 - i. Forms and form-removal limitations.
 - j. Shoring and reshoring procedures.
 - k. Methods for achieving specified floor and slab flatness and levelness.
 - l. Floor and slab flatness and levelness measurements.
 - m. Concrete repair procedures.
 - n. Concrete protection.
 - o. Initial curing of standard-cured and field curing of field-cured test cylinders (ASTM C31/C31M.)
 - p. Protection of field cured field test cylinders.
 - q. Distribution of test reports.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Portland cement.
2. Blended hydraulic cement.
3. Performance-based hydraulic cement.
4. Fly ash.
5. Slag cement.
6. Silica fume.
7. Natural or other pozzolans.
8. Aggregates.
9. Ground calcium carbonate and aggregate mineral fillers.
10. Admixtures:
 - a. Include limitations of use. Admixtures that do not comply with reference ASTM International requirements must be submitted with test data for approval.
11. Color pigments.
12. Fiber reinforcement.
13. Vapor retarders.
14. Floor and slab treatments.
15. Liquid floor treatments.

16. Curing materials.
 - a. Include documentation from color pigment manufacturer, indicating that proposed methods of curing are recommended by color pigment manufacturer.
17. Joint fillers.
18. Repair materials.
- B. Sustainable Design Submittals:
 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
 3. Laboratory Test Reports: For **[liquid floor treatments][and][curing and sealing compounds]**, indicating compliance with requirements for low-emitting materials.
 4. Health Product Declaration (HPD): Provide documentation confirming product compliance with one of the following:
 - a. Inventory or HPD to at least 0.01 percent by weight with no GreenScreen LT-1 or GHS Category 1 hazards.
 - b. Inventory or HPD to at least 0.01 percent by weight, with at least 75 percent assessed using GreenScreen Benchmark assessment.
 - c. Third-party-verified Declare product label, designated "Red List Free."
 - d. Material Health Certificate or Cradle to Cradle certification with minimum Bronze level of Material Health.
- C. Design Mixtures: For each concrete mixture, include the following:
 1. Mixture identification.
 2. Compressive strength at 28 days or other age as specified.
 3. Compressive strength required at stages of construction.
 4. Durability exposure classes for Exposure Categories F, S, W, and C.
 5. Maximum w/cm ratio.
 6. Calculated equilibrium and fresh density for lightweight concrete.
 7. Slump or slump flow limit.
 8. Air content.
 9. Nominal maximum aggregate size.
 10. Steel-fiber reinforcement content.
 11. Synthetic microfiber content.
 12. Synthetic macrofiber content.
 13. Intended placement method.
 14. Submit adjustments to design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant changes.
- D. Shop Drawings:
 1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
- E. Samples: For **[manufacturer's standard colors for color pigment][vapor retarder]**.
- F. Concrete Schedule: For each location of each class of concrete indicated in "Concrete Mixture Class Types" Article, including the following:

1. Concrete class designation.
2. Location within Project.
3. Exposure class designation.
4. Formed surface finish designation and final finish.
5. Final finish for floors.
6. Floor treatment, if any.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Testing Agency: Include documentation indicating compliance with ASTM E329 or ASTM C1077 and copies of applicable ACI certificates for testing technicians or ACI Concrete Construction Special Inspector - MH, ASCC.

B. Material Certificates: For each of the following:

1. Cementitious materials.
2. Admixtures.
3. Fiber reinforcement.
4. Curing compounds.
5. Floor and slab treatments.
6. Bonding agents.
7. Adhesives.
8. Vapor retarders.
9. Semirigid joint filler.
10. Joint-filler strips.
11. Repair materials.

C. Material Test Reports: For the following:

1. Portland cement.
2. Blended hydraulic cement.
3. Performance-based hydraulic cement.
4. Fly ash.
5. Slag cement.
6. Silica fume.
7. Natural or other pozzolans.
8. Aggregates.
9. Ground calcium carbonate and aggregate mineral filler.
10. Admixtures.

D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances in accordance with ACI 117 and in compliance with **ASTM E1155 (ASTM E1155M)**.

E. Research Reports:

1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder/termite barrier, showing compliance with ICC's Acceptance Criteria AC380.

F. Preconstruction Test Reports: For each mix design.

- G. Field quality-control reports.
- H. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified Installer who employs Project personnel qualified as an ACI-certified Concrete Flatwork Associate and Concrete Flatwork Finisher and a supervisor who is a certified ACI Advanced Concrete Flatwork Finisher/Technician or an ACI Concrete Flatwork Finisher with experience installing and finishing concrete.
 - 1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.
- B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
 - 1. Manufacturer's production facilities and delivery vehicles certified in accordance with NRMCA's certification requirements or equivalent approval by a State DOT.
- C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing that performs duties as directed by the Owner.
 - 1. Personnel performing laboratory tests to be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Level 1. Testing agency laboratory supervisor tests to be an ACI-certified Concrete Laboratory Testing Technician, Level 2.
- D. Field Quality-Control Testing Agency Qualifications: An independent agency, [**acceptable to authorities having jurisdiction,**] qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
 - 1. Personnel conducting field tests on plastic concrete properties are to be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with policies from ACI CPP 610.1 or an equivalent certification program.
- E. Mockups: Cast concrete [**slab-on-ground**][**and**][**formed-surface**] panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship. Provide up to two batches of concrete to demonstrate the number of required mockups.
 - 1. Slab-on-Ground: Build panel in the location indicated or, if not indicated, as directed by the Owner.
 - a. Divide panel into four equal panels to demonstrate saw joint cutting.
 - 2. Formed Surfaces: Build panel in the location indicated or, if not indicated, as directed by the Owner.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.

1. Include the following information in each test report:
 - a. Admixture dosage rates.
 - b. Slump.
 - c. Air content.
 - d. Seven-day compressive strength.
 - e. 28-day compressive strength.
 - f. Evaluation of permeability-reducing admixtures.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM C94/C94M and **ACI 301 (ACI 301M)**.

1.9 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with **ACI 301 (ACI 301M)** as follows:

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When air temperature has fallen to, or is expected to fall below **40 deg F (4.4 deg C)** during the protection period, maintain delivered concrete mixture temperature within the temperature range required by **ACI 301 (ACI 301M)**.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than **35 deg F (1.7 deg C)**, other than reinforcing steel.

- B. Hot-Weather Placement: Comply with **ACI 301 (ACI 301M)** and **ACI 305.1 (ACI 305.1M)**, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed [**95 deg F (35 deg C)**][**other permitted limit**].
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.10 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS**2.1 CONCRETE STANDARDS**

- A. ACI Publications: Comply with **ACI 301 (ACI 301M)** unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

- A. Regional Materials: Concrete shall be manufactured within **100 miles (160 km)** of Project site from aggregates[**and cementitious materials**] that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- B. Indigenous Materials: Concrete shall be manufactured within **500 miles (800 km)** of Project site from aggregates[**and cementitious materials**] that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- C. Source Limitations:
 1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
 2. Obtain each type of admixture from single source from single manufacturer.
- D. Cementitious Materials:
 1. Portland Cement: ASTM C150/C150M, [Type I][Type II][Type III][Type V], [gray][white].
 2. Blended Hydraulic Cement: ASTM C595/C595M, [Type IS, portland blast-furnace slag][Type IP, Portland-pozzolan][Type IL, portland-limestone][Type IT, ternary blended] cement.
 3. Performance-Based Hydraulic Cement: ASTM C1157/C1157M: [Type GU, general use][Type HE, high early strength][Type MS, moderate sulfate resistance][Type HS, high sulfate resistance][Type MH, moderate heat of hydration][Type LH, low heat of hydration].
 4. Pozzolans: ASTM C618, Class C, F, or N.
 5. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
 6. Ground Glass Pozzolan: ASTM C1866/C1866M, Type GS or GE.
 7. Silica Fume: ASTM C1240.
- E. Normal-Weight Aggregates:
 1. Coarse Aggregate: ASTM C33/C33M, [Class 3S][Class 3M][Class 1N].
 2. Maximum Coarse-Aggregate Size: [1-1/2 inches (38 mm)][1 inch (25 mm)][3/4 inch (19 mm)] nominal.
 3. Fine Aggregate: ASTM C33/C33M.
 4. Recycled Aggregate: Provide documentation of characteristics of recycled aggregate and mechanical properties and durability of proposed concrete, which incorporates recycled aggregate to conform to applicable requirements for the class of concrete.
 5. Alkali-Silica Reaction: Comply with one of the following for each aggregate used:
 - a. Expansion Result of Aggregate: Not more than 0.04 percent at one year when tested in accordance with ASTM C1293.
 - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567. Do not use this option with fly ash with an alkali content greater than 4.0 percent. Submit supporting data for each aggregate showing expansion in excess of 0.10 percent when tested in accordance with ASTM C1260.
 - c. Alkali Content in Concrete: Not to exceed **4 lb./cu. yd. (2.37 kg/cu. m)** for aggregate with expansion greater than or equal to 0.04 percent and less than 0.12 percent or **3 lb./cu. yd. (1.78 kg/cu. m)** for aggregate with expansion greater than or equal to 0.12 percent and less than 0.24 percent. Test aggregate reactivity in accordance with ASTM C1293. Calculate alkali content of concrete in accordance with **ACI 301 (ACI 301M)**. Do not use this option with natural pozzolan or fly ash that has a calcium oxide content greater than 18 percent or an alkali content greater than 4.0 percent; or for an aggregate with expansion at one year greater than or equal to 0.24 percent when tested in accordance with ASTM C1293.

F. Lightweight Aggregate: ASTM C330/C330M, [1-inch (25-mm)][3/4-inch (19-mm)][1/2-inch (13-mm)][3/8-inch (10-mm)] nominal maximum aggregate size.

1. Limit lightweight aggregate for internal curing to prewetted lightweight fine aggregate in accordance with ASTM C1761/C1761M.

G. Ground Calcium Carbonate or Aggregate Mineral Filler: ASTM C1797. Unless otherwise permitted, do not use mineral filler derived from carbonate sources in concrete for members assigned to Exposure Class S1, S2, or S3.

2.3 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260/C260M.

B. Chemical Admixtures: Do not use calcium chloride or admixtures containing calcium chloride[**in steel-reinforced concrete**].

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Admixtures with special properties, with documentation of claimed performance enhancement, ASTM C494/C494M, Type S.
7. Set-Accelerating Corrosion-Inhibiting Admixture: ASTM C1582/C1582M.

- a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- 1) [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
- 2) [GCP Applied Technologies Inc.]
- 3) [MAPEI Corporation]
- 4) [Master Builders Solutions]
- 5) [Sika Corporation]

8. Permeability-Reducing Admixture: ASTM C494/C494M, Type S, hydrophilic, permeability-reducing crystalline or colloidal [nano-]silica admixture, capable of reducing water absorption of concrete exposed to hydrostatic pressure (PRAH).

- a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- 1) [AQUAFIN, Inc]
- 2) [AVECS LLC]
- 3) [Barrier One, Inc.]
- 4) [Bone Dry Products, Inc.]
- 5) [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
- 6) [ISE Logik Industries, Inc.]
- 7) [Kryton International, Inc.]

- 8) [Master Builders Solutions]
 - 9) [Penetron USA, Inc.]
 - 10) [Xypex Chemical Corporation]
- b. Permeability: No leakage when tested in accordance with U.S. Army Corps of Engineers CRD C48 at a hydraulic pressure of **200 psi (1.28 MPa)** for 14 days.
9. Moisture-Vapor-Reducing Admixture: ASTM C494/C494M, Type S, hydrophilic, moisture-vapor-reducing, capable of reducing water absorption in and moisture-vapor emission from concrete (MVRA).
- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
- 1) [AQUAFIN, Inc]
 - 2) [AVECS LLC]
 - 3) [Barrier One, Inc.]
 - 4) [Bone Dry Products, Inc.]
 - 5) [Concure Products Inc.]
 - 6) [ISE Logik Industries, Inc.]
 - 7) [Kryton International, Inc.]
 - 8) [Master Builders Solutions]
 - 9) [Moxie International]
 - 10) [Xypex Chemical Corporation]
- C. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments, color stable, **[free of carbon black,]** nonfading, and resistant to lime and other alkalis.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
- a. [Alabama Pigments Company, LLC]
 - b. [Bon Tool Co.]
 - c. [Brickform; a division of Solomon Colors]
 - d. [Butterfield Color, Inc.]
 - e. [Dynamic Color Solutions, Inc]
 - f. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - g. [Hoover Color Corporation]
 - h. [Lambert Corporation]
 - i. [Lanxess Corporation]
 - j. [Master Builders Solutions]
 - k. [Matcrete Inc.]
 - l. [NewLook International, Inc.]
 - m. [Proline Concrete Tools, Inc.]
 - n. [QC Construction Products]
 - o. [Scofield, a Business Unit of Sika Corporation]
 - p. [Solomon Colors Inc.]
 - q. [Stampcrete International, Ltd]
 - r. [SureCrete Design Products, a Fenix Group SPC Company]
 - s. [Venator Materials PLC]

2. Color: **[As indicated by manufacturer's designation][as directed by the Owner].**

- D. Mixing Water for Concrete Mixtures and Water Used to Make Ice: ASTM C1602/C1602M. Include documentation of compliance with limits for alkalis, sulfates, chlorides, or solids content of mixing water from Table 2 in ASTM C1602/C1602M.

2.4 FIBER REINFORCEMENT

- A. Carbon-Steel-Wire Fiber: ASTM A820/A820M, Type 1, cold-drawn wire, deformed, minimum of **[1.5 inches (38 mm)][2 inches (50 mm)][2.4 inches (60 mm)]** long, with an aspect ratio of **[35 to 40][45 to 50][60 to 65]**.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. **[Bekaert]**
- b. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
- c. **[FullForce by ABC Polymer Industries, LLC]**
- d. **[Sika Corporation]**

- B. Carbon-Steel Cut Sheet Fiber: ASTM A820/A820M, Type 2, cut sheet, deformed, minimum of **[1.5 inches (38 mm)][2 inches (50 mm)][2.4 inches (60 mm)]** long, and aspect ratio of **[35 to 40][45 to 50][60 to 65]**.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. **[Concrete Fiber Solutions]**
- b. **[Fibercon International, Inc.]**
- c. **[Sika Corporation]**

- C. Synthetic Monofilament Microfiber: Monofilament polypropylene microfibers complying with ASTM C1116/C1116M, Type III, **[1/2 to 1-1/2 inches (13 to 38 mm)][1 to 2-1/4 inches (25 to 57 mm)]** long.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
- b. **[FullForce by ABC Polymer Industries, LLC]**
- c. **[GCP Applied Technologies Inc.]**
- d. **[MAPEI Corporation]**
- e. **[Master Builders Solutions]**
- f. **[Sika Corporation]**

- D. Synthetic Fibrillated Microfiber: Fibrillated polypropylene microfibers complying with ASTM C1116/C1116M, Type III, [1/2 to 1-1/2 inches (13 to 38 mm)][1 to 2-1/4 inches (25 to 57 mm)] long.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - b. **[FullForce by ABC Polymer Industries, LLC]**
 - c. **[GCP Applied Technologies Inc.]**
 - d. **[Master Builders Solutions]**
 - e. **[Sika Corporation]**
- E. Synthetic Macrofiber: Synthetic macrofibers complying with ASTM C1116/C1116M, Type III, [1 to 2-1/4 inches (25 to 57 mm)] long.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - b. **[FullForce by ABC Polymer Industries, LLC]**
 - c. **[GCP Applied Technologies Inc.]**
 - d. **[MAPEI Corporation]**
 - e. **[Master Builders Solutions]**
 - f. **[Sika Corporation]**

2.5 VAPOR RETARDERS

- A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A[, **except with maximum water-vapor permeance of**]. Include manufacturer's recommended thickness and adhesive or pressure-sensitive tape.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Barrier-Bac; Inteplast Group]**
 - b. **[Foxfire Enterprises, Inc.]**
 - c. **[ISI Building Products]**
 - d. **[Poly-America, L.P.]**
 - e. **[R&D Workshop]**
 - f. **[Reef Industries, Inc.]**
 - g. **[Stego Industries, LLC]**
 - h. **[Tex-Trude]**
 - i. **[Viaflex]**
 - j. **[W. R. Meadows, Inc]**

- B. Sheet Vapor Retarder, Class C: ASTM E1745, Class C[, **except with maximum water-vapor**

permeance of; not less than **10 mils (0.25 mm)** thick. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. **[ISI Building Products]**
- b. **[Stego Industries, LLC]**
- c. **[Tex-Trude]**
- d. **[Viaflex]**

- C. Sheet Vapor Retarder/Termite Barrier: ASTM E1745, Class A, except with maximum water-vapor permeance of 0.03 perms; complying with ICC Acceptance Criteria AC380. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. **[Polyguard Products, Inc.]**

2. Low-Temperature Flexibility: Pass at **minus 15 deg F (minus 26 deg C)**; ASTM D146/D146M.
3. Puncture Resistance: **224 lbf (996 N)** minimum; ASTM E154/E154M.
4. Water Absorption: 0.1 percent weight-gain maximum after 48-hour immersion at **70 deg F (21 deg C)**; ASTM D570.
5. Hydrostatic-Head Resistance: **231 ft. (70 m)** minimum; ASTM D5385/D5385M.

- D. Bituminous Vapor Retarder: ASTM E1993/E1993M, **110-mil- (2.8-mm-)** thick, semiflexible, seven-ply sheet membrane, consisting of reinforced core and carrier sheet with fortified asphalt layers, protective weather coating, and removable plastic release liner. Furnish manufacturer's accessories, including bonding asphalt, pointing mastics, and self-adhering joint tape.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. **[W. R. Meadows, Inc]**

2. Water-Vapor Permeance: **0.0011 grains/h x sq. ft. x inches Hg (0.063 ng/Pa x s x sq. m)** when tested in accordance with ASTM E154/E154M.
3. Tensile Strength: **156 lbf/inch (27.35 kN/m)** when tested in accordance with ASTM E154/E154M.
4. Puncture Resistance: **140 lbf (662 N)** when tested in accordance with ASTM E154/E154M.

2.6 FLOOR AND SLAB TREATMENTS

- A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20

percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing [3/8-inch (10-mm)][No. 4 (4.75-mm)][No. 8 (2.36-mm)] sieve.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Anti-Hydro International, Inc]**
 - b. **[Dayton Superior Corporation]**
 - c. **[Lambert Corporation]**
 - d. **[Laticrete International, Inc.]**
 - e. **[Metalcrete Industries]**
- B. Slip-Resistive Aluminum Granule Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of not less than 95 percent fused aluminum-oxide granules.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Anti-Hydro International, Inc]**
 - b. **[Laticrete International, Inc.]**
 - c. **[Master Builders Solutions]**
- C. Emery Dry-Shake Floor Hardener: **[Pigmented][Unpigmented]**, factory-packaged, dry combination of portland cement, graded emery aggregate, and plasticizing admixture; with emery aggregate consisting of no less than 60 percent of total aggregate content.
 1. Color: **[As indicated by manufacturer's designation][As directed by the Owner]**.
- D. Metallic Dry-Shake Floor Hardener: **[Pigmented][Unpigmented]**, factory-packaged, dry combination of portland cement, graded metallic aggregate, rust inhibitors, and plasticizing admixture; with metallic aggregate consisting of no less than 65 percent of total aggregate content.
 1. Color: **[As indicated by manufacturer's designation][As directed by the Owner]**.
- E. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, and plasticizing admixture.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Dayton Superior Corporation]**
 - b. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - c. **[Kaufman Products, Inc]**
 - d. **[Laticrete International, Inc.]**
 - e. **[Master Builders Solutions]**
 - f. **[Metalcrete Industries]**
 - g. **[SpecChem, LLC]**
 - h. **[US MIX Co.]**

- F. Pigmented Mineral Dry-Shake Floor Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Anti-Hydro International, Inc]**
 - b. **[Butterfield Color, Inc.]**
 - c. **[Dynamic Color Solutions, Inc]**
 - d. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - e. **[H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.]**
 - f. **[Kaufman Products, Inc]**
 - g. **[Lambert Corporation]**
 - h. **[Master Builders Solutions]**
 - i. **[Scofield, a Business Unit of Sika Corporation]**
 - j. **[SpecChem, LLC]**
 2. Color: **[As indicated by manufacturer's designation][As directed by the Owner].**

2.7 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[SIMIRON Inc.]**
 - b. **[Bone Dry Products, Inc.]**
 - c. **[ChemMasters, Inc]**
 - d. **[ChemTec International]**
 - e. **[Concrete Sealers USA]**
 - f. **[Curecrete Distribution Inc.]**
 - g. **[Dayton Superior Corporation]**
 - h. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - i. **[HTS Chemical; Hi-Tech Systems]**
 - j. **[Kaufman Products, Inc]**
 - k. **[Laticrete International, Inc.]**
 - l. **[MAPEI Corporation]**
 - m. **[Master Builders Solutions]**
 - n. **[NewLook International, Inc.]**
 - o. **[Nox-Crete Products Group]**
 - p. **[Penetron USA, Inc.]**
 - q. **[PROSOCO, Inc]**

- r. [SINAK]
- s. [Solomon Colors Inc.]
- t. [SpecChem, LLC]
- u. [Specialty Products Group]
- v. [US SPEC, Division of US MIX Company]
- w. [V-Seal Concrete Sealers & Specialty Coatings]
- x. [Vexcon Chemicals Inc.]
- y. [W. R. Meadows, Inc]

- 2. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- 3. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less.
- 4. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.8 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. [Bon Tool Co.]
- b. [Brickform; a division of Solomon Colors]
- c. [ChemMasters, Inc]
- d. [Dayton Superior Corporation]
- e. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
- f. [Kaufman Products, Inc]
- g. [Lambert Corporation]
- h. [Laticrete International, Inc.]
- i. [MAPEI Corporation]
- j. [Master Builders Solutions]
- k. [Metalcrete Industries]
- l. [Nox-Crete Products Group]
- m. [Sika Corporation]
- n. [SINAK]
- o. [SpecChem, LLC]
- p. [TK Products Construction Coatings, a Fenix Group SPC Company]
- q. [Vexcon Chemicals Inc.]
- r. [W. R. Meadows, Inc]

- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately **9 oz./sq. yd. (305 g/sq. m)** when dry.

- C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
1. Color:
 - a. Ambient Temperature Below 50 deg F (10 deg C): Black.
 - b. Ambient Temperature between 50 and 85 deg F (10 and 29 deg C): Any color.
 - c. Ambient Temperature Above 85 deg F (29 deg C): White.
- D. Curing Paper: **8 ft. (2438 mm)** wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
- E. Water: Potable water that does not cause staining of the surface.
- F. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Anti-Hydro International, Inc]**
 - b. **[ChemMasters, Inc]**
 - c. **[Dayton Superior Corporation]**
 - d. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - e. **[Kaufman Products, Inc]**
 - f. **[Lambert Corporation]**
 - g. **[Laticrete International, Inc.]**
 - h. **[MAPEI Corporation]**
 - i. **[Nox-Crete Products Group]**
 - j. **[SpecChem, LLC]**
 - k. **[TK Products Construction Coatings, a Fenix Group SPC Company]**
 - l. **[Vexcon Chemicals Inc.]**
 - m. **[W. R. Meadows, Inc]**
- G. Clear, Waterborne, Membrane-Forming, Nondissipating Curing Compound: ASTM C309, Type 1, Class B.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Anti-Hydro International, Inc]**
 - b. **[ChemMasters, Inc]**
 - c. **[Dayton Superior Corporation]**

- d. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - e. [Kaufman Products, Inc]
 - f. [Lambert Corporation]
 - g. [Laticrete International, Inc.]
 - h. [Master Builders Solutions]
 - i. [Metalcrete Industries]
 - j. [Nox-Crete Products Group]
 - k. [PROSOCO, Inc]
 - l. [SpecChem, LLC]
 - m. [TK Products Construction Coatings, a Fenix Group SPC Company]
 - n. [Vexcon Chemicals Inc.]
 - o. [W. R. Meadows, Inc]
- H. Clear, Waterborne, Membrane-Forming, Curing Compound: ASTM C309, Type 1, Class B, 18 to 25 percent solids, nondissipating.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
- a. [ChemMasters, Inc]
 - b. [Dayton Superior Corporation]
 - c. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - d. [Kaufman Products, Inc]
 - e. [Lambert Corporation]
 - f. [Laticrete International, Inc.]
 - g. [Master Builders Solutions]
 - h. [Metalcrete Industries]
 - i. [Nox-Crete Products Group]
 - j. [SpecChem, LLC]
 - k. [V-Seal Concrete Sealers & Specialty Coatings]
 - l. [Vexcon Chemicals Inc.]
 - m. [W. R. Meadows, Inc]
- I. Clear, Solvent-Borne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
- a. [ChemMasters, Inc]
 - b. [Concrete Sealers USA]
 - c. [Dayton Superior Corporation]
 - d. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - e. [Kaufman Products, Inc]
 - f. [Lambert Corporation]
 - g. [Laticrete International, Inc.]
 - h. [MAPEI Corporation]
 - i. [Master Builders Solutions]

- j. **[Metalcrete Industries]**
- k. **[Nox-Crete Products Group]**
- l. **[PROSOCO, Inc]**
- m. **[Right Pointe]**
- n. **[SpecChem, LLC]**
- o. **[TK Products Construction Coatings, a Fenix Group SPC Company]**
- p. **[Vexcon Chemicals Inc.]**
- q. **[W. R. Meadows, Inc]**

- 2. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- 3. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less.
- 4. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

J. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. **[ChemMasters, Inc]**
- b. **[Concrete Sealers USA]**
- c. **[Dayton Superior Corporation]**
- d. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
- e. **[Kaufman Products, Inc]**
- f. **[Lambert Corporation]**
- g. **[Laticrete International, Inc.]**
- h. **[MAPEI Corporation]**
- i. **[Metalcrete Industries]**
- j. **[Nox-Crete Products Group]**
- k. **[Right Pointe]**
- l. **[SINAK]**
- m. **[SpecChem, LLC]**
- n. **[TK Products Construction Coatings, a Fenix Group SPC Company]**
- o. **[Vexcon Chemicals Inc.]**
- p. **[W. R. Meadows, Inc]**

- 2. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- 3. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less.

4. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.9 ACCESSORIES

- A. Expansion- and Isolation-Joint-Filler Strips: **[ASTM D1751, asphalt-saturated cellulosic fiber][or][ASTM D1752, cork or self-expanding cork]**.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, **[epoxy resin with a Type A shore durometer hardness of 80][aromatic polyurea with a Type A shore durometer hardness range of 90 to 95]** in accordance with ASTM D2240.
- C. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:
 1. **[Types I and II, nonload bearing][Types IV and V, load bearing]**, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Floor Slab Protective Covering: **8 ft. (2438 mm)** wide cellulose fabric.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[McTech Group, Inc.]**

2.10 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from **1/8 inch (3 mm)** and that can be feathered at edges to match adjacent floor elevations.
 1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 3. Aggregate: Well-graded, washed gravel, **1/8 to 1/4 inch (3 to 6 mm)** or coarse sand, as recommended by underlayment manufacturer.
 4. Compressive Strength: Not less than **[4100 psi (29 MPa)]** at 28 days when tested in accordance with ASTM C109/C109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from **1/4 inch (6 mm)** and that can be filled in over a scarified surface to match adjacent floor elevations.
 1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, **1/8 to 1/4 inch (3 to 6 mm)** or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than **[5000 psi (34.5 MPa)]** at 28 days when tested in accordance with ASTM C109/C109M.

2.11 CONCRETE MIXTURE MATERIALS

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with **ACI 301 (ACI 301M)**.
 1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland or hydraulic cement in concrete assigned to Exposure Class F3 as follows:
 1. Fly Ash or Other Pozzolans: 25 percent by mass.
 2. Slag Cement: 50 percent by mass.
 3. Silica Fume: 10 percent by mass.
 4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
 5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
 1. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
 2. Use permeability-reducing admixture in concrete mixtures where indicated.
- D. Color Pigment: Add color pigment to concrete mixture in accordance with manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.12 CONCRETE MIXTURE CLASS TYPES

- A. Class A: Normal-weight concrete used for footings, grade beams, and tie beams.
 1. Exposure Class: **ACI 318 (ACI 318M) [Class F0][Class F1][Class F2][Class F3][Class S0][Class S1][Class S2][Class S3][Class W0][Class W1][Class W2][Class C0][Class C1][Class C2]**.
 2. Minimum Compressive Strength: **[5000 psi (34.5 MPa)][4500 psi (31 MPa)][4000 psi (27.6 MPa)][3500 psi (24.1 MPa)][3000 psi (20.7 MPa)][As indicated]** at **[28][56][90]** days.
 3. Maximum w/cm Ratio: **[0.55][0.50][0.45][0.40]**.
 4. Slump Limit: **[4 inches (100 mm), plus or minus 1 inch (25 mm)][5 inches (125 mm), plus or minus 1-1/2 inches (40 mm)][maximum 9 inches (225 mm), plus or minus 1-1/2 inches (40 mm)]** for concrete.
 5. Slump Flow Limit: **[22 inches (550 mm), plus or minus 1-1/2 inches (40 mm)][30 inches (762 mm), plus or minus 2-1/2 inches (65 mm)]**.
 6. Air Content:
 - a. Exposure Class F1: **[5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch (25-mm)]**

- nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch (38-mm) nominal maximum aggregate size].
- b. Exposure Classes F2 and F3: [6.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size][6.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch (25-mm) nominal maximum aggregate size][5.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch (38-mm) nominal maximum aggregate size].
7. Limit water-soluble, chloride-ion content in hardened concrete to [1.00][0.30][0.15] percent by weight of cementitious materials.
 8. Compressive strength or alternative methods of estimating in-place strength of concrete by maturity or other nondestructive testing with acceptable correlation between test results and concrete compressive strength.
- B. Class B: Normal-weight concrete used for foundation walls.
1. Exposure Class: **ACI 318 (ACI 318M)** [Class F0][Class F1][Class F2][Class F3][Class S0][Class S1][Class S2][Class S3][Class W0][Class W1][Class W2][Class C0][Class C1][Class C2].
 2. Minimum Compressive Strength: [5000 psi (34.5 MPa)][4500 psi (31 MPa)][4000 psi (27.6 MPa)][3500 psi (24.1 MPa)][3000 psi (20.7 MPa)][As indicated] at [28][56][90] days.
 3. Maximum w/cm Ratio: [0.55][0.50][0.45][0.40].
 4. Slump Limit: [4 inches (100 mm), plus or minus 1 inch (25 mm)][5 inches (125 mm), plus or minus 1.5 inches (40 mm)][maximum 9 inches (225 mm), plus or minus 1.5 inches (40 mm)] for concrete.
 5. Slump Flow Limit: [22 inches (550 mm), plus or minus 1.5 inches (40 mm)][30 inches (762 mm), plus or minus 2.5 inches (65 mm)].
 6. Air Content:
 - a. Exposure Class F1: [5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch (25-mm) nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch (38-mm) nominal maximum aggregate size].
 - b. Exposure Classes F2 and F3: [6.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size][6.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch (25-mm) nominal maximum aggregate size][5.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch (38-mm) nominal maximum aggregate size].
 7. Limit water-soluble, chloride-ion content in hardened concrete to [1.00][0.30][0.15] percent by weight of cement.
 8. Compressive strength or alternative methods of estimating in-place strength of concrete by maturity or other nondestructive testing with acceptable correlation between test results and concrete compressive strength.
- C. Class C: Normal-weight concrete used for interior slabs-on-ground.
1. Exposure Class: **ACI 318 (ACI 318M)** [Class F0][Class F1][Class F2][Class F3][Class S0][Class S1][Class S2][Class S3][Class W0][Class W1][Class W2][Class C0][Class C1][Class C2].
 2. Minimum Compressive Strength: [5000 psi (34.5 MPa)][4500 psi (31 MPa)][4000 psi

- (27.6 MPa)][3500 psi (24.1 MPa)][3000 psi (20.7 MPa)][As indicated] at [28][56][90] days.
3. Maximum w/cm Ratio : [0.55][0.50][0.45][0.40].
 4. Slump Limit: [4 inches (100 mm), plus or minus 1 inch (25 mm)][5 inches (125 mm), plus or minus 1.5 inches (40 mm)][maximum 9 inches (225 mm), plus or minus 1.5 inches (40 mm)] for concrete.
 5. Slump Flow Limit: [22 inches (550 mm), plus or minus 1.5 inches (40 mm)][30 inches (762 mm), plus or minus 2.5 inches (65 mm)].
 6. Air Content:
 - a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
 7. Limit water-soluble, chloride-ion content in hardened concrete to [1.00][0.30][0.15] percent by weight of cement.
 8. Steel-Fiber Reinforcement: Add to concrete mixture, in accordance with manufacturer's written instructions, at a rate of [50 lb/cu. yd. (29.7 kg/cu. m)].
 9. Synthetic Microfiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of [1.0 lb/cu. yd. (0.60 kg/cu. m)][1.5 lb/cu. yd. (0.90 kg/cu. m)].
 10. Synthetic Macrofiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of [4.0 lb/cu. yd. (2.4 kg/cu. m)][5 lb/cu. yd. (3 kg/cu. m)].

D. Class D: Normal-weight concrete used for interior suspended slabs.

1. Exposure Class: **ACI 318 (ACI 318M)** [Class F0][Class F1][Class F2][Class F3][Class S0][Class S1][Class S2][Class S3][Class W0][Class W1][Class W2][Class C0][Class C1][Class C2].
2. Minimum Compressive Strength: [5000 psi (34.5 MPa)][4500 psi (31 MPa)][4000 psi (27.6 MPa)][3500 psi (24.1 MPa)][3000 psi (20.7 MPa)][As indicated] at [28][56][90] days.
3. Maximum w/cm Ratio: [0.55][0.50][0.45][0.40].
4. Slump Limit: [4 inches (100 mm), plus or minus 1 inch (25 mm)][5 inches (125 mm), plus or minus 1.5 inches (40 mm)][maximum 9 inches (225 mm), plus or minus 1.5 inches (40 mm)] for concrete.
5. Slump Flow Limit: [22 inches (550 mm), plus or minus 1.5 inches (40 mm)][30 inches (762 mm), plus or minus 2.5 inches (65 mm)].
6. Air Content:
 - a. Total air content must not exceed 3 percent for concrete used in trowel-finished floors.
7. Limit water-soluble, chloride-ion content in hardened concrete to [1.00][0.30][0.15] percent by weight of cement.
8. Steel-Fiber Reinforcement: Add to concrete mixture, in accordance with manufacturer's written instructions, at a rate of [50 lb/cu. yd. (29.7 kg/cu. m)].
9. Synthetic Microfiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of [1.0 lb/cu. yd. (0.60 kg/cu. m)][1.5 lb/cu. yd. (0.90 kg/cu. m)].
10. Synthetic Macrofiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of [4.0 lb/cu. yd. (2.4 kg/cu. m)][5 lb/cu. yd. (3 kg/cu. m)].

E. Class E: Structural lightweight concrete used for interior suspended slabs.

1. Exposure Class: **ACI 318 (ACI 318M)** [Class F0][Class F1][Class F2][Class F3][Class S0][Class S1][Class S2][Class S3][Class W0][Class W1][Class W2][Class C0][Class C1][Class C2].
2. Minimum Compressive Strength: [5000 psi (34.5 MPa)][4500 psi (31 MPa)][4000 psi (27.6 MPa)][3500 psi (24.1 MPa)][3000 psi (20.7 MPa)][As indicated] at [28][56][90] days.
3. Equilibrium Density: 115 lb/cu. ft. (1842 kg/cu. m), plus or minus 4 lb/cu. ft. (48.1 kg/cu. m) in

- accordance with ASTM C567/C567M.
 4. Slump Limit: **[4 inches (100 mm), plus or minus 1 inch (25 mm)][5 inches (125 mm), plus or minus 1.5 inches (40 mm)][maximum 9 inches (225 mm), plus or minus 1.5 inches (40 mm)]** for concrete.
 5. Slump Flow Limit: **[22 inches (550 mm), plus or minus 1.5 inches (40 mm)][30 inches (762 mm), plus or minus 2.5 inches (65 mm)]**.
 6. Air Content:
 - a. Total air content must not to exceed 3 percent for concrete used in trowel-finished floors.
 7. Limit water-soluble, chloride-ion content in hardened concrete to **[1.00][0.30][0.15]** percent by weight of cement.
 8. Steel-Fiber Reinforcement: Add to concrete mixture, in accordance with manufacturer's written instructions, at a rate of **[50 lb/cu. yd. (29.7 kg/cu. m)]**.
 9. Synthetic Microfiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of **[1.0 lb/cu. yd. (0.60 kg/cu. m)][1.5 lb/cu. yd. (0.90 kg/cu. m)]**.
 10. Synthetic Macrofiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of **[4.0 lb/cu. yd. (2.4 kg/cu. m)][5 lb/cu. yd. (3 kg/cu. m)]**.
- F. Class F: Normal-weight concrete used for concrete toppings.
1. Exposure Class: **ACI 318 (ACI 318M) [Class F0][Class F1][Class F2][Class F3][Class S0][Class S1][Class S2][Class S3][Class W0][Class W1][Class W2][Class C0][Class C1][Class C2]**.
 2. Minimum Compressive Strength: **[5000 psi (34.5 MPa)][4500 psi (31 MPa)][4000 psi (27.6 MPa)][3500 psi (24.1 MPa)][3000 psi (20.7 MPa)][As indicated]**at **[28][56][90]** days.
 3. Maximum w/cm Ratio: **[0.55][0.50][0.45][0.40]**.
 4. Slump Limit: **[4 inches (100 mm), plus or minus 1 inch (25 mm)][5 inches (125 mm), plus or minus 1.5 inches (40 mm)][maximum 9 inches (225 mm), plus or minus 1.5 inches (40 mm)]** for concrete.
 - a. Exposure Class F1: **[5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch (25-mm) nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch (38-mm) nominal maximum aggregate size]**.
 - b. Exposure Classes F2 and F3: **[6.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size][6.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch (25-mm) nominal maximum aggregate size][5.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch (38-mm) nominal maximum aggregate size]**.
 5. Limit water-soluble, chloride-ion content in hardened concrete to **[1.00][0.30][0.15]** percent by weight of cement.
 - a. Total air content must not to exceed 3 percent for concrete used in trowel-finished floors.
 6. Steel-Fiber Reinforcement: Add to concrete mixture, in accordance with manufacturer's written instructions, at a rate of **[50 lb/cu. yd. (29.7 kg/cu. m)]**
 7. Synthetic Microfiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of **[1.0 lb/cu. yd. (0.60 kg/cu. m)][1.5 lb/cu. yd. (0.90 kg/cu. m)]**.
 8. Synthetic Macrofiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of **[4.0 lb/cu. yd. (2.4 kg/cu. m)][5 lb/cu. yd. (3 kg/cu. m)]**.

G. Class G: Normal-weight concrete used for building frame members.

1. Exposure Class: **ACI 318 (ACI 318M) [Class F0][Class F1][Class F2][Class F3][Class S0][Class S1][Class S2][Class S3][Class W0][Class W1][Class W2][Class C0][Class C1][Class C2]**.
2. Minimum Compressive Strength: **[5000 psi (34.5 MPa)][4500 psi (31 MPa)][4000 psi (27.6 MPa)][3500 psi (24.1 MPa)][3000 psi (20.7 MPa)][As indicated]** at **[28][56][90]** days.
3. Maximum w/cm Ratio: **[0.55][0.50][0.45][0.40]**.
4. Slump Limit: **[4 inches (100 mm), plus or minus 1 inch (25 mm)][5 inches (125 mm), plus or minus 1.5 inches (40 mm)][maximum 9 inches (225 mm), plus or minus 1.5 inches (40 mm)]** for concrete.
5. Slump Flow Limit: **[22 inches (550 mm), plus or minus 1.5 inches (40 mm)][30 inches (762 mm), plus or minus 2.5 inches (65 mm)]**.
6. Air Content:
 - a. Exposure Class F1: **[5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch (25-mm) nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch (38-mm) nominal maximum aggregate size]**.
 - b. Exposure Classes F2 and F3: **[6.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size][6.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch (25-mm) nominal maximum aggregate size][5.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch (38-mm) nominal maximum aggregate size]**.
7. Limit water-soluble, chloride-ion content in hardened concrete to **[1.00][0.30][0.15]** percent by weight of cement.

H. Class H: Normal-weight concrete used for building walls.

1. Exposure Class: **ACI 318 (ACI 318M) [Class F0][Class F1][Class F2][Class F3][Class S0][Class S1][Class S2][Class S3][Class W0][Class W1][Class W2][Class C0][Class C1][Class C2]**.
2. Minimum Compressive Strength: **[5000 psi (34.5 MPa)][4500 psi (31 MPa)][4000 psi (27.6 MPa)][3500 psi (24.1 MPa)][3000 psi (20.7 MPa)][As indicated]** at **[28][56][90]** days.
3. Maximum w/cm Ratio: **[0.55][0.50][0.45][0.40]**.
4. Slump Limit: **[4 inches (100 mm), plus or minus 1 inch (25 mm)][5 inches (125 mm), plus or minus 1.5 inches (40 mm)][maximum 9 inches (225 mm), plus or minus 1.5 inches (40 mm)]** for concrete.
5. Slump Flow Limit: **[22 inches (550 mm), plus or minus 1.5 inches (40 mm)][30 inches (762 mm), plus or minus 2.5 inches (65 mm)]**.
6. Air Content:
 - a. Exposure Class F1: **[5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch (25-mm) nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch (38-mm) nominal maximum aggregate size]**.
 - b. Exposure Classes F2 and F3: **[6.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size][6.0 percent, plus or minus 1.5 percent at point of delivery for concrete**

containing 1-inch (25-mm) nominal maximum aggregate size][5.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch (38-mm) nominal maximum aggregate size].

7. Limit water-soluble, chloride-ion content in hardened concrete to [1.00][0.30][0.15] percent by weight of cement.

I. Class I: Normal-weight concrete used for interior metal pan stairs and landings:

1. Exposure Class: **ACI 318 (ACI 318M) [Class F0][Class F1][Class F2][Class F3][Class S0][Class S1][Class S2][Class S3][Class W0][Class W1][Class W2][Class C0][Class C1][Class C2]**.
2. Minimum Compressive Strength: [3000 psi (20.7 MPa)][As indicated] at 28 days.
3. Maximum w/cm Ratio: [0.53][0.45][0.40].
4. Maximum Size Aggregate: 1/2 inch (13 mm).
5. Slump Limit: 3 inches (75 mm), plus 1 inch (25 mm) or minus 2 inches (50 mm).
6. Air Content: [0] percent, plus or minus 1.5 percent at point of delivery.
7. Limit water-soluble, chloride-ion content in hardened concrete to [1.00][0.30][0.15] percent by weight of cement.

J. Class J: Normal-weight concrete used for exterior retaining walls.

1. Exposure Class: **ACI 318 (ACI 318M) [Class F0][Class F1][Class F2][Class F3][Class S0][Class S1][Class S2][Class S3][Class W0][Class W1][Class W2][Class C0][Class C1][Class C2]**.
2. Minimum Compressive Strength: [5000 psi (34.5 MPa)][4500 psi (31 MPa)][4000 psi (27.6 MPa)][3500 psi (24.1 MPa)][3000 psi (20.7 MPa)][As indicated] at [28][56][90] days.
3. Maximum w/cm Ratio: [0.55][0.50][0.45][0.40].
4. Slump Limit: [4 inches (100 mm), plus or minus 1 inch (25 mm)][5 inches (125 mm), plus or minus 1.5 inches (40 mm)][maximum 9 inches (225 mm), plus or minus 1.5 inches (40 mm)] for concrete.
5. Slump Flow Limit: [22 inches (550 mm), plus or minus 1.5 inches (40 mm)][30 inches (762 mm), plus or minus 2.5 inches (65 mm)].
6. Air Content:
 - a. Exposure Class F1: [5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch (25-mm) nominal maximum aggregate size][4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch (38-mm) nominal maximum aggregate size].
 - b. Exposure Classes F2 and F3: [6.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch (19-mm) nominal maximum aggregate size][6.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch (25-mm) nominal maximum aggregate size][5.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-1/2-inch (38-mm) nominal maximum aggregate size].
7. Limit water-soluble, chloride-ion content in hardened concrete to [1.00][0.30][0.15] percent by weight of cement.

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and furnish delivery ticket.

- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For mixer capacity of **1 cu. yd. (0.76 cu. m)** or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
 2. For mixer capacity larger than **1 cu. yd. (0.76 cu. m)**, increase mixing time by 15 seconds for each additional **1 cu. yd. (0.76 cu. m)**.
 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
1. Before placing concrete, verify that installation of concrete forms, accessories, reinforcement, and embedded items is complete and that required inspections have been performed.
 2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
1. Daily access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
 4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 TOLERANCES

- A. Comply with **ACI 117 (ACI 117M)**.

3.4 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install reglets to receive waterproofing and through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.5 INSTALLATION OF VAPOR RETARDERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
 2. Face laps away from exposed direction of concrete pour.
 3. Lap vapor retarder over footings and grade beams not less than **6 inches (150 mm)**, sealing vapor retarder to concrete.
 4. Lap joints **6 inches (150 mm)** and seal with manufacturer's recommended tape.
 5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
 6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
 7. Protect vapor retarder during placement of reinforcement and concrete.
 - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by **6 inches (150 mm)** on all sides and sealing to vapor retarder.
- B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder in accordance with manufacturer's written instructions.

3.6 INSTALLATION OF CAST-IN-PLACE CONCRETE

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. As directed by the Owner, notify the Owner and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Water addition in transit or at the Project site must be in accordance with ASTM C94/C94M and must not exceed the permitted amount indicated on the concrete delivery ticket.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
1. If a section cannot be placed continuously, provide construction joints as indicated.
 2. Deposit concrete to avoid segregation.
 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with **ACI 301 (ACI 301M)**.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least **6 inches (150 mm)** into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Do not place concrete floors and slabs in a checkerboard sequence.
 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 3. Maintain reinforcement in position on chairs during concrete placement.
 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
 5. Level concrete, cut high areas, and fill low areas.
 6. Slope surfaces uniformly to drains where required.
 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
 8. Do not further disturb slab surfaces before starting finishing operations.

3.7 INSTALLATION OF JOINTS

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings as directed by the Owner.
 2. Place joints perpendicular to main reinforcement.
 - a. Continue reinforcement across construction joints unless otherwise indicated.
 3. Form keyed joints as indicated. Embed keys at least **1-1/2 inches (38 mm)** into concrete.
 4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 6. Space vertical joints in walls [**as indicated on Drawings**]. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
 7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 8. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least [**one-fourth**] of concrete thickness as follows:
1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of **1/8 inch (3 mm)**. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut **1/8-inch (3-mm-)** wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
2. Terminate full-width joint-filler strips not less than **1/2 inch (13 mm)** or more than **1 inch (25 mm)** below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

F. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

3.8 APPLICATION OF FINISHING FLOORS AND SLABS

A. Scratch Finish:

1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
2. Use stiff brushes, brooms, or rakes to produce a profile depth of **1/4 inch (6 mm)** in one direction.
3. Apply scratch finish to surfaces **[to receive concrete floor toppings][to receive mortar setting beds for bonded cementitious floor finishes]**.

B. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture and complies with **ACI 117 (ACI A117M)** tolerances for conventional concrete.
3. Apply float finish to surfaces **[to receive trowel finish][and][to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo]**.

C. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighen until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface. Use of an approved finishing aid is acceptable.
5. Do not apply troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces **[exposed to view][or][to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system]**.
7. Finish surfaces to the following tolerances, in accordance with **ASTM E1155 (ASTM E1155M)**, for a randomly trafficked floor surface:

a. Slabs on Ground:

- 1) Specified overall values of flatness, FF 25; and of levelness, FL 20; with minimum local values of flatness, FF 17; and of levelness, FL 15.

- 2) Specified overall values of flatness, FF 35; and of levelness, FL 25; with minimum local values of flatness, FF 24; and of levelness, FL 17.
 - 3) Specified overall values of flatness, FF 45; and of levelness, FL 35; with minimum local values of flatness, FF 30; and of levelness, FL 24.
 - 4) Specified overall values of flatness, FF 50; and of levelness, FL 35; with minimum local values of flatness, FF 40; and of levelness, FL 24.
- b. Suspended Slabs:
- 1) Specified overall values of flatness, FF 25; and of levelness, FL 20; with minimum local values of flatness, FF 17; and of levelness, FL 15.
 - 2) Specified overall values of flatness, FF 35; and of levelness, FL 20; with minimum local values of flatness, FF 24; and of levelness, FL 15.
 - 3) Specified overall values of flatness, FF 45; and of levelness, FL 35; with minimum local values of flatness, FF 30; and of levelness, FL 24.
- D. Trowel and Fine-Broom Finish: First apply a trowel finish to surfaces **[indicated on Drawings][where ceramic or quarry tile is to be installed by either thickset or thinset method]**. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.
1. Coordinate required final finish as directed by the Owner before application.
 2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with a fiber-bristle broom perpendicular to main traffic route.
 2. Coordinate required final finish as directed by the Owner before application.
- F. Slip-Resistive Finish: Before final floating, apply slip-resistive **[aggregate][aluminum granule]** finish to concrete stair treads, platforms, and ramps, as indicated on Drawings.
1. Apply in accordance with manufacturer's written instructions and as follows:
 - a. Uniformly spread **[25 lb/100 sq. ft. (12 kg/10 sq. m)]** of dampened slip-resistive **[aggregate][aluminum granules]** over surface in one or two applications.
 - b. Tamp aggregate flush with surface, but do not force below surface.
 - c. After broadcasting and tamping, apply float finish.
 - d. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive **[aggregate][aluminum granules]**.
- G. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces in accordance with manufacturer's written instructions and as follows:
1. Uniformly apply dry-shake floor hardener at a rate of **[100 lb/100 sq. ft. (49 kg/10 sq. m)]** unless greater amount is recommended by manufacturer.
 2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating.
 3. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
 4. After final floating, apply a trowel finish.
 5. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

3.9 APPLICATION OF FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 (ACI 301M) Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
 - a. Patch voids larger than **1-1/2 inches (38 mm)** wide or **1/2 inch (13 mm)** deep.
 - b. Remove projections larger than **1 inch (25 mm)**.
 - c. Tie holes do not require patching.
 - d. Surface Tolerance: **ACI 117 (ACI 117M)**, Class D.
 - e. Apply to concrete surfaces for metal lap pan deck formed surfaces and those surfaces that are buried or covered with subsequent installed surfaces.
2. ACI 301 (ACI 301M) Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
 - a. Patch voids larger than **3/4 inch (19 mm)** wide or **1/2 inch (13 mm)** deep.
 - b. Remove projections larger than **1/4 inch (6 mm)**.
 - c. Patch tie holes.
 - d. Surface Tolerance: **ACI 117 (ACI 117M)**, Class B.
 - e. Locations: Apply to concrete surfaces **[exposed to public view,][to receive a rubbed finish,][or to be covered with a coating or covering material applied directly to concrete]**.
3. ACI 301 (ACI 301M) Surface Finish SF-3.0:
 - a. Patch voids larger than **3/4 inch (19 mm)** wide or **1/2 inch (13 mm)** deep.
 - b. Remove projections larger than **1/8 inch (3 mm)**.
 - c. Patch tie holes.
 - d. Surface Tolerance: **ACI 117 (ACI 117M)** Class A.
 - e. Locations: Apply to concrete surfaces **[exposed to public view,][to receive a rubbed finish,][or to be covered with a coating or covering material applied directly to concrete]**.

B. Rubbed Finish: Apply the following to as-cast surface finishes where indicated on Drawings:

1. Smooth-Rubbed Finish:
 - a. Perform no later than one day after form removal.
 - b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
 - c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.
 - d. Maintain required patterns or variances as shown on Drawings or to match **[design reference sample][field sample panels][mockups]**.
2. Grout-Cleaned Rubbed Finish:
 - a. Clean concrete surfaces after contiguous surfaces are completed and accessible.
 - b. Do not clean concrete surfaces as Work progresses.
 - c. Mix 1 part portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
 - d. Wet concrete surfaces.

- e. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap, and keep surface damp by fog spray for at least 36 hours.
 - f. Maintain required patterns or variances as shown on Drawings or to match **[design reference sample][field sample panels][mockups]**.
- C. Abrasive-Blast Finish: Apply the following to as-cast surface finishes where indicated on Drawings:
1. Perform abrasive blasting after compressive strength of concrete exceeds **2000 psi (13.8 MPa)**.
 2. Coordinate with formwork removal to ensure that surfaces to be abrasive blasted are treated at the same age.
 3. Surface Continuity:
 - a. Perform abrasive-blast finishing as continuous operation, maintaining continuity of finish on each surface or area of Work.
 - b. Maintain required patterns or variances in depths of blast to match **[design reference sample][field sample panels][mockups]**.
 4. Abrasive Blasting:
 - a. Abrasive-blast corners and edges of patterns carefully, using backup boards to maintain uniform corner and edge lines.
 - b. Determine type of nozzle pressure and blasting techniques required to match field sample.
 - c. Depth of Cut: Use an abrasive grit of proper type and gradation to expose aggregate and surrounding matrix surfaces to match field sample, as follows:
 - 1) Brush Texture: Remove cement matrix to dull surface sheen and expose face of fine aggregate, with no significant reveal.
 - 2) Light Texture: Expose fine aggregate with occasional exposure of coarse aggregate and uniform color, with maximum reveal of **1/16 inch (1.5 mm)**.
 - 3) Medium Texture: Generally, expose coarse aggregate with slight reveal and with a maximum reveal of **1/4 inch (6 mm)**.
 - 4) Heavy Texture: Expose and reveal coarse aggregate to a maximum projection of one-third its diameter, with reveal range of **1/4 to 1/2 inch (6 to 13 mm)**.
 - d. Maintain required patterns or variances in reveal projection to match **[design reference sample][field sample panels][mockups]**.
- D. High-Pressure Water-Jet Finish: Apply the following to as-cast surface finishes where indicated on Drawings:
1. Perform high-pressure water jetting on concrete that has achieved a minimum compressive strength of **4500 psi (31 MPa)**.
 2. Coordinate with formwork removal to ensure that surfaces to be high-pressure water-jet finished are treated at same age for uniform results.
 3. Surface Continuity: Perform high-pressure water-jet finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work.
 4. Maintain required patterns or variances in reveal projection to match **[design reference sample][field sample panels][mockups]**.
- E. Bushhammer Finish: Apply the following to as-cast surface finishes where indicated on Drawings:
1. Perform bushhammer finish to concrete that has achieved a minimum compressive strength of **4500 psi (31 MPa)**.
 2. Surface Continuity:

- a. Perform bushhammer finishing in as continuous an operation as possible, maintaining continuity of finish on each surface or area of Work.
3. Surface Cut:
 - a. Maintain required depth of cut and general aggregate exposure.
 - b. Use power tool with hammer attachments for large, flat surfaces, and use hand hammers for small areas, at corners and edges, and for restricted locations where power tools cannot reach.
4. Remove impressions of formwork and form facings with exception of tie holes.
5. Maintain required patterns or variances of cut as shown on Drawings or to match **[design reference sample][field sample panels][mockups]**.
6. Maintain control of concrete chips, dust, and debris in each Work area, limiting migration of airborne materials and dust by use of tarpaulins, windbreaks, or similar devices.

3.10 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

- A. Filling in:
 1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
 2. Mix, place, and cure concrete, as specified, to match color and texture with in-place construction exposed to view.
 3. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 2. Construct concrete bases **[4 inches (100 mm)][6 inches (150 mm)][8 inches (200 mm)]** high unless otherwise indicated on Drawings, and extend base not less than **6 inches (150 mm)** in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
 3. Minimum Compressive Strength: **[5000 psi (34.5 MPa)][4500 psi (31 MPa)][4000 psi (27.6 MPa)][3500 psi (24.1 MPa)][3000 psi (20.7 MPa)]** at 28 days.
 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on **18-inch (450-mm)** centers around the full perimeter of concrete base.
 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
 6. Prior to pouring concrete, place and secure anchorage devices.
 - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Cast anchor-bolt insert into bases.
 - c. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.
 1. Cast-in inserts and accessories, as shown on Drawings.
 2. Screed, tamp, and trowel finish concrete surfaces.

3.11 APPLICATION OF CONCRETE CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
 - 1. Comply with **ACI 301 (ACI 301M)** for cold weather protection during curing.
 - 2. Comply with **ACI 301 (ACI 301M)** and **ACI 305.1 (ACI 305.1M)** for hot-weather protection during curing.
 - 3. Maintain moisture loss no more than **0.2 lb/sq. ft. x h (1 kg/sq. m x h)**, calculated in accordance with ACI 305R, before and during finishing operations.
- B. Curing Formed Surfaces: Comply with **ACI 308.1 (ACI 308.1M)** as follows:
 - 1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
 - 2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
 - 3. If forms remain during curing period, moist cure after loosening forms.
 - 4. If removing forms before end of curing period, continue curing for remainder of curing period as follows:
 - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
 - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
 - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
 - d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
 - e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
 - 2) Maintain continuity of coating and repair damage during curing period.
- C. Curing Unformed Surfaces: Comply with **ACI 308.1 (ACI 308.1M)** as follows:
 - 1. Begin curing after finishing concrete.
 - 2. Interior Concrete Floors:
 - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than **12 inches (300 mm)**.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least **12 inches (300 mm)**, and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

- b) Cure for not less than seven days.
- 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following not in cold weather:
 - a) Water.
 - b) Continuous water-fog spray.
- b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than **12 inches (300 mm)**.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least **12 inches (300 mm)**, and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
- c. Floors to Receive Polished Finish: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than **12 inches (300 mm)**.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
- d. Floors To Receive Chemical Stain:
 - 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
 - 2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.

- 3) Butt sides of curing paper tight; do not overlap sides of curing paper.
- 4) Leave curing paper in place for duration of curing period, but not less than 28 days.

e. Floors To Receive Urethane Flooring:

- 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
- 2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped **6 inches (150 mm)** and sealed in place.
- 3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
- 4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

f. Floors To Receive Curing Compound:

- 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
- 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
- 3) Maintain continuity of coating, and repair damage during curing period.
- 4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

g. Floors To Receive Curing and Sealing Compound:

- 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
- 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
- 3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.12 APPLICATION OF LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than **[three][seven][14][28]** days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
4. Rinse with water; remove excess material until surface is dry.
5. Apply a second coat in a similar manner if surface has received a float finish or abrasive surface preparation.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

3.13 INSTALLATION OF JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least **[one][six]** month(s).
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least **2 inches (50 mm)** deep in formed joints.
- D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.14 INSTALLATION OF CONCRETE SURFACE REPAIRS

- A. Defective Concrete:
 1. Repair and patch defective areas as directed by the Owner.
 2. Remove and replace concrete that cannot be repaired and patched to meet specification requirements.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a **No. 16 (1.18-mm)** sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks in excess of **0.01 inch (0.25 mm)** spalls, air bubbles exceeding surface finish limits, honeycombs, rock pockets, fins and other projections on the surface exceeding surface finish limits, and stains and other discolorations that cannot be removed by cleaning.
 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than **1/2 inch (13 mm)** in any dimension to solid concrete.
 - a. Limit cut depth to **3/4 inch (19 mm)**.
 - b. Make edges of cuts perpendicular to concrete surface.
 - c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
 - d. Fill and compact with patching mortar before bonding agent has dried.
 - e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
 - a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
 - b. Compact mortar in place and match surrounding surface.
 3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance, as directed by the Owner.
- D. Repairing Unformed Surfaces:
 1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
 - a. Correct low and high areas.
 - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of **0.01 inch (0.25 mm)** wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by adding patching mortar.
 - a. Finish repaired areas to blend into adjacent concrete.
5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
 - a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - b. Feather edges to match adjacent floor elevations.
6. Correct other low areas scheduled to remain exposed with repair topping.
 - a. Cut out low areas to ensure a minimum repair topping depth of **1/4 inch (6 mm)** to match adjacent floor elevations.
 - b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
7. Repair defective areas, except random cracks and single holes **1 inch (25 mm)** or less in diameter, by cutting out and replacing with fresh concrete.
 - a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a **3/4-inch (19-mm)** clearance all around.
 - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
 - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
 - d. Place, compact, and finish to blend with adjacent finished concrete.
 - e. Cure in same manner as adjacent concrete.
8. Repair random cracks and single holes **1 inch (25 mm)** or less in diameter with patching mortar.
 - a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
 - b. Dampen cleaned concrete surfaces and apply bonding agent.
 - c. Place patching mortar before bonding agent has dried.
 - d. Compact patching mortar and finish to match adjacent concrete.
 - e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, as directed by the Owner, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, as directed by the Owner.

3.15 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: **[the Owner][Engage]** a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency to be responsible for providing curing facility for initial curing of strength test specimens on-site and verifying that test specimens are cured in accordance with standard curing requirements in ASTM C31/C31M.
 2. Testing agency to immediately report to The Owner and concrete manufacturer any failure of Work to comply with Contract Documents.
 3. Testing agency to report results of tests and inspections, in writing, the Owner within 48 hours of inspections and tests, as directed by the Owner.
 - a. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and **ACI 301 (ACI 301M)**, including the following as applicable to each test and inspection:
 - 1) Project name.
 - 2) Name of testing agency.
 - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
 - 4) Name of concrete manufacturer.
 - 5) Date and time of inspection, sampling, and field testing.
 - 6) Date and time of concrete placement.
 - 7) Location in Work of concrete represented by samples.
 - 8) Date and time sample was obtained.
 - 9) Truck and batch ticket numbers.
 - 10) Design compressive strength at 28 days.
 - 11) Concrete mixture designation, proportions, and materials.
 - 12) Field test results of fresh concrete, including slump or slump flow, air content, temperature and density.
 - 13) Information on storage and curing of samples at the Project site, including curing method and maximum and minimum temperatures during initial curing period.
 - 14) Type of fracture and compressive break strengths at seven days and 28 days.
 4. Provide a space and source of power or other resources for curing and access to test specimens by the testing agency.
- C. Delivery Tickets: comply with ASTM C94/C94M.
- D. Inspections:
1. Headed bolts and studs.
 2. Verification of use of required design mixture.
 3. Concrete placement, including conveying and depositing.
 4. Curing procedures and maintenance of curing temperature.
 5. Verification of concrete strength before removal of shores and forms from beams and slabs.
 6. Batch Plant Inspections: On a random basis, as directed by the Owner.
- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding **5 cu. yd. (4 cu. m)**, but less than **25 cu. yd. (19 cu. m)**, plus one set for each additional **150 cu. yd. (114 cu. m)** or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing is to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C143/C143M:

- a. One test at point of delivery for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests as needed.
3. Slump Flow: ASTM C1611/C1611M:
 - a. One test at point of delivery for each composite sample when strength test specimens are cast, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests as needed.
4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; **[ASTM C173/C173M volumetric method, for structural lightweight concrete]**.
 - a. One test for each composite sample when strength test specimens are cast, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C1064/C1064M:
 - a. One test hourly when air temperature is **40 deg F (4.4 deg C)** and below or **80 deg F (27 deg C)** and above, and one test for each composite sample when strength test specimens are cast.
6. Concrete Density: ASTM C138/C138M:
 - a. One test for each composite sample when strength test specimens are cast.
7. Unit Weight: ASTM C138/C138M density of fresh structural lightweight concrete.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture. The fresh density should be consistent with that associated with the equilibrium density within a tolerance of plus or minus 4 lb/ft.³.
8. Compression Test Specimens: ASTM C31/C31M:
 - a. Cast and standard cure two sets of **[two][three][four] 6 inches (150 mm) by 12-inches (300 mm) or 4-inch (100-mm) by 8-inch (200-mm)** cylindrical specimens for each composite sample.
 - b. Cast, and field cure **[two]** sets of **[two][three][four]** standard cylindrical specimens for each composite sample.
9. Compressive-Strength Tests: ASTM C39/C39M.
 - a. Test one set of **[two][three][four]** standard cured specimens at seven days and one set of two specimens at 28 **[other age]** days.
 - b. Test one set of **[two][three][four]** field-cured specimens at seven days and one set of two specimens at 28 days.
 - c. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
10. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor to evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
11. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests of standard cured cylinders equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by

- more than **500 psi (3.4 MPa)** if specified compressive strength is **5000 psi (34.5 MPa)**, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than **5000 psi (34.5 MPa)**.
12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by the Owner but will not be used as sole basis for approval or rejection of concrete.
 13. Additional Tests:
 - a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by the Owner.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by the Owner.
 - 1) Acceptance criteria for concrete strength to be in accordance with **ACI 301 (ACI 301M)**, Section 1.7.6.3.
 14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- F. Measure floor and slab flatness and levelness in accordance with **ASTM E1155 (ASTM E1155M)** within **[24][48][72]** hours of completion of floor finishing and promptly report test results, as directed by the Owner.
- 3.16 PROTECTION
- A. Protect concrete surfaces as follows:
1. Protect from petroleum stains.
 2. Diaper hydraulic equipment used over concrete surfaces.
 3. Prohibit vehicles from interior concrete slabs.
 4. Prohibit use of pipe-cutting machinery over concrete surfaces.
 5. Prohibit placement of steel items on concrete surfaces.
 6. Prohibit use of acids or acidic detergents over concrete surfaces.
 7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
 8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using floor slab protective covering.

END OF SECTION 03 30 00 00



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Task	Specification	Specification Description
03 30 53 00	03 30 00 00	Cast-In-Place Concrete
03 31 00 00	03 30 00 00	Cast-In-Place Concrete
03 31 13 00	03 30 00 00	Cast-In-Place Concrete
03 31 13 00	32 13 13 00	Concrete Paving
03 31 13 00	32 13 16 00	Decorative Concrete Paving
03 31 16 00	03 30 00 00	Cast-In-Place Concrete
03 35 00 00	03 30 00 00	Cast-In-Place Concrete
03 35 13 00	03 30 00 00	Cast-In-Place Concrete
03 35 16 00	03 30 00 00	Cast-In-Place Concrete
03 35 19 00	03 30 00 00	Cast-In-Place Concrete
03 35 23 00	03 30 00 00	Cast-In-Place Concrete
03 35 26 00	03 30 00 00	Cast-In-Place Concrete
03 35 29 00	03 30 00 00	Cast-In-Place Concrete
03 35 33 00	03 30 00 00	Cast-In-Place Concrete



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SECTION 03 35 43 00 - POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stain materials.
2. Liquid floor treatments.
3. Polished concrete surface finish requirements.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for new concrete designed for polished concrete finishing, including concrete materials, mixture design, placement procedures, initial finishing, and curing.

1.2 DEFINITIONS

- A. Aggregate Exposure Class: Visual observation of polished floor aggregate surface exposure area after grinding and polishing operations. Aggregate exposure class ranges are A, B, and C.
- B. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of polished concrete.
- C. Distinctness of Image (DOI): The distinctness (clarity) of images reflected by the glossy coating surface appearance of the polished concrete finish appearance levels. The transmission of this reflection is measured in accordance with ASTM D5767.
- D. Haze: The cloudiness or milky appearance of images from objects produced by reflection in a polished concrete surface. The measurement of this appearance is defined in accordance with ASTM D4039. The test method reading is put into a calculation resulting in a Haze Index value.
- E. Specular Gloss: A reflectance value determined by a single measurement of gloss from shining a known amount of light at a surface within a specific angle of illumination in accordance with ASTM D523.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with polished concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Cast-in-place concrete subcontractor.
 - e. Polished concrete finishing subcontractor.

- f. Architect.
- g. Owner's representative.

- 2. Review **[concrete slab design for compressive strength, flatness and levelness,][cold- and hot-weather concreting procedures,][curing procedures,][sequencing,][construction joints,][concrete repair procedures,][concrete finishing,]** polished concrete appearance and aggregate exposure requirements, polished concrete mockups, and protection of polished concrete.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Laboratory Test Reports: For **[stains][and][liquid floor treatments]**, indicating compliance with requirements for low-emitting materials.
- C. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.
- D. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of product requiring color selection.
- E. Samples for Verification: Actual sample of finished products for each type of exposed color.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. An installer experienced in performing polished concrete finishing with a minimum of five previous projects similar in material, design, and extent to that indicated for this Project.
 - 2. Trained and certified by manufacturer of polished concrete system materials.
 - 3. Concrete Polishing Craftsman of the Concrete Polishing Council.
- B. Polished Concrete Standards: Comply with ACI 310.1.

1.6 MOCKUPS

- A. Build mockups **[10 by 10 ft (3.05 by 3.05 m)]** to verify selections made under Sample submittals and to demonstrate typical joints, surface finish, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in the location of the Work and of the size indicated or, if not indicated, as directed by Architect for **[newly placed][existing]** concrete.
 - 2. Demonstrate surface preparation, **[coloring,][pattern,][curing,]** tested aggregate exposure, tested polish appearance, sealing and protecting of polished concrete.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed

- Work if undisturbed at time of Substantial Completion.
5. Remove rejected mockups.

1.7 FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as needed for other construction activities.
- B. Ambient Conditions: Ensure installation location and Project ambient conditions comply with manufacturers written instructions.

PART 2 - PRODUCTS

2.1 STAIN MATERIALS

- A. Reactive Stain: Acidic-based stain with wetting agents and high-grade, UV-stable metallic salts that react with calcium hydroxide in cured concrete to produce permanent, variegated, or translucent color effects.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
- a. **[Americrete, Inc.]**
 - b. **[Artcrete, Inc]**
 - c. **[Bomanite Co]**
 - d. **[Bon Tool Co.]**
 - e. **[Brickform; a division of Solomon Colors]**
 - f. **[Butterfield Color, Inc.]**
 - g. **[Decosup Inc.]**
 - h. **[EPMAR Corporation; a Quaker Houghton company]**
 - i. **[H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.]**
 - j. **[QC Construction Products]**
 - k. **[Scofield, a Business Unit of Sika Corporation]**
 - l. **[Specialty Concrete Products, Inc]**
 - m. **[Stampcrete International, Ltd]**
 - n. **[Super Stone, Inc.]**
 - o. **[SureCrete Design Products, a Fenix Group SPC Company]**
 - p. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[Americrete, Inc.]**
 - b. **[Artcrete, Inc]**
 - c. **[Bomanite Co]**
 - d. **[Bon Tool Co.]**
 - e. **[Brickform; a division of Solomon Colors]**
 - f. **[Butterfield Color, Inc.]**
 - g. **[Decosup Inc.]**
 - h. **[EPMAR Corporation; a Quaker Houghton company]**

- i. [H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.]
 - j. [QC Construction Products]
 - k. [Scofield, a Business Unit of Sika Corporation]
 - l. [Specialty Concrete Products, Inc]
 - m. [Stampcrete International, Ltd]
 - n. [Super Stone, Inc.]
 - o. [SureCrete Design Products, a Fenix Group SPC Company]
 - p. <Insert manufacturer's name>
- B. Penetrating Stain: Coloring agents used to add consistent color to polished concrete surfaces without coloring the aggregates.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Americrete, Inc.]
 - b. [AmeriPolish]
 - c. [Bomanite Co]
 - d. [Bon Tool Co.]
 - e. [Brickform; a division of Solomon Colors]
 - f. [Butterfield Color, Inc.]
 - g. [Duckback Products]
 - h. [H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.]
 - i. [Scofield, a Business Unit of Sika Corporation]
 - j. [Super Stone, Inc.]
 - k. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Americrete, Inc.]
 - b. [AmeriPolish]
 - c. [Bomanite Co]
 - d. [Bon Tool Co.]
 - e. [Brickform; a division of Solomon Colors]
 - f. [Butterfield Color, Inc.]
 - g. [Duckback Products]
 - h. [H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.]
 - i. [Scofield, a Business Unit of Sika Corporation]
 - j. [Super Stone, Inc.]
 - k. <Insert manufacturer's name>
- C. VOC Content: For field applications[**that are inside the weatherproofing system**], verify paints and coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
1. Primers, Sealers, and Undercoaters: 100 g/L.
 2. Clear Wood Finishes, Varnishes: 275 g/L.
 3. Clear Wood Finishes, Lacquers: 275 g/L.
 4. Shellacs, Clear: 730 g/L.
 5. Stains: 100 g/L.

- D. Low-Emitting Materials: For field applications that are inside the weatherproofing system, verify 90 percent of paints and coatings comply with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. Material Emissions and Pollutant Control: Verify not less than 85 percent of field-applied paints and coatings that are inside the weatherproofing system comply with the following:
 - 1. Low-Emitting Materials: Verify VOC emissions comply with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
- F. VOC Emissions: For field applications inside the building, verify wall paints contain no more than half of the chronic REL of VOCs when tested in accordance with the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify the building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.

2.2 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear liquid materials for the applications of cleaning solutions, densifiers, and sealers that strengthen or protect polished concrete surfaces.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Advanced Floor Products]**
 - b. **[AmeriPolish]**
 - c. **[ARDEX Americas]**
 - d. **[AWRC Corporation]**
 - e. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - f. **[H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.]**
 - g. **[Laticrete International, Inc.]**
 - h. **[MAPEI Corporation]**
 - i. **[Moxie International]**
 - j. **[NewLook International, Inc.]**
 - k. **[Nox-Crete Products Group]**
 - l. **[PROSOCO, Inc]**
 - m. **[QuestMark]**
 - n. **[Vexcon Chemicals Inc.]**
 - o. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Advanced Floor Products]**
 - b. **[AmeriPolish]**
 - c. **[ARDEX Americas]**
 - d. **[AWRC Corporation]**

- e. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - f. **[H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.]**
 - g. **[Laticrete International, Inc.]**
 - h. **[MAPEI Corporation]**
 - i. **[Moxie International]**
 - j. **[NewLook International, Inc.]**
 - k. **[Nox-Crete Products Group]**
 - l. **[PROSOCO, Inc]**
 - m. **[QuestMark]**
 - n. **[Vexcon Chemicals Inc.]**
 - o. **<Insert manufacturer's name>**
3. Verify products comply with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. Verify products comply with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less.
 5. Verify products comply with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.3 POLISHED CONCRETE SURFACE FINISH REQUIREMENTS

- A. Aggregate Exposure Class: **[Class A Cement Fines 85 to 95 percent fines; 5 to 15 percent fine aggregate][Class B Fine Aggregate 85 to 95 percent fine aggregate; 5 to 15 percent blend of fines and coarse aggregate][Class C Coarse Aggregate 10 to 20 percent cement fines and fine aggregates].**
- B. Polish Concrete Appearance Levels: **[Level 1: Flat (Ground) up to 100-grit polish; DOI 0 to 9; Haze Reading less than 10][Level 2: Satin (Honed) up to 200- to 400-grit polish; DOI 10 to 39; Haze Reading less than 10; Reflective Sheen: Low to medium][Level 3: Polished (Polished Gloss up to 400- to 800-grit polish; DOI 40 to 69; Haze Reading less than 10; Reflective Sheen: Medium to high][Level 4: Highly Polished (Very High Gloss) 800-grit and higher polish; DOI 70 to 100; Haze Reading less than 10; Reflective Sheen: High to highest][Match design reference sample].**
- C. Slip Resistance: Minimum Dynamic Coefficient of Friction (DCOF) of 0.42. Provide required slip resistance based on final gloss level and determined by the Concrete Polishing Council.

2.4 ACCESSORIES

- A. Repair Materials: As recommended in writing by manufacturer to repair and fill cracks, and repair surfaces compatible with polishing materials.
- B. Water: Potable.
- C. Cleaning Agents: As recommended in writing by manufacturer.

2.5 POLISHING EQUIPMENT

- A. Equipment and Supplies: Provide equipment and supplies, not limited to, the concrete grinding and

concrete polisher equipment, tooling and polishing diamonds for the polished concrete finishing Work.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that concrete substrates are acceptable for grinding, polishing and product installation as recommended by manufacturer.
- B. Do not begin Work until unsatisfactory conditions have been addressed and corrected.

3.2 PREPARATION

- A. Verify that concrete substrate preparation is in accordance with manufacturer's written instructions.
- B. Clean surfaces free of dust, dirt and other contaminants incompatible with liquids applied products and polishing.
- C. Clean and seal cracks as recommended by manufacturer.
- D. Prepare, clean and fill joints with joint filler as recommended in writing by manufacturer.
- E. Clean surface completely of any dust with cleaning solution as recommended in writing by manufacturer.

3.3 APPLICATION

- A. Machine grind floor surfaces progressively to receive aggregate and polish appearance levels indicated to match approved mockup.
- B. Scoring: Score decorative jointing in concrete surfaces **1/16 inch (1.6 mm)** deep with diamond blades to match pattern indicated. Rinse until water is clear. Score **[after][before]** staining.
 - 1. Joint Width: **[3/8 inch (10 mm)]<Insert dimension>**.
- C. Apply penetrating stain densifier treatment for polished concrete in polishing sequence and in accordance with manufacturer's written instructions, allowing recommended drying time between successive coats.
- D. Apply reactive color stain for polished concrete in polishing sequence and in accordance with manufacturer's written instructions.
- E. Apply color dyes for polished concrete in polishing sequence and in accordance with manufacturer's written instructions.
- F. Apply sealers to polished concrete in polishing sequence and in accordance with manufacturers' written instructions.
- G. Continue progressively polishing to aggregate and polish appearance levels to match approved mockup for final finish appearance.

- H. Visually inspect to remove defects and repolish areas that are defective. Repolish those areas that do not meet specified aggregate and polish levels per approved mockup.
- I. Complete edges of floor finish that adjoins surrounding floor areas in a sharp and clean manner.
- J. Neutralize and clean polished floor surfaces.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing and inspecting agency to perform tests at three random locations for areas up to **100 sq. ft. (465 sq. m)** and inspections and to submit reports.
- B. Measure polish specular gloss level, DOI, and haze as specified; repolish if required to achieve Project requirements.
- C. Verify aggregate exposure as specified. Machine surfaces if required to achieve Project requirements.
- D. Verify compliance of slip resistance to comply with specified slip-resistance rating.
- E. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

- A. Control and dispose of waste products produced by grinding and polishing operations.
- B. Protect installed polished concrete surfaces from damage during construction in accordance with manufacturer's written instructions.

END OF SECTION 03 35 43 00



Task	Specification	Specification Description
03 35 43 00	03 30 00 00	Cast-In-Place Concrete
03 35 63 00	03 30 00 00	Cast-In-Place Concrete
03 35 66 00	03 30 00 00	Cast-In-Place Concrete
03 35 83 00	03 30 00 00	Cast-In-Place Concrete
03 37 00 00	03 30 00 00	Cast-In-Place Concrete



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SECTION 03 37 13 00 - SHOTCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Dry-mix shotcrete.
2. Wet-mix shotcrete.

1.2 DEFINITIONS

- A. Shotcrete:** Mortar or concrete pneumatically projected onto a surface at high velocity.
- B. Dry-Mix Shotcrete:** Shotcrete with most of the mixing water added at nozzle.
- C. Wet-Mix Shotcrete:** Shotcrete with ingredients, including mixing water, mixed before introduction into delivery hose.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **[Project site]**.

1. Require representatives of each entity directly concerned with shotcrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for shotcrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Shotcrete Installer.
2. Review methods and procedures related to shotcrete, but not limited to, the following:
 - a. Qualification data, equipment, and facilities needed to make progress and avoid delays.
 - b. Shotcrete finishes and finishing.
 - c. Cold- and hot-weather shotcreting procedures.
 - d. Curing procedures
 - e. Construction joints.
 - f. Forms and form-removal limitations.
 - g. Reinforcement accessory installation.
 - h. Shotcrete repair procedures.
 - i. Protection of shotcrete.
3. Before submitting design mixtures, review each shotcrete design mixture and examine procedures for ensuring quality of shotcrete materials.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include reinforcement and forming accessories, shotcrete materials, admixtures, and curing compounds.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- C. Design Mixtures: For each shotcrete mixture. Submit alternative design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. For predampened dry-mix mixtures, indicate amounts of mixing water to be added to the dry-mix materials before mixing and conveying through the delivery hose.
- D. Shop Drawings: For shotcrete installation.
 - 1. Include plans, elevations, sections, and support and anchor details.
 - 2. Detail fabrication, bending, and placing of reinforcement; number and location of splices; and special reinforcement required for openings through shotcrete structures.
 - 3. Detail formwork fabrication, assembly, and support.
 - 4. Indicate locations of proposed construction joints.
- E. Samples: For **[waterstops, approximately 24 inches (600 mm) long][and][each exposed product and for each color and finish specified, approximately 24 by 24 by 2 inches (600 by 600 by 50 mm) in size]**.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[Installer][testing agency][and][preconstruction testing service]**.
- B. Material Certificates: For each of the following:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials.
 - 4. Steel reinforcement and accessories.
 - 5. Fiber reinforcement.
 - 6. Waterstops.
 - 7. Curing compounds.
- C. Preconstruction Test Reports: For shotcrete.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer employing nozzle operators for Project, each of whom **[attains mean core grades not exceeding 2.5, according to ACI 506.2, on preconstruction tests][is**

ACI Shotcrete Nozzleman certified in Dry-Mix Process for Vertical Position][is ACI Shotcrete Nozzleman certified in Dry-Mix Process for Vertical and Overhead Positions][is ACI Shotcrete Nozzleman certified in Wet-Mix Process for Vertical Position][and][is ACI Shotcrete Nozzleman certified in Wet-Mix Process for Vertical and Overhead Positions] as appropriate to the required shotcrete work.

- B. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.
- C. Standard: Comply with ACI 506.2, "Specification for Shotcrete," unless otherwise indicated.
- D. Shotcrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design shotcrete mixtures.
- E. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution, as directed by the Owner.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: **[the Owner][Engage]** a qualified testing agency to perform preconstruction testing on shotcrete.
 - 1. Produce and test shotcrete test panels before shotcrete placement according to requirements in ACI 506.2 for each design mixture, shooting orientation, and nozzle operator. Produce test panels with dimensions of **24 by 24 inches (600 by 600 mm)** minimum and of average thickness of shotcrete, but not less than **3-1/2 inches (90 mm)**.
 - 2. From each test panel, testing agency to obtain six test specimens: one set of three specimens unreinforced, and one set of three specimens reinforced. Agency will perform the following:
 - a. Strength Testing: Test each set of unreinforced specimens for compressive strength according to ASTM C42/C42M.
 - b. Core Grading: Visually inspect each set of reinforced shotcrete cores taken from test panels and determine mean core grades according to ACI 506.2.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. **Avoid damaging coatings on steel reinforcement.**
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. Forms: Form-facing panels that will provide continuous, straight, smooth, concrete surfaces. Furnish panels in largest practical sizes to minimize number of joints.

2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A615/A615M, **Grade 60 (Grade 420)**, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- C. Galvanized Reinforcing Bars: **[ASTM A615/A615M, Grade 60 (Grade 420)][ASTM A706/A706M]**, deformed bars, ASTM A767/A767M, **[Class I][Class II]** zinc coated after fabrication and bending.
- D. Plain-Steel Wire: ASTM A1064/A1064M, **[as drawn][galvanized]**.
- E. Welded Wire Reinforcement: ASTM A1064/A1064M, **[plain, fabricated from as-drawn steel wire][plain, fabricated from galvanized-steel wire][deformed]**, furnished in flat sheet.
- F. Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place; manufactured according to CRSI's "Manual of Standard Practice" and as follows:
 - 1. For uncoated reinforcement, use **[all-plastic][CRSI Class 1, plastic-protected][or][CRSI Class 2, stainless steel]** bar supports.
 - 2. For zinc-coated reinforcement, use **[galvanized wire or dielectric-polymer-coated wire][or][all-plastic]** bar supports.
- G. Reinforcing Anchors: ASTM A36/A36M, unheaded rods or ASTM A307, Grade A, hex-head bolts; carbon steel; and carbon-steel nuts.
 - 1. Finish: **[Plain, uncoated][Hot-dip zinc coating, ASTM A153/A153M]**.
- H. Zinc Repair Material: ASTM A780/A780M, zinc-based solder, paint containing zinc dust, or sprayed zinc.

2.3 SHOTCRETE MATERIALS

- A. Portland Cement: ASTM C150/C150M, **[Type I][or][Type III]**. Use only one brand and type of cement for Project.
 - 1. Fly Ash: ASTM C618, Class C or Class F.
 - 2. Slag Cement: ASTM C989/C989M, Grade 100 or Grade 120.
 - 3. Silica Fume: ASTM C1240, amorphous silica.
- B. Blended Hydraulic Cement: ASTM C595/C595M, **[Type IS, portland blast-furnace slag][Type IP, portland-pozzolan][Type IL, portland-limestone][Type IT, ternary blended]** cement.
- C. Normal-Weight Aggregates: ASTM C33/C33M, from a single source, and as follows:
 - 1. Combined Aggregate Size: ACI 506R or ASTM C1436, Grading **[No. 1][No. 2]** sieve analysis.
 - 2. Deleterious Substances: As specified for **[fine aggregate][coarse-aggregate Class 3S][coarse-aggregate Class 3M][coarse-aggregate Class 1N]** according to ASTM C33/C33M.
- D. Lightweight Aggregates: ASTM C330/C330M.
 - 1. Combined Aggregate Size: ACI 506R, Grading **[No. 1][No. 2]** sieve analysis.

- E. Water: Potable, complying with ASTM C94/C94M, and free from deleterious materials that may affect color stability, setting, or strength of shotcrete.
- F. Carbon-Steel Fiber: ASTM A820/A820M, [**Type I, cold-drawn wire**][or][**Type II, cut sheet**], deformed.
 - 1. Nominal Length: [**0.5 inch (13 mm)**][**1 inch (25 mm)**][**1.5 inches (38 mm)**].
 - 2. Aspect Ratio: [**35 to 40**][**45 to 50**][**60 to 65**].
- G. Synthetic Fiber: [**Monofilament**][or][**fibrillated**] polypropylene fibers engineered and designed for use in shotcrete, complying with ASTM C1116/C1116M, Type III, [**1 to 1.5 inches (25 to 38 mm)**][**1.5 to 2 inches (38 to 50 mm)**] long.
- H. Ground Wire: High-strength steel wire, 0.8 to 1.0 mm in diameter.
- I. Joint Filler Strips: [**ASTM D1751, asphalt-saturated cellulosic fiber**][or][**ASTM D1752, cork or self-expanding cork**].
- J. Admixtures: ASTM C1141/C1141M, Class A (liquid) or Class B (nonliquid), but limited to the following admixture materials. Provide admixtures for shotcrete that contain no more than 0.1 percent chloride ions. Certify compatibility of admixtures with each other and with other cementitious materials.
 - 1. Accelerating Admixture, Conventional: ASTM C494/C494M, Type C or Type E.
 - 2. Pozzolan Admixture: Fly ash, slag cement, and silica fume as limited in "Portland Cement" Paragraph in this article.
 - 3. Coloring Admixture: ASTM C979/C979M, synthetic mineral-oxide pigment or colored, water-reducing admixture, free of carbon black; color stable, nonfading, and resistant to lime and other alkalis.
 - 4. Air-Entraining Admixture: As limited in "Shotcrete Mixtures" Article.

2.4 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513, [**with factory-installed metal eyelets,**] for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - 1. Profile: [**Flat dumbbell without center bulb**][**Ribbed without center bulb**][**As indicated**].
 - 2. Dimensions: [**4 inches by 3/16 inch thick (100 mm by 4.75 mm thick)**]; nontapered.
- B. Flexible PVC Waterstops: CE CRD-C 572, [**with factory-installed metal eyelets,**] for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - 1. Profile: [**Flat dumbbell without center bulb**][**Ribbed without center bulb**][**As indicated**].
 - 2. Dimensions: [**4 inches by 3/16 inch thick (100 mm by 4.75 mm thick)**]; nontapered.
- C. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, **3/4 by 1 inch (19 by 25 mm)**.
- D. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free, hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete; **3/8 by 3/4 inch (10 by 19 mm)**.

2.5 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately **9 oz./sq. yd. (305 g/sq. m)** dry, or cotton mats.
- B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Curing Compound: ASTM C309, Type 1, Class B; clear, **[waterborne][solvent-borne]**, membrane-forming curing compound.

2.6 SHOTCRETE MIXTURES

- A. Source Limitations for Shotcrete: Obtain each color, size, type, and variety of shotcrete material and shotcrete mixture from single manufacturer with resources to provide shotcrete of consistent quality in appearance and physical properties.
- B. Design Mixtures: Prepare design mixtures for each type and strength of shotcrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 506.2.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixture or field test data, or both.
- C. Cementitious Materials Replacing Portland Cement: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
- D. Cementitious Materials, Maximum Content: Limit use of **[fly ash][slag cement][and][silica fume]** to not exceed, in combination, **[25]** percent of portland cement by weight.
- E. Limit water-soluble chloride ions to maximum percentage by weight of cement or cementitious materials permitted by **ACI 301 (ACI 301M)**.
- F. Admixtures: Use admixtures according to manufacturer's written instructions.
- G. Coloring Admixture: Add coloring admixture to shotcrete mixture according to manufacturer's written instructions and to result in hardened shotcrete color consistent with approved mockup.
- H. Design-Mixture Adjustments: Subject to compliance with requirements, shotcrete design-mixture adjustments may be proposed when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.
- I. Shotcrete Mixture: Proportion mixture to provide shotcrete with the following properties:
 - 1. Compressive Strength (28 Days): **[5000 psi (34.5 MPa)][4500 psi (31 MPa)][4000 psi (27.6 MPa)][3500 psi (24.1 MPa)]**.
 - 2. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight wet-mix shotcrete having an air content before pumping of **[7][8]** percent with a tolerance of plus or minus 1-1/2 percent.
 - 3. Carbon-Steel Fiber: Uniformly disperse in shotcrete mix, according to manufacturer's written instructions, at a rate of **[50 lb/cu. yd. (30 kg/cu. m)][100 lb/cu. yd. (60 kg/cu. m)]**.
 - 4. Synthetic Fiber: Uniformly disperse in shotcrete mix, according to manufacturer's written

- instructions, at a rate of [1.5 lb/cu. yd. (0.90 kg/cu. m)][5 lb/cu. yd. (3 kg/cu. m)].
5. Color: [As indicated by manufacturer's designation][as directed by the Owner].
 6. Color of [Flash][Finish] Coat: [As indicated by manufacturer's designation][as directed by the Owner].

2.7 SHOTCRETE EQUIPMENT

- A. Mixing Equipment: Capable of thoroughly mixing shotcrete materials in sufficient quantities to maintain continuous placement.
- B. Dry-Mix Delivery Equipment: Capable of discharging aggregate-cement mixture into delivery hose under close control and maintaining continuous stream of uniformly mixed materials at required velocity to discharge nozzle. Equip discharge nozzle with manually operated water-injection system for directing even distribution of water to aggregate-cement mixture.
 1. Provide uniform, steady supply of clean, compressed air to maintain constant nozzle velocity while simultaneously operating blow pipe for cleaning away rebound.
 2. Provide water supply with uniform pressure at discharge nozzle to ensure uniform mixing with aggregate-cement mix. Provide water pump to system if line water pressure is inadequate.
- C. Wet-Mix Delivery Equipment: Capable of discharging aggregate-cement-water mixture accurately, uniformly, and continuously.

2.8 BATCHING AND MIXING

- A. Dry-Mix Process: Measure mixture proportions by weight batching according to ASTM C94/C94M or by volume batching complying with ASTM C685/C685M requirements.
 1. In volume batching, adjust fine-aggregate volume for bulking. Test fine-aggregate moisture content at least once daily to determine extent of bulking.
 2. Prepackaged shotcrete materials may be used at Contractor's option. Predampen prepackaged shotcrete materials and mix before use.
- B. Wet-Mix Process: Measure, batch, mix, and deliver shotcrete according to ASTM C94/C94M[and **ASTM C1116/C1116M**] and furnish batch ticket information.
 1. Comply with ASTM C685/C685M when shotcrete ingredients are delivered dry and proportioned and mixed on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Concrete and Masonry Substrates: Before applying shotcrete, remove unsound or loose materials and contaminants that may inhibit shotcrete bonding. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and **1/2 inch (13 mm)** deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders. Dampen surfaces to saturated, surface-dry condition before shotcreting.
 1. Abrasive blast or hydroblast existing surfaces that do not require chipping to remove paint, oil, grease, or other contaminants and to provide roughened surface for proper shotcrete bonding.

- B. Earth Substrates: Compact and trim to line and grade before placing shotcrete. Do not place shotcrete on frozen surfaces. Dampen surfaces to saturated, surface-dry condition before shotcreting.
- C. Rock Substrates: Clean rock surfaces of loose materials, mud, and other foreign matter that might weaken shotcrete bonding. [**Dampen surfaces to saturated, surface-dry condition before shotcreting.**]
- D. Steel Substrates: Clean steel surfaces by abrasive blasting according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

3.2 FORMS

- A. Design, erect, support, brace, and maintain forms, according to **ACI 301 (ACI 301M)**, to support shotcrete and construction loads and to facilitate shotcreting. Construct forms so shotcrete members and structures are secured to prevent excessive vibration or deflection during shotcreting.
 - 1. Fabricate forms to be readily removable without impact, shock, or damage to shotcrete surfaces and adjacent materials.
 - 2. Construct forms to required sizes, shapes, lines, and dimensions using ground wires and depth gages to obtain accurate alignment, location, and grades in finished structures. Construct forms to prevent mortar leakage but permit escape of air and rebound during shotcreting. Provide for openings, offsets, blocking, screeds, anchorages, inserts, and other features required in the Work.
- B. Form openings, chases, recesses, bulkheads, keyways, and screeds in formwork. Determine sizes and locations from trades providing such items. Accurately place and securely support items built into forms.

3.3 STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that weaken shotcrete bonding.
- C. Securely embed reinforcing anchors into existing substrates, located as required.
- D. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports, bolsters, chairs, spacers, and other devices as required to maintain minimum concrete cover.
- E. Set wire ties with ends directed into shotcrete, not toward exposed shotcrete surfaces.
- F. Install welded wire reinforcement in largest practical sheets on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- G. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A780/A780M. Use galvanized-steel wire ties to fasten zinc-coated steel reinforcement.

3.4 JOINTS

- A. General: Construct joints at locations as directed by the Owner.
- B. Construction Joints: Locate and install construction joints tapered to a 1:1 slope where joint is not subject to compression loads and square where joint is perpendicular to main reinforcement. Continue reinforcement through construction joints unless otherwise indicated.
- C. Contraction Joints: Construct contraction joints in shotcrete using saw cuts **1/8-inch- (3-mm-)** wide by one-third of slab depth or joint-filler strips **1/4-inch- (6-mm-)** wide by one-third of shotcrete depth unless otherwise indicated.
 - 1. After shotcrete has cured, remove strip inserts and clean groove of loose debris.
 - 2. Space joints at [**15 feet (4.5 m) o.c.**][**centers indicated**] horizontally and vertically.
 - 3. Tool edges round on each side of strip inserts if floated or troweled finishes are required.
 - 4. Where shooting over an existing substrate joint, align new shotcrete joint with existing joint.

3.5 INSTALLATION OF WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.
- B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.
- C. Prevent waterstop displacement during shotcrete application.

3.6 ALIGNMENT CONTROL

- A. Ground Wires: Install ground wires to establish thickness and planes of shotcrete surfaces. Install ground wires at corners and offsets not established by forms. Pull ground wires taut and position adjustment devices to permit additional tightening.

3.7 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by shotcrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.8 APPLICATION

- A. Apply shotcrete applied by [**dry-mix**][**or**][**wet-mix**] process and according to ACI 506.2.
- B. Apply temporary protective coverings and protect adjacent surfaces against deposit of rebound and overspray or impact from nozzle stream.
- C. Moisten wood forms immediately before placing shotcrete where form coatings are not used.

- D. Apply [**dry-mix shotcrete materials within 45 minutes after predampening**][and][**wet-mix shotcrete materials within 90 minutes after batching**].
- E. Deposit shotcrete continuously in multiple passes, to required thickness, without cold joints and laminations developing. Place shotcrete with nozzle held perpendicular to receiving surface. Begin shotcreting in corners and recesses.
1. Remove and dispose of rebound and overspray materials during shotcreting to maintain clean surfaces and to prevent rebound entrapment.
 2. Remove and dispose of cuttings during the trimming or rodding process to prevent unconsolidated material from falling onto lower reinforcement.
- F. Maintain reinforcement in position during shotcreting. Place shotcrete to completely encase reinforcement and other embedded items. Maintain steel reinforcement free of overspray, and prevent buildup against front face during shotcreting.
- G. Do not place subsequent lifts until previous lift of shotcrete is capable of supporting new shotcrete.
- H. Do not permit shotcrete to sag, slough, or dislodge.
- I. Remove hardened overspray, rebound, and laitance from shotcrete surfaces to receive additional layers of shotcrete; dampen surfaces before shotcreting.
- J. Do not disturb shotcrete surfaces before beginning finishing operations.
- K. Remove ground wires or other alignment-control devices after shotcrete placement.
- L. Shotcrete Core Grade: Apply shotcrete to achieve mean core grades not exceeding 2.5 according to ACI 506.2, with no single core grade exceeding 3.0.
- M. Installation Tolerances: Place shotcrete without exceeding installation tolerances permitted by **ACI 117 (ACI 117M)**, increased by a factor of two.
- N. Cold-Weather Shotcreting: Mix, place, and protect shotcrete according to ACI 306.1 and as follows. Protect shotcrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. Discontinue shotcreting when ambient temperature is **40 deg F (4.4 deg C)** and falling.
 2. Uniformly heat water and aggregates before mixing to obtain a shotcrete shooting temperature of not less than **50 deg F (10 deg C)** and no more than **90 deg F (32 deg C)**.
 3. Do not use frozen materials or materials containing ice or snow.
 4. Do not place shotcrete on frozen surfaces or surfaces containing frozen materials.
 5. Do not use calcium chloride, salt, or other materials containing antifreeze agents.
- O. Hot-Weather Shotcreting: Mix, place, and protect shotcrete according to ACI 305.1 when hot-weather conditions and high temperatures would seriously impair quality and strength of shotcrete, and as follows:
1. Cool ingredients before mixing to maintain, at time of placement, shotcrete temperature below **[100 deg F (38 deg C) for dry mix][and][90 deg F (32 deg C) for wet mix]**.
 2. Reduce temperature of reinforcing steel and receiving surfaces below **100 deg F (38 deg C)** before shotcreting.

3.9 SURFACE FINISHES

- A. General: Finish shotcrete according to descriptions in ACI 506R.
- B. Natural Finishes:
 - 1. Gun Finish: Natural undisturbed finish as sprayed.
 - 2. Rod Finish: Rough-textured finish obtained by screeding or cutting exposed face of shotcrete to plane with cutting rod, edge of trowel, or straightedge after initial set. Do not push or float with flat part of trowel.
 - 3. Broom Finish: Rough-textured finish obtained by screeding or cutting exposed face of shotcrete to plane with cutting rod, edge of trowel, or straightedge after initial set; followed by uniform brooming.
- C. Flash-Coat Finish: After screeding or cutting exposed face of shotcrete to plane after initial set, apply up to **1/4-inch (6-mm)** coat of shotcrete using ACI 506R, Grading No. 1, fine-screened sand modified with maximum aggregate size not exceeding **No. 4 (4.75-mm)** sieve to provide a finely textured finish.
- D. Flash-Coat with Final Finish: After screeding or cutting exposed face of shotcrete to plane after initial set, apply up to **1/4-inch (6-mm)** coat of shotcrete using ACI 506R, Grading No. 1, fine-screened sand modified with maximum aggregate size not exceeding **No. 4 (4.75-mm)** sieve, and apply **[wood-float][rubber-float][brush-float][steel-trowel]** finish.
- E. Finish-Coat Finish: After screeding or cutting exposed face of shotcrete to plane after initial set, apply shotcrete finish coat, **1/4 to 1 inch (6 to 25 mm)** thick, using ACI 506R, Grading No. 1, fine-screened sand modified with maximum aggregate size not exceeding **No. 4 (4.75-mm)** sieve to provide a finish of uniform texture and appearance.
- F. Finish-Coat with Final Finish: After screeding or cutting exposed face of shotcrete to plane after initial set, apply shotcrete finish coat, **1/4 to 1 inch (6 to 25 mm)** thick, using ACI 506R, Grading No. 1, fine-screened sand modified with maximum aggregate size not exceeding **No. 4 (4.75-mm)** sieve, and apply **[wood-float][rubber-float][brush-float][steel-trowel]** finish.

3.10 CURING

- A. Protect freshly placed shotcrete from premature drying and excessive cold or hot temperatures.
- B. Begin curing immediately after placing and finishing but not before free water, if any, has disappeared from shotcrete surface.
- C. Curing Exposed Surfaces: Cure shotcrete by one of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Water-saturated absorptive covers or moisture-retaining covers. Lap and seal sides and ends of covers with **12-inch (300-mm)** lap over adjacent covers.
 - 2. Curing Compound: Apply uniformly in continuous operation by power spray according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Apply curing compound to natural gun and flash-coat finishes at rate of **1 gal./100 sq. ft.**

(1 L/2.5 sq. m).

- D. Curing Formed Surfaces: Cure formed shotcrete surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

3.11 FORM REMOVAL

- A. Forms not supporting weight of shotcrete may be removed after curing for 24 consecutive hours at not less than **50 deg F (10 deg C)**, provided shotcrete is hard enough not to be damaged by form-removal operations and provided curing and protecting operations are maintained.
 - 1. Leave forms supporting weight of shotcrete in place until shotcrete has attained design compressive strength. Determine compressive strength of in-place shotcrete by testing representative field-cured specimens of shotcrete.
 - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing materials are unacceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: **[the Owner][Engage]** a qualified testing agency to perform tests and inspections.
- B. Air Content: ASTM C173/C173M, volumetric method or ASTM C231/C231M, pressure method; one test for each compressive-strength test for each mixture of air-entrained, wet-mix shotcrete measured before pumping.
- C. Shotcrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is **40 deg F (4.4 deg C)** and below and when **80 deg F (27 deg C)** and above, and one test for each set of compressive-strength specimens.
- D. Test Panels: Make a test panel, reinforced as in structure, for each shotcrete mixture and for each workday or for every **[50 cu. yd. (38 cu. m)]** of shotcrete placed, whichever is less. Produce test panels with dimensions of **24 by 24 inches (600 by 600 mm)** minimum and of average thickness of shotcrete, but not less than **4-1/2 inches (115 mm)**. Testing agency will obtain sets of test specimens from each test panel.
 - 1. Compressive Strength Testing: One set of three unreinforced specimens. Test each set of unreinforced specimens for compressive strength according to construction testing requirements in ACI 506.2.
 - 2. Visual Core Grading: One set of three reinforced specimens. Visually inspect each set of reinforced shotcrete cores taken from test panels and determine mean core grades according to ACI 506.2.
- E. In-Place Shotcrete Testing: One set of three unreinforced cores for each mixture and for each workday or for every **[50 cu. yd. (38 cu. m)]** of shotcrete placed, whichever is less. Test cores for compressive strength according to ACI 506.2 and ASTM C42/C42M. Do not cut steel reinforcement.
- F. Strength of shotcrete will be considered satisfactory according to the following:

1. Specimen Cores: Mean compressive strength of each set of three unreinforced cores equals or exceeds 85 percent of specified compressive strength, with no individual core less than 75 percent of specified compressive strength.
2. Specimen Cubes: Mean compressive strength of each set of three unreinforced cubes to equal or exceed design compressive strength with no individual cube less than 88 percent of specified compressive strength.

G. Shotcrete will be considered defective if it does not pass tests and inspections.

H. Prepare test and inspection reports.

3.13 REPAIRS

A. Remove and replace shotcrete that is delaminated or exhibits laminations, voids, or sand/rock pockets exceeding limits for specified core grade of shotcrete.

1. Remove unsound or loose materials and contaminants that may inhibit bond of shotcrete repairs.
2. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and **1/2 inch (13 mm)** deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders.
3. Dampen surfaces and apply new shotcrete. [**Match adjacent color and finish.**]

B. Repair core holes from in-place testing according to repair provisions in **ACI 301 (ACI 301M)**, except do not use shotcrete. Match adjacent color and finish.

3.14 CLEANING

A. Immediately remove and dispose of rebound and overspray materials from final shotcrete surfaces and areas not intended for shotcrete placement.

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SECTION 03 37 13 00A - GLASS-FIBER-REINFORCED CONCRETE (GFRC)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass-fiber-reinforced concrete (GFRC) panels **[with][without]** panel frames.
 - a. GFRC panels include **[wall units][window wall units][mullions][column covers][fascia units][cornices][soffits]**.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for embedding weld plates and angles in concrete for attaching connection devices.
2. Section 047200 "Cast Stone Masonry" for cast stone facings, trim, and accessories.
3. Section 051200 "Structural Steel Framing" for attaching connection devices to steel framing.

1.2 DEFINITIONS

- A. Design Reference Sample: Sample of GFRC color, finish, and texture, as directed by the Owner.
- B. GFRC Panels: GFRC components, including panel frames, anchors, connections, and integral ribs, as applicable.

1.3 COORDINATION

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]**.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Form liners.
2. Surface retarders.
3. Portland cement.
4. Metakaolin.
5. Glass fibers.
6. Facing aggregate.
7. Coloring admixture.

8. Polymer-curing admixture.
9. Air-entraining admixture.
10. Chemical admixtures.
11. Stainless steel plate.
12. Stainless steel bars and shapes.
13. Carbon-steel shapes and plates.
14. Carbon-steel bars.
15. Malleable-iron castings.
16. Carbon-steel castings.
17. Carbon-steel bolts.
18. High-strength bolts, nuts, and washers.
19. Welding electrodes.
20. Cold-formed steel framing.
21. Hollow structural section framing.
22. Steel channel and angle framing.
23. GFRC design mixes.
24. Galvanizing repair paint.

B. Shop Drawings: Show fabrication and installation details for GFRC panels including the following:

1. Panel elevations, sections, and dimensions.
2. Thickness of facing mix, GFRC backing, and bonding pads for typical panels.
3. Finishes.
4. Joint and connection details.
5. Panel corner details.
6. Erection details.
7. Panel frame details for typical panels including sizes, spacings, thicknesses, and yield strengths of various members.
8. Locations and details of connection hardware attached to structure.
9. Sizes, locations, and details of flex, gravity, and seismic anchors for typical panels.
10. Other items sprayed into panels.
11. Erection sequence for special conditions.
12. Relationship to adjacent materials.
13. Description of loose, cast-in, and field hardware.

C. Samples for Verification: Actual sample of finished products representative of GFRC finish, color, and texture variations.

D. Delegated Design Submittals: For GFRC panels, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Environmental Product Declaration (EPD): For each product.
4. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
5. Environmental Product Declaration: For each product.
6. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of

- transportation, and cost for each regional material.
- 7. Environmental Product Declaration: For each product.
- 8. Environmental Product Declaration: For each product.
- 9. Third-Party Certifications: For each product.
- 10. Third-Party Certified Life Cycle Assessment: For each product.
- 11. Product Data: For coatings, indicating VOC content.
- 12. Laboratory Test Reports: For coatings, indicating compliance with requirements for low-emitting materials.

1.6 INFORMATIONAL SUBMITTALS

A. Certificates:

- 1. Welding certificates.
- 2. Steel Sheet Certificates: For steel sheet used in cold-formed steel panel framing, mill certificates signed by manufacturers of steel sheet, or test reports from a qualified testing agency, indicating that steel sheet used in cold-formed metal panel framing complies with requirements including uncoated steel thickness, yield strength, tensile strength, total elongation, chemical requirements, and galvanized-coating thickness.
- 3. Mill Certificates: For structural-steel shapes and hollow structural sections used in panel framing.

B. Source Quality-Control Submittals:

- 1. Source Quality-Control Programs: For GFRC manufacturer.

C. Field Quality-Control Submittals:

- 1. Field quality-control[**and special inspection**] reports.

D. Qualification Statements: For GFRC manufacturer.

E. Delegated Design Engineer Qualifications: Include the following:

- 1. Experience providing delegated design engineering services of the type indicated.
- 2. Documentation that delegated design engineer is licensed in **[jurisdiction][state]** where Project is located.

1.7 QUALITY ASSURANCE

A. Qualifications:

- 1. Manufacturers: Designated a PCI-certified plant for Group G - Glass Fiber Reinforced Concrete, and who employs on Project experienced PCI-certified GFRC testing and inspection personnel[**or designated an IAS AC157-certified plant for GFRC**][, **or designated an APA-certified plant for GFRC production**].
- 2. Delegated Design Engineer: A professional engineer who is legally qualified to practice in **[state]** where Project is located and who is experienced in providing engineering services of the type indicated.
- 3. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:
 - a. AWS D1.1/D1.1M.
 - b. AWS D1.3/D1.3M.

1.8 MOCKUPS

- A. Sample Panels: After sample approval and before fabricating GFRC units, produce a minimum of **[two]** sample panels approximately **[16 sq. ft. (1.5 sq. m)]** in area as directed by the Owner to verify selections made under Sample submittals. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.
 - 1. Locate panels where indicated or, if not indicated, as directed by the Owner.
 - 2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
 - 3. After acceptance of repair technique, maintain one sample panel at manufacturer's plant and one at Project site in an undisturbed condition as a standard for judging the completed Work.
 - 4. Demolish and remove sample panels when directed.
- B. Range Samples: After sample panel approval and before fabricating GFRC units, produce a minimum of **[three][five]** sets of range samples, approximately **[16 sq. ft. (1.5 sq. m)]** in area, representing anticipated range of each color and texture on Project's units. Maintain one set of range samples at Project site and remaining range sample sets at manufacturer's plant as color and texture approval reference.
- C. Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and installation, as directed by the Owner.
 - 1. Build mockup **[as indicated on Drawings]**, as directed by the Owner.
 - a. Include typical components, attachments to building structure, and methods of installation.
 - b. Include window opening with GFRC returns.
 - c. Include sealant-filled joint complying with requirements in Section 079200 "Joint Sealants."
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, as directed by the Owner.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Handle and transport GFRC panels supported on nonstaining material and with nonstaining resilient spacers between panels.
- B. Store GFRC panels off of ground on firm, level, and smooth surfaces supported on nonstaining material and with nonstaining resilient spacers between panels. Place stored panels so identification marks are clearly visible.

1.10 WARRANTY

- A. Special Warranty: **[Manufacturer agrees][Installer agrees][Manufacturer and Installer agree]** to repair or replace components of GFRC panels that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including cracking.

- b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- 2. Warranty Period: **[Two]** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS-FIBER-REINFORCED CONCRETE (GFRC)

A. GFRC Panels:

- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Advanced Architectural Stone]**
 - b. **[GFRC Cladding Systems, LLC]**
 - c. **[Stromberg Architectural Products, Inc.]**

2.2 SOURCE LIMITATIONS

- A. Obtain GFRC panels from single manufacturer.

2.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design GFRC panels.
- B. Structural Performance: GFRC panels to withstand the following design loads as well as the effects of thermal- and moisture-induced dimensional changes within limits and under conditions indicated, as directed by the Owner:
 - 1. Deflection Limits: Design panel frames to withstand design loads without lateral deflections greater than L/240 of wall span.
 - 2. Thermal Movements: Provide for thermal movements resulting from annual ambient temperature changes of **[80 deg F (26 deg C)][120 deg F (67 deg C)]**.
 - 3. Design panel frames and connections to accommodate deflections and other building movements.
 - 4. Design panel frames to transfer window loads to building structure.
- C. Quality-Control Standard: Comply with requirements and recommendations in PCI MNL 130, "Manual for Quality Control for Plants and Production of Glass Fiber Reinforced Concrete Products," unless more stringent requirements are indicated.
- D. AISI Specifications: Comply with AISI S100, "North American Specification for the Design of Cold-Formed Steel Structural Members."
- E. AISC Specifications: Comply with AISC 360, "Specification for Structural Steel Buildings."

2.4 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous GFRC surfaces within tolerances; nonreactive with GFRC and capable of producing required finish surfaces.
 - 1. Mold-Release Agent: Commercially produced liquid-release agent that does not bond with, stain, or adversely affect GFRC surfaces and does not impair subsequent surface or joint treatments of GFRC.
- B. Form Liners: Units of face design, texture, arrangement, and configuration [**indicated**][**to match GFRC design reference sample**]. Provide solid backing and form supports to ensure that form liners remain in place during GFRC application. Use with manufacturer's recommended liquid-release agent that does not bond with, stain, or adversely affect GFRC surfaces and does not impair subsequent surface or joint treatments of GFRC.
- C. Surface Retarder: Chemical liquid-set retarder capable of temporarily delaying hardening of newly placed GFRC face mix to depth of reveal specified.

2.5 GFRC MATERIALS

- A. Obtain each GFRC material of same type, brand, and color from single source or producer.
- B. Portland Cement: ASTM C150/C150M; Type I, or III.
 - 1. For surfaces exposed to view in finished structure, use [**gray**][**white**] cement.
- C. Metakaolin: ASTM C618, Class N.
- D. Glass Fibers: Alkali resistant, with a minimum zirconia content of 16 percent, **1 to 2 inches (25 to 50 mm)** long, specifically produced for use in GFRC, and complying with ASTM C1666/C1666M.
- E. Backing Sand: Washed and dried silica, complying with composition requirements in ASTM C144; passing a **No. 20 (0.85-mm)** sieve with a maximum of 2 percent passing a **No. 100 (0.15-mm)** sieve.
- F. Facing Aggregate: ASTM C33/C33M, except for gradation, and PCI MNL 130, **1/4-inch (6-mm)** maximum size.
 - 1. Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match sample.
 - 2. Fine Aggregate: Natural or manufactured sand with a maximum of 5 percent passing a **No. 100 (0.15-mm)** sieve and a maximum of 3 percent passing a **No. 200 (0.075-mm)** sieve.
- G. Coloring Admixture: ASTM C979/C979M, synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, nonfading, and alkali resistant.
- H. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of GFRC and complying with ASTM C1602/C1602M and chemical limits in PCI MNL 130 for nonpotable mixing water.
- I. Polymer-Curing Admixture: Acrylic thermoplastic copolymer dispersion complying with PCI MNL 130.
- J. Air-Entraining Admixture: ASTM C260/C260M, containing not more than 0.1 percent chloride ions.

- K. Chemical Admixtures: ASTM C494/C494M, containing not more than 0.1 percent chloride ions.

2.6 ANCHORS, CONNECTORS, AND MISCELLANEOUS MATERIALS

- A. Stainless Steel Plates: ASTM A666, Type 304, Type 316, or Type 201.
- B. Carbon-Steel Shapes and Plates: ASTM A36/A36M, finished as follows:
1. Finish: Zinc coated by **[hot-dip process in accordance with ASTM A123/A123M, after fabrication, or ASTM A153/A153M, as applicable][electrodeposition in accordance with ASTM B633, SC 3]**.
- C. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.
- D. Carbon-Steel Bars: ASTM A108, Grade 1018, not less than **1/4 inch (6 mm)** in diameter, finished as follows:
1. Finish: Zinc coated by **[hot-dip process in accordance with ASTM A123/A123M, after fabrication, or ASTM A153/A153M, as applicable][electrodeposition in accordance with ASTM B633, SC 3]**.
- E. Malleable-Iron Castings: ASTM A47/A47M, **Grade 32510 (Grade 22010)**.
- F. Carbon-Steel Castings: ASTM A27/A27M, **Grade 60-30 (Grade 415-205)**.
- G. Carbon-Steel Bolts: ASTM A307, Grade A; carbon-steel, hex-head bolts; carbon-steel nuts; and flat, unhardened steel washers, finished as follows:
1. Finish: Zinc coated by **[hot-dip process in accordance with ASTM A123/A123M, after fabrication, and ASTM A153/A153M, as applicable][electrodeposition in accordance with ASTM B633, SC 3, Types 1 and 2]**.
- H. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, **Grade A325 (Grade A325M)**, Type 1, heavy-hex steel structural bolts; **ASTM A563 (ASTM A563M), Grade DH (Class 10S)** heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers, finished as follows:
1. Finish: Zinc coated by **[hot-dip process in accordance with ASTM A 123/A 123M, after fabrication, and ASTM A 153/A 153M, as applicable][electrodeposition in accordance with ASTM B 633, SC 3, Types 1 and 2]**.
- I. Welding Electrodes: Comply with AWS standards.
- J. Galvanizing Repair Paint: ASTM A 780/A 780M.

2.7 PANEL FRAME MATERIALS

- A. Cold-Formed Steel Framing: Manufacturer's standard C-shaped steel studs, complying with AISI S100 with minimum uncoated steel thickness of **0.053 inch (1.35 mm)[of web depth indicated]**; with stiffened flanges, U-shaped steel track; and of the following steel sheet:
1. Metallic-Coated Steel Sheet: ASTM A653/A653M, structural-steel sheet, **[G60 (Z180)][G90 (Z275)]** zinc coating, of grade required by structural performance of framing.
 2. Painted, Nonmetallic-Coated Steel Sheet: ASTM A1011/A1011M, hot rolled; or ASTM

A1008/A1008M, cold rolled; nonmetallic coated in accordance with ASTM A1003/A1003M; of grade required by structural performance of framing.

- B. Hollow Structural Section Framing: Steel tubing, ASTM A500/A500M, Grade B, or ASTM A513/A513M, finished as follows:
 - 1. Finish: Shop primed with organic zinc-rich primer complying with SSPC-Paint 20 on surfaces prepared to comply with SSPC-SP 6/NACE No. 3.
- C. Steel Channel and Angle Framing: ASTM A36/A36M, finished as follows:
 - 1. Finish: Shop primed with organic zinc-rich primer complying with SSPC-Paint 20 on surfaces prepared to comply with SSPC-SP 6/NACE No. 3.

2.8 GFRC MIXES

- A. Mist Coat: Slurry of portland cement, sand, water, and admixtures; of same proportions as backing mix without glass fibers.
- B. Face Mix: Proportion face mix of portland cement, facing aggregates, water, and admixtures to comply with design requirements.
- C. Backing Mix: Proportion backing mix of portland cement, glass fibers, sand, water, and admixtures to comply with design requirements. Provide nominal glass-fiber content of not less than 5 percent by weight of total mix.
- D. Polymer-Curing Admixture: 6 to 7 percent by weight of polymer-curing admixture solids to dry portland cement.
- E. Air Content: 3 to 7-1/2 percent; ASTM C185.
- F. Coloring Admixture: Not to exceed 10 percent of cement weight.

2.9 PANEL FRAME FABRICATION

- A. Fabricate panel frames and accessories plumb, square, true to line, and with components securely fastened.
 - 1. Fabricate panel frames using jigs or templates.
 - 2. Cut cold-formed metal framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed metal framing members by welding. Comply with AWS D1.3/D1.3M.
 - 4. Fasten framing members of hollow structural sections, steel channels, or steel angles by welding. Comply with AWS D1.1/D1.1M.
 - 5. Weld anchors to panel frames.
- B. Reinforce framing assemblies, as necessary, to withstand erection stresses.
- C. Galvanizing Repair: Touch up damaged galvanized surfaces in accordance with ASTM A780/A780M.
- D. Painting Repair: Touch up damaged painted surfaces using same primer.

2.10 MOLD FABRICATION

- A. Construct molds that result in finished GFRC complying with profiles, dimensions, and tolerances indicated, without damaging GFRC during stripping. Construct molds to prevent water leakage and loss of cement paste.
 - 1. Coat contact surfaces of molds with form-release agent.
 - 2. Coat contact surfaces of molds with surface retarder.
- B. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during GFRC application. Coat form liner with form-release agent.

2.11 GFRC FABRICATION

- A. Proportioning and Mixing: For backing mix, meter sand/cement slurry and glass fibers to spray head at rates to achieve design mix proportions and glass-fiber content in accordance with PCI MNL 130 procedures.
- B. Spray Application: Comply with spray-up method procedures in accordance with PCI MNL 130.
- C. Hand form and consolidate intricate details, incorporate formers or infill materials, and overspray before material reaches initial set to ensure complete bonding.
- D. Attach panel frame to GFRC before initial set of GFRC backing, maintaining a minimum clearance of **1/2 inch (13 mm)** from GFRC backing, and without anchors protruding into GFRC backing.
- E. Build up homogeneous GFRC bonding pads over anchor feet, maintaining a minimum thickness of **1/2 inch (13 mm)** over tops of anchor feet, before initial set of GFRC backing. Measure bonding pad thickness at 25 percent of anchor locations.
- F. Integral Ribs: Build up homogeneous GFRC integral ribs over expanded polystyrene or polyurethane foam rib formers to comply with design requirements.
- G. Inserts and Embedments: Build up homogeneous GFRC bosses or bonding pads over inserts and embedments to provide enough anchorage and embedment to comply with design requirements.
- H. Curing: Employ initial curing method that ensures sufficient strength for removing units from mold. Comply with PCI MNL 130 procedures.
 - 1. Keep moisture off the surfaces of mixes with polymer curing admixtures during the first three hours of curing. Maintain temperature between **60 and 120 deg F (16 and 49 deg C)** during the first 16 hours.
 - 2. Prevent drying of moist curing mixes during the first 24 hours. Maintain units in surface-damp condition at a temperature above **60 deg F (16 deg C)** and 95 percent relative humidity for seven days.
- I. Panel Identification: Mark each GFRC panel to correspond with identification mark on Shop Drawings. Mark each panel with its casting date.

2.12 FABRICATION TOLERANCES

- A. Manufacturing Tolerances: Manufacture GFRC panels so each finished unit complies with **[PCI MNL 130 dimensional tolerances.]****[the following dimensional tolerances:]**

1. Overall Height and Width of Units, Measured at the Face Adjacent to Mold:
 - a. 10 ft. (3 m) or less, plus or minus 1/8 inch (3 mm).
 - b. More than 10 ft. (3 m), plus or minus 1/8 inch per 10 ft. (3 mm per 3 m); 1/4 inch (6 mm) maximum.
2. Edge Return: Plus 1/2 inch (13 mm), minus 0 inch (0 mm).
3. Architectural Facing Thickness: Plus 1/8 inch (3 mm), minus 0 inch (0 mm).
4. Backing Thickness: Plus 1/4 inch (6 mm), minus 0 inch (0 mm).
5. Panel Depth from Face of Skin to Back of Panel Frame or Integral Rib: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
6. Angular Variation of Plane of Side Mold: Plus or minus 1/32 inch per 3 inches (0.8 mm per 75 mm) of depth, or plus or minus 1/16 inch (1.5 mm) total, whichever is greater.
7. Variation from Square or Designated Skew (Difference in Length of Two Diagonal Measurements): Plus or minus 1/8 inch per 72 inches (3 mm per 1800 mm) or 1/4 inch (6 mm) total, whichever is greater.
8. Local Smoothness: 1/4 inch per 10 ft. (6 mm per 3 m).
9. Bowing: Not to exceed L/240 unless panel complies with erection tolerances using connection adjustments.
10. Length and Width of Block Outs and Openings within One Panel: Plus or minus 1/4 inch (6 mm).
11. Location of Window Opening within Panel: Plus or minus 1/4 inch (6 mm).
12. Maximum Permissible Warpage of One Corner out of the Plane of the Other Three: 1/16 inch per 12 inches (1.5 mm per 305 mm) of distance from nearest adjacent corner, unless panel complies with erection tolerances using connection adjustments.

B. Position Tolerances: Measured from datum line locations, as indicated on Shop Drawings.

1. Panel Frame and Track: Plus or minus 1/4 inch (6 mm).
2. Inserts: Plus or minus 1/2 inch (13 mm).
3. Special Handling Devices: Plus or minus 3 inches (75 mm).
4. Location of Bearing Devices: Plus or minus 1/4 inch (6 mm).
5. Block Outs: Plus or minus 3/8 inch (10 mm).

C. Panel Frame Tolerances: As follows:

1. Vertical and Horizontal Alignment: 1/4 inch per 10 ft. (6 mm per 3 m).
2. Spacing of Framing Member: Plus or minus 3/8 inch (10 mm).
3. Squareness of Frame: Difference in length of diagonals of 3/8 inch (10 mm).
4. Overall Size of Frame: Plus or minus 3/8 inch (10 mm).

2.13 FINISHES

- A. Exposed faces to be free of joint marks, grain, and other obvious defects. Corners, including false joints, to be uniform, straight, and sharp.
- B. Finish exposed-face surfaces of GFRC to match approved [design reference sample][sample panels][mockups] and as follows, as directed by the Owner:
 1. As-Cast-Surface Finish: Provide surfaces to match approved sample for acceptable surface, air voids, sand streaks, and honeycomb, with uniform color and texture.
 2. Textured-Surface Finish: Impart by form liners.
 3. Exposed-Aggregate Finish: Use chemical-retarding agents applied to concrete forms and washing and brushing procedures to expose aggregate and surrounding matrix surfaces after form removal.

4. Sand- or Abrasive-Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
5. Acid-Etched Finish: Use acid and hot-water solution equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.

2.14 SOURCE QUALITY CONTROL

- A. Testing Agency: **[as directed by the Owner will engage][Engage]** a qualified testing agency to evaluate GFRC fabricator's quality-control and testing methods.
 1. Allow testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with testing agency and provide samples of materials and GFRC mixes as may be requested for additional testing and evaluation.
- B. Quality-Control Testing: Establish and maintain a quality-control program for manufacturing GFRC panels in accordance with PCI MNL 130.
 1. Test materials and inspect production techniques.
 2. Quality-control program monitors glass-fiber content, spray rate, unit weight, product physical properties, anchor pull-off and shear strength, and curing period and conditions.
 3. Prepare test specimens and test in accordance with ASTM C1228 and PCI MNL 130 procedures.
 4. Test GFRC inserts and anchors in accordance with ASTM C1230 to validate design values.
 5. Produce test boards at a rate of no fewer than one per work shift per operator for each spray machine and for each mix design.
 - a. For each test board, determine glass-fiber content in accordance with ASTM C1229 and flexural yield and ultimate strength in accordance with ASTM C947.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine structure and conditions for compliance with requirements for installation tolerances, bearing surfaces, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

- A. Install clips, hangers, and other accessories required for connecting GFRC panels to supporting members and backup materials.
- B. Install GFRC panels level, plumb, square, and in alignment. Provide temporary supports and bracing as required to maintain position, stability, and alignment of panels until permanent connections are completed.
 1. Maintain horizontal and vertical joint alignment and uniform joint width.
 2. Remove projecting hoisting devices.
- C. Connect GFRC panels in position by bolting or welding, or both, as indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as possible after connecting is completed.

- D. Welding: Comply with applicable AWS D1.1/D1.1M and AWS D1.3/D1.3M requirements for welding, appearance, quality of welds, and methods used in correcting welding work.
 - 1. Protect GFRC panels from damage by field welding or cutting operations, and provide noncombustible shields as required.
- E. At bolted connections, use lock washers or other acceptable means to prevent loosening of nuts.

3.3 ERECTION TOLERANCES

- A. Erect GFRC panels to comply with **[PCI MNL 130]****[the following noncumulative tolerances. For erection tolerances not listed below, comply with PCI MNL 130].**
 - 1. Plan Location from Building Grid Datum: Plus or minus **1/2 inch (13 mm)**.
 - 2. Top Elevation from Nominal Top Elevation:
 - a. Exposed Individual Panel: Plus or minus **1/4 inch (6 mm)**.
 - b. Nonexposed Individual Panel: Plus or minus **1/2 inch (13 mm)**.
 - c. Exposed Panel Relative to Adjacent Panel: **1/4 inch (6 mm)**.
 - d. Nonexposed Panel Relative to Adjacent Panel: **1/2 inch (13 mm)**.
 - 3. Support Elevation from Nominal Elevation:
 - a. Maximum Low: **1/2 inch (13 mm)**.
 - b. Maximum High: **1/4 inch (6 mm)**.
 - 4. Maximum Plumb Variation over the Lesser of Height of Structure or **100 Ft. (30 m)**: **1 inch (25 mm)**.
 - 5. Plumb in Any **10 Ft. (3 m)** of Element Height: **1/4 inch (6 mm)**.
 - 6. Maximum Offset in Alignment of Matching Edges: **1/4 inch (6 mm)**.
 - 7. Face Width of Joint (Governs over Joint Taper):
 - a. Panel Dimension **20 Ft. (6 m)** or Less: Plus or minus **1/4 inch (6 mm)**.
 - b. Panel Dimension More Than **20 Ft. (6 m)**: Plus or minus **3/8 inch (9.5 mm)**.
 - 8. Maximum Joint Taper: **3/8 inch (10 mm)**.
 - 9. Maximum Joint Taper in **10 Ft. (3 m)**: **1/4 inch (6 mm)**.
 - 10. Maximum Offset in Alignment of Matching Faces: **1/4 inch (6 mm)**.
 - 11. Differential Bowing, as Erected, between Adjacent Members of Same Design: **1/4 inch (6 mm)**.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: **[as directed by the Owner will engage][Engage]** a qualified special inspector to perform the following special inspections and prepare reports:
 - 1. Erection of GFRC panels.
- B. Testing Agency: **[as directed by the Owner will engage][Engage]** a qualified testing agency to perform tests and inspections and prepare test reports.
- C. Visually inspect field welds and test in accordance with ASTM E165/E165M or with ASTM E709 and ASTM E1444/E1444M. High-strength bolted connections are subject to inspections.

- D. As directed by the Owner testing agency to report test results promptly and in writing to Contractor and the Owner.
- E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- F. Additional testing and inspecting, at Contractor's expense, to be performed to determine compliance of replaced or additional work with specified requirements.

3.5 REPAIRS

- A. Repairs are permitted provided structural adequacy of GFRC panel and appearance are not impaired, as directed by the Owner.
- B. Mix patching materials and repair GFRC so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces.
- C. Prepare and repair accessible damaged galvanized coatings with galvanizing repair paint in accordance with ASTM A780/A780M.
- D. Wire brush and clean accessible weld areas on prime-painted components and paint with same type of shop primer.
- E. Remove and replace damaged GFRC panels when repairs do not comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Perform cleaning procedures, if necessary, in accordance with GFRC manufacturer's written instructions. Clean soiled GFRC surfaces with detergent and water, using soft fiber brushes and sponges, and rinse with clean water. Prevent damage to GFRC surfaces and staining of adjacent materials.

END OF SECTION 03 37 13 00A

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Task	Specification	Specification Description
03 37 13 00	03 30 00 00	Cast-In-Place Concrete
03 37 16 00	03 30 00 00	Cast-In-Place Concrete
03 37 16 00	03 11 16 00	Architectural Concrete
03 39 00 00	03 30 00 00	Cast-In-Place Concrete
03 39 13 00	03 30 00 00	Cast-In-Place Concrete
03 39 13 00	03 11 16 00	Architectural Concrete
03 39 23 00	03 30 00 00	Cast-In-Place Concrete
03 39 23 23	03 30 00 00	Cast-In-Place Concrete



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SECTION 03 41 00 00 - PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Precast structural concrete.
2. Thin brick and accessories.
3. Stone materials and accessories.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for [**concrete topping and**]placing connection anchors in concrete.
2. Section 051200 "Structural Steel Framing" for furnishing and installing connections attached to structural-steel framing.
3. Section 055000 "Metal Fabrications" for kickers and other miscellaneous steel shapes.
4. Section 071900 "Water Repellents" for water-repellent finish treatments.

1.2 DEFINITIONS

- A. Design Reference Sample: Sample of approved precast structural concrete color, finish, and texture, as directed by the Owner.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at [**Project site**].

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
3. Health Product Declaration (HPD): Provide documentation confirming product compliance with one of the following:
 - a. Inventory or HPD to at least 0.01 percent by weight with no GreenScreen LT-1 or GHS Category 1 hazards.
 - b. Inventory or HPD to at least 0.01 percent by weight, with at least 75 percent assessed using GreenScreen Benchmark assessment.
 - c. Third-party-verified Declare product label, designated "Red List Free."

- d. Material Health Certificate or Cradle to Cradle certification with minimum Bronze level of Material Health.
- 4. Health Product Declaration (HPD): Provide documentation indicating that manufacturer has screened and publicly provided ingredient disclosure to 1000 ppm, and has developed an action plan to mitigate known hazards.
- C. Design Mixtures: For each precast concrete mixture. Include compressive strength and, if required, water-absorption tests.
- D. Shop Drawings:
 - 1. Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement.
 - 2. Detail fabrication and installation of precast structural concrete units, including connections at member ends and to adjoining construction.
 - 3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
 - 4. Indicate separate face and backup mixture locations and thicknesses.
 - 5. Indicate type, size, and length of welded connections by AWS standard symbols.
 - 6. Detail loose and cast-in hardware, lifting and erection inserts, connections, and joints.
 - 7. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
 - 8. Include and locate openings larger than **10 inches (250 mm)**. Where additional structural support is required, include header design.
 - 9. Indicate location of each precast structural concrete unit by same identification mark placed on panel.
 - 10. Indicate relationship of precast structural concrete units to adjacent materials.
 - 11. Indicate locations, dimensions, and details of thin-brick units, including corner units and special shapes, and joint treatment.
 - 12. Indicate locations, dimensions, and details of stone facings, anchors, and joint widths.
 - 13. Indicate estimated camber for precast floor slabs with concrete toppings.
 - 14. Indicate shim sizes and grouting sequence.
 - 15. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
- E. Samples:
 - 1. For each type of finish indicated on exposed surfaces of precast structural concrete units with architectural finish, in sets of three, representative of finish, color, and texture variations expected; approximately **12 by 12 by 2 inches (300 by 300 by 50 mm)**.
 - a. Where other faces of precast concrete unit are exposed, include Samples illustrating workmanship, color, and texture of backup concrete as well as facing concrete.
 - 2. Samples for each thin-brick unit required, showing full range of color and texture expected. Include Samples showing color and texture of joint treatment.
 - a. Grout Samples for Initial Selection: Color charts consisting of actual sections of grout showing manufacturer's full range of colors.
 - b. Grout Samples for Verification: Showing color and texture of joint treatment.
- F. Delegated Design Submittals: For precast structural concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional

engineer responsible for their preparation.

1. Show precast structural concrete unit types, connections, types of reinforcement, including special reinforcement, and concrete cover on reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from precast structural concrete.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[Installer][fabricator][testing agency]**.
- B. Welding certificates.
- C. Material Certificates: For the following:
 1. Cementitious materials.
 2. Reinforcing materials and prestressing tendons.
 3. Admixtures.
 4. Bearing pads.
 5. Insulation.
 6. Structural-steel shapes and hollow structural sections.
 7. Thin-brick units and accessories.
 8. Stone anchors and accessories.
- D. Material Test Reports: For aggregates, by a qualified testing agency.
- E. Preconstruction test reports.
- F. Source quality-control reports.
- G. Field quality-control **[and special inspection]** reports.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 1. Designated as a PCI-certified plant as follows:
 - a. Group C, **[Category C1 - Precast Concrete Products (no prestressed reinforcement)][Category C2 - Prestressed Hollowcore and Repetitively Produced Products][Category C3 - Prestressed Straight Strand Structural Members][Category C4 - Prestressed Deflected Strand Structural Members]**.
 - b. Group CA, **[Category C1A - Precast Concrete Products (no prestressed reinforcement)][Category C2A - Prestressed Hollowcore and Repetitively Produced Products][Category C3A - Prestressed Straight-Strand Structural Members][Category C4A - Prestressed Deflected-Strand Structural Members]**.
- B. Required Certified Installer Qualifications: A precast concrete erector qualified and designated by PCI's Certificate of Compliance, to erect **[Category S1 - Simple][Category S2 - Complex]** Structural Systems.
- C. Installer Qualifications: An experienced precast concrete erector who has retained a "PCI-Certified Field

Auditor" to conduct a field audit of a project installed by erector in **[Category S1 - Simple][Category S2 - Complex]** Structural Systems and who can produce an Erectors' Post Audit Declaration, according to PCI MNL 127, "PCI Erector's Manual - Standards and Guidelines for the Erection of Precast Concrete Products."

- D. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.
- E. Quality-Control Standard: For manufacturing procedures, testing requirements, and quality-control recommendations for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."
- F. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."
- G. Sample Panels: After sample approval and before fabricating precast structural concrete units with **[architectural finish][thin-brick facing][stone facing]**, produce a minimum of **[two]** sample panels approximately **[16 sq. ft. (1.5 sq. m)]** in area, as directed by the Owner. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.
 - 1. Locate panels where indicated or, if not indicated, as directed by the Owner.
 - 2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
 - 3. After approval of repair technique, maintain one sample panel at fabricator's plant and one at Project site in an undisturbed condition as a standard for judging the completed Work.
 - 4. Demolish and remove sample panels when directed.
- H. Mockups: After sample panel approval but before production of precast structural concrete units with **[architectural finish][thin-brick facing][stone facing]**, construct full-sized mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Build mockup as indicated on Drawings including **[sealants]** and precast structural concrete units with an architectural finish complete with anchors, connections, flashings, and joint fillers.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless as directed by the Owner.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Stone Anchor Testing: Engage a qualified testing agency to perform preconstruction testing according to ASTM C1354/C1354M or ASTM E488, modified as follows:
 - 1. Furnish test specimens, including stone anchors, that are representative of materials proposed for incorporation into the Work.
 - 2. Anchorage Tests: Test **12 inches (300 mm)** square samples for **[each combination of]** stone variety, orientation of cut, finish, and anchor type proposed for use on Project. Test for shear and tensile strength of anchorage system.

1.8 COORDINATION

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Support units during shipment on nonstaining shock-absorbing material in same position as during storage.
- B. Store units with adequate bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
 - 1. Store units with dunnage across full width of each bearing point unless otherwise indicated.
 - 2. Place adequate dunnage of even thickness between each unit.
 - 3. Place stored units so identification marks are clearly visible, and units can be inspected.
- C. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.
- D. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design precast structural concrete units[**including stone facing system**].
- B. Design Standards: Comply with **ACI 318 (ACI 318M)** and with design recommendations in PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of precast structural concrete units indicated.
- C. Fire-Resistance Calculations: Where indicated, provide precast structural concrete units whose fire resistance meets prescriptive requirements of authorities having jurisdiction or has been calculated according to [**ACI 216.1 (ACI 216.1M)**][**PCI MNL 124, "Design for Fire Resistance of Precast Prestressed Concrete,"**] and is acceptable to authorities having jurisdiction.
- D. Structural Performance:
 - 1. Precast structural concrete units and connections to withstand design loads indicated within limits and under conditions indicated.
 - 2. Provide precast structural concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:
 - a. Design precast structural concrete framing system and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements. Maintain precast structural concrete deflections within limits of **ACI 318 (ACI 318M)**.
 - 1) Thermal Movements: Allow for in-plane thermal movements resulting from annual

ambient temperature changes of [minus 18 to plus 120 deg F (minus 10 to plus 67 deg C)][120 deg F (67 deg C)].

- b. Fire-Resistance Rating: Select material and minimum thicknesses to provide indicated fire rating.
- c. Vehicular Impact Loads: Design spandrel beams acting as vehicular barriers for passenger cars to resist a single **[6000-lbf (26.7-kN)]** load applied horizontally in any direction to the spandrel beam, with anchorages or attachments capable of transferring this load to the structure. Design spandrel beams assuming the load to act at a height of **18 or 27 inches (457 or 686 mm)** above the floor or ramp surface, whichever is more severe, on an area not to exceed **1 sq. ft. (0.0929 sq. m)**.

2.2 PRECAST STRUCTURAL CONCRETE

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - 1. **[Coreslab Structures]**
 - 2. **[GATE Precast Company]**
 - 3. **[Wells Concrete]**

2.3 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
 - 1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.
- B. Form Liners: Units of face design, texture, arrangement, and configuration **[indicated][to match those used for precast concrete design reference sample]**. Furnish with manufacturer's recommended form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.
- C. Surface Retarder: Chemical set retarder, capable of temporarily delaying setting of newly placed concrete mixture to depth of reveal specified.

2.4 REINFORCING MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25][60]** percent.
- B. Reinforcing Bars: ASTM A615/A615M, **Grade 60 (Grade 420)**, deformed.
- C. Low-Alloy-Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- D. Galvanized Reinforcing Bars: **[ASTM A615/A615M, Grade 60 (Grade 420)][ASTM A706/A706M]**,

deformed bars, with ASTM A767/A767M, Class II zinc coating and chromate treatment.[**Galvanize after fabrication and bending.**]

- E. Epoxy-Coated Reinforcing Bars: **[ASTM A615/A615M, Grade 60 (Grade 420)][ASTM A706/A706M]**, deformed bars, **[ASTM A775/A775M][or][ASTM A934/A934M]** epoxy coated, with less than 2 percent damaged coating in each **12-inch (300-mm)** bar length.
- F. Steel Bar Mats: ASTM A184/A184M, fabricated from **[ASTM A615/A615M, Grade 60 (Grade 420)][ASTM A706/A706M]**, deformed bars, assembled with clips.
- G. Plain-Steel Welded Wire Reinforcement: ASTM A185/A185M, fabricated from **[as-drawn steel][galvanized-steel]** wire into flat sheets.
- H. Deformed-Steel Welded Wire Reinforcement: ASTM A497/A497M or ASTM A1064/A1064M, flat sheet.
- I. Epoxy-Coated-Steel Wire: ASTM A884/A884M, Class A coated, **[plain][deformed]**, flat sheet, **[Type 1 bendable][Type 2 nonbendable]** coating.
- J. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

2.5 PRESTRESSING TENDONS

- A. Pretensioning Strand: **[ASTM A416/A416M, Grade 250 (Grade 1720) or Grade 270 (Grade 1860), uncoated, seven-wire][or][ASTM A886/A886M, Grade 270 (Grade 1860), indented, seven-wire]**, low-relaxation strand.
- B. Unbonded Post-Tensioning Strand: ASTM A416/A416M, **Grade 270 (Grade 1860)**, uncoated, seven-wire, low-relaxation strand.
 - 1. Coat unbonded post-tensioning strand with post-tensioning coating complying with ACI 423.7 and sheath with polypropylene tendon sheathing complying with ACI 423.7. Include anchorage devices and coupler assemblies.
- C. Post-Tensioning Bars: ASTM A722/A722M, uncoated high-strength steel bar.

2.6 CONCRETE MATERIALS

- A. Regional Materials: Concrete shall be manufactured within **100 miles (160 km)** of Project site from aggregates[**and cementitious materials**] that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- B. Indigenous Materials: Concrete shall be manufactured within **500 miles (800 km)** of Project site from aggregates[**and cementitious materials**] that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- C. Portland Cement: ASTM C150/C150M, Type I or Type III, gray, unless otherwise indicated.
 - 1. For surfaces exposed to view in finished structure, use gray or white cement, of same type, brand, and mill source.

D. Supplementary Cementitious Materials:

1. Pozzolans: ASTM C618, Class C, F, or N with maximum loss on ignition of 3 percent.
2. Metakaolin: ASTM C618, Class N.
3. Silica Fume: ASTM C1240, with optional chemical and physical requirement.
4. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.

E. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C33/C33M, with coarse aggregates complying with **[Class 5S][Class 5M][Class 4S][Class 4M]**. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
 - a. Gradation: **[Uniformly graded][Gap graded][To match design reference sample]**.
2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand compatible with coarse aggregate to match approved finish sample.

F. Lightweight Aggregates: Except as modified by PCI MNL 116, ASTM C330/C330M, with absorption less than 11 percent.

G. Coloring Admixture: ASTM C979/C979M, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.

H. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.

I. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.

J. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.

1. Water-Reducing Admixtures: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. Water-Reducing and Accelerating Admixture: ASTM C494/C494M, Type E.
5. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
6. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
7. Plasticizing Admixture: ASTM C494/C494M, Type S.
8. Plasticizing and Retarding Admixture: ASTM C494/C494M, Type S.
9. Corrosion-Inhibiting Admixture: ASTM C1582/C1582M.

2.7 STEEL CONNECTION MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A36/A36M.

B. Carbon-Steel-Headed Studs: ASTM A108, Grade 1010 through 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 116.

C. Carbon-Steel Plate: ASTM A283/A283M, Grade C.

- D. Malleable-Iron Castings: ASTM A47/A47M, Grade 32510 or Grade 35028.
- E. Carbon-Steel Castings: ASTM A27/A27M, **Grade 60-30 (Grade 415-205)**.
- F. High-Strength, Low-Alloy Structural Steel: ASTM A572/A572M.
- G. Carbon-Steel Structural Tubing: ASTM A500/A500M, Grade B or Grade C.
- H. Wrought Carbon-Steel Bars: ASTM A675/A675M, **Grade 65 (Grade 450)**.
- I. Deformed-Steel Wire or Bar Anchors: ASTM A496/A496M or ASTM A706/A706M.
- J. Carbon-Steel Bolts and Studs: **ASTM A307, Grade A (ASTM F568M, Property Class 4.6)**; carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A563/A563M; and flat, unhardened steel washers, ASTM F844.
- K. High-Strength Bolts, Nuts, and Washers:
 - 1. ASTM F3125/F3125M, **Grade A325 (Grade A325M)**, Type 1, heavy-hex steel structural bolts; ASTM A563/A563M heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 - a. Finish: **[Plain][Hot-dip zinc coating][Mechanically deposited zinc coating]**.
 - 2. ASTM F3125/F3125M, **Grade A490 (Grade A490M)**, Type 1, heavy-hex steel structural bolts; ASTM A563/A563M heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
- L. Zinc-Coated Finish: For exterior steel items[, **steel in exterior walls,**] and items indicated for galvanizing, apply zinc coating by **[hot-dip process according to ASTM A123/A123M or ASTM A153/A153M][electrodeposition according to ASTM B633, SC 3, Types 1 and 2]**.
 - 1. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.
 - 2. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC-Paint 20.
- M. Shop-Primed Finish: Prepare surfaces of nongalvanized-steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3, and shop apply **[lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in MPI 79][SSPC-Paint 25]** according to SSPC-PA 1.
- N. Welding Electrodes: Comply with AWS standards.
- O. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install precast structural concrete units.

2.8 STAINLESS STEEL CONNECTION MATERIALS

- A. Stainless Steel Plate: ASTM A240/A240M or ASTM A666, Type 304, Type 316, or Type 201.
- B. Stainless Steel Bolts and Studs: **ASTM F593, Alloy Group 1 or 2 (ASTM F738M, Grade A1 or A4)**, hex-head bolts and studs; **ASTM F594, Alloy Group 1 or 2 (ASTM F836M, Grade A1 or A4)** stainless

steel nuts; and flat, stainless steel washers.

1. Lubricate threaded parts of stainless steel bolts with an antiseize thread lubricant during assembly.

- C. Stainless Steel-Headed Studs: ASTM A276/A276M, Alloy 304 or 316, with minimum mechanical properties of PCI MNL 116.

2.9 BEARING PADS

- A. Provide one of the following bearing pads for precast structural concrete units[**as recommended by precast fabricator for application**]:

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore, Type A durometer hardness, ASTM D2240; minimum tensile strength **2250 psi (15.5 MPa)**, ASTM D412.
2. Random-Oriented-Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. 70 to 90 Shore, Type A durometer hardness, ASTM D2240; capable of supporting a compressive stress of **3000 psi (20.7 MPa)** with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer; 80 to 100 Shore, Type A durometer hardness, ASTM D2240; complying with AASHTO's "AASHTO LRFD Bridge Design Specifications," Division II, Section 18.10.2; or with MIL-C-882E.
4. Frictionless Pads: PTFE, glass-fiber reinforced, bonded to stainless or mild-steel plate, or random-oriented-fiber-reinforced elastomeric pads; of type required for in-service stress.
5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.10 ACCESSORIES

- A. Reglets Specified Elsewhere: Specified in Section 076200 "Sheet Metal Flashing and Trim."
- B. Reglets: **[PVC extrusions,][Stainless steel, Type 302 or Type 304,][Copper,]** felt or fiber filled, or with face opening of slots covered.
- C. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install structural precast concrete units.

2.11 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C150/C150M, Type I, and clean, natural sand, ASTM C144 or ASTM C404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C1218/C1218M.
- B. Nonmetallic, Nonshrink Grout: Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107/C1107M, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C1218/C1218M.

- C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C881/C881M, of type, grade, and class to suit requirements.

2.12 THIN BRICK AND ACCESSORIES

A. Thin Brick:

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Acme Brick Company]**
 - b. **[Belden Brick Company (The)]**
 - c. **[Endicott Clay Products Co]**
 - d. **[General Shale, Inc.]**
 - e. **[Glen-Gery Corporation]**
2. Thickness not less than **1/2 inch (13 mm)** or more than **1 inch (25 mm)** thick, and as follows:
 - a. Dimensional Tolerances: Plus **0 inch (0 mm)** or minus **1/16 inch (1.6 mm)** for any dimension **8 inches (203 mm)** or less and plus **0 inch (0 mm)** or minus **3/32 inch (2.4 mm)** for any dimension more than **8 inches (203 mm)**.
 - b. Out-of-Square Tolerance: Plus or minus **1/16 inch (1.6 mm)**.
 - c. Warpage Tolerance: Plus **0 inch (0 mm)** or minus **1/16 inch (1.6 mm)**.
 - d. Variation of Shape from Specified Angle: Plus or minus one degree.
 - e. Modulus of Rupture: Not less than **250 psi (1.7 MPa)** when tested according to ASTM C67/C67M.
 - f. Tensile Bond Strength: Not less than **150 psi (1.0 MPa)** when tested before and after freeze-thaw test according to ASTM E488 as modified. Adhere a steel plate with a welded rod on a single thin-brick face with epoxy for each test.
 - g. 24-Hour Cold-Water Absorption: Not more than 6 percent when tested according to ASTM C67/C67M.
 - h. Freeze-Thaw Resistance: No detectable disintegration or separation after 300 freezing-and-thawing cycles when tested according to ASTM C666/C666M, Method B.
 - i. Chemical Resistance: Tested according to ASTM C650 and rated "not affected."
 - j. Efflorescence: Tested according to ASTM C67/C67M and rated "not effloresced."
 - k. Surface Coating: Thin brick with colors or textures applied as coatings to withstand 50 cycles of freezing and thawing; ASTM C67/C67M with no observable difference in applied finish when viewed from **10 ft. (3 m)**.
 - l. Back Surface Texture: Scored, combed, wire roughened, ribbed, keybacked, or dovetailed.
- B. Regional Materials: Brick shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- C. Indigenous Materials: Brick shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- D. Special Shapes: Include corners, edge corners, and end edge corners.
- E. Face Size: **[2-1/4 inches (57 mm) high by 7-5/8 inches (194 mm) long][2-1/4 inches (57 mm) high**

by 11-5/8 inches (295 mm) long][3-5/8 inches (92 mm) high by 7-5/8 inches (194 mm) long][3-5/8 inches (92 mm) high by 11-5/8 inches (295 mm) long].

- F. **[Where indicated to "match existing,"]** provide thin brick matching color, texture, and face size of existing adjacent brick work, as directed by the Owner.
- G. Face Color and Texture: **as directed by the Owner**
- H. Sand-Cement Mortar: Portland cement, ASTM C150/C150M, Type I, and clean, natural sand, ASTM C144. Mix at ratio of 1 part cement to 4 parts sand, by volume, with minimum water required for placement.
- I. Pointing Grout: Packaged, polymer-modified, sanded grout complying with ANSI A118.7.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Bostik; Arkema]**
 - b. **[C-Cure]**
 - c. **[Custom Building Products]**
 - d. **[DAP Products Inc.]**
 - e. **[H.B. Fuller Construction Products Inc. / TEC]**
 - f. **[Jamo Inc]**
 - g. **[Laticrete International, Inc.]**
 - h. **[MAPEI Corporation]**
 - i. **[Parex, a Sika brand]**
 - j. **[ProSpec; H.B. Fuller Construction Products Inc.]**
 - k. **[Southern Grouts & Mortars, Inc]**
 - l. **[Summitville Tiles, Inc.]**
 - 2. Polymer Type: Acrylic resin in **[dry, redispersible form, packaged with other dry ingredients][liquid-latex form for adding packaged dry-grout mix]**.
 - 3. Colors: **[As indicated by manufacturer's designations][as directed by the Owner]**.

2.13 STONE MATERIALS AND ACCESSORIES

- A. Stone facing for precast structural concrete is specified in Section 044200 "Exterior Stone Cladding."
- B. Anchors: Stainless steel, ASTM A276/A276M, Type 304 or Type 316, of temper and diameter required to support loads without exceeding allowable design stresses.
 - 1. Fit each anchor leg with neoprene grommet collar of width at least twice the diameter and of length at least five times the diameter of anchor.
- C. Silicone, Nonstaining, S, NS, 25, NT, M: Chemically curing, elastomeric, single-component, nonsag, neutral-curing, silicone sealant; Class 25, Use NT (nontraffic), and Use M (masonry) that complies with applicable requirements in Section 079200 "Joint Sealants" and that does not stain stone:
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the**

following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [GE Construction Sealants; Momentive Performance Materials Inc.]
- b. [The Dow Chemical Company]
- c. [Tremco Incorporated]

D. Urethane, S, NS, 25, T, M: Chemically curing, elastomeric, single-component, nonsag, urethane sealant; Class 25, Use T (traffic), and Use M (masonry) that complies with applicable requirements in Section 079200 "Joint Sealants" and that does not stain stone:

- 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Master Builders Solutions]
- b. [Sika Corporation]
- c. [Tremco Incorporated]

E. Epoxy Filler: ASTM C881/C881M, 100 percent solids, sand-filled nonshrinking, nonstaining of type, class, and grade to suit application.

- 1. Elastomeric Anchor Sleeve: 1/2 inch (13 mm) long; 60 Shore, Type A durometer hardness; ASTM D2240.

F. Bond Breaker: [Preformed, compressible, resilient, nonstaining, nonwaxing, closed-cell polyethylene foam pad, nonabsorbent to liquid and gas, 1/8 inch (3.2 mm) thick][Polyethylene sheet, ASTM D4397, 6 to 10 mils (0.15 to 0.25 mm) thick].

2.14 INSULATED FLAT-WALL PANEL ACCESSORIES

- A. Molded-Polystyrene Board Insulation: ASTM C578, [Type XI, 0.70 lb/cu. ft. (12 kg/cu. m)][Type I, 0.90 lb/cu. ft. (15 kg/cu. m)][Type VIII, 1.15 lb/cu. ft. (18 kg/cu. m)][Type II, 1.35 lb/cu. ft. (22 kg/cu. m)][Type IX, 1.80 lb/cu. ft. (29 kg/cu. m)]; [square][ship-lap] edges; thickness as directed by the Owner.
- B. Extruded-Polystyrene Board Insulation: ASTM C578, [Type X, 1.30 lb/cu. ft. (21 kg/cu. m)][Type IV, 1.55 lb/cu. ft. (26 kg/cu. m)][Type VI, 1.80 lb/cu. ft. (29 kg/cu. m)][Type VII, 2.20 lb/cu. ft. (35 kg/cu. m)][Type V, 3.00 lb/cu. ft. (48 kg/cu. m)]; [square][ship-lap] edges; thickness as directed by the Owner
- C. Polyisocyanurate Board Insulation: ASTM C591, [Type I, 1.8 lb/cu. ft. (29 kg/cu. m)][Type II, 2.5 lb/cu. ft. (40 kg/cu. m)][Type III, 3.0 lb/cu. ft. (48 kg/cu. m)] unfaced, thickness as directed by the Owner
- D. Wythe Connectors: [Glass-fiber-reinforced vinylester connectors][Polypropylene pin connectors][Stainless steel pin connectors][Bent galvanized reinforcing bars][Galvanized welded wire trusses][Galvanized bent wire connectors][Epoxy-coated carbon-fiber grid][Fiberglass trusses] manufactured to connect wythes of precast concrete panels.

2.15 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
 - 1. Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
 - 2. Limit use of fly ash to **[20][35]** percent replacement of portland cement by weight and ground granulated blast-furnace slag to **[20][50]** percent of portland cement by weight; metakaolin and silica fume to 10 percent of portland cement by weight.
- B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.
- C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by **ACI 318 (ACI 318M)** or PCI MNL 116 when tested according to ASTM C1218/C1218M.
- D. Normal-Weight Concrete Mixtures: Proportion **[face mixtures][face and backup mixtures][full-depth mixture][face and backup mixtures or full-depth mixtures, at fabricator's option]** by either laboratory trial batch or field test data methods according to ACI PRC-211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): **5000 psi (34.5 MPa)**.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- E. Water Absorption: For structural precast concrete with an architectural finish, limit water absorption to 6 percent by weight or 14 percent by volume, tested according to ASTM C642, except for boiling requirement.
- F. Lightweight Concrete Backup Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI PRC-211.2, with materials to be used on Project, to provide lightweight concrete with the following properties:
 - 1. Compressive Strength (28 Days): **5000 psi (34.5 MPa)**.
 - 2. Unit Weight: Calculated equilibrium unit weight of **115 lb/cu. ft. (1842 kg/cu. m)**, plus or minus **3 lb/cu. ft. (48 kg/cu. m)**, according to ASTM C567/C567M.
- G. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.
- H. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.
- I. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.16 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
 - 1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing

and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.

- B. Maintain molds to provide completed precast structural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
 - 1. Form joints are not permitted on faces of structural precast concrete with an architectural finish that is exposed to view in the finished work.
 - 2. Edge and Corner Treatment: Uniformly [**chamfered**][**radiused**].

2.17 THIN-BRICK FACINGS

- A. Place form-liner templates accurately to provide grid for thin-brick facings. Provide solid backing and supports to maintain stability of liners while placing thin bricks and during concrete placement.
- B. Securely place thin-brick units face down into form-liner pockets and place concrete backing mixture.
- C. Completely fill joint cavities between thin-brick units with sand-cement mortar, and place precast concrete backing mixture while sand-cement mortar is still fluid enough to ensure bond.
- D. Mix and install pointing grout according to ANSI A108.10. Completely fill joint cavities between thin-brick units with pointing grout, and compress into place without spreading pointing grout onto faces of thin-brick units. Remove excess pointing grout immediately to prevent staining of thin brick.
 - 1. Tool joints to a [**slightly concave**][**V**]-shape when pointing grout is thumbprint hard.
- E. Clean faces and joints of thin-brick facing.

2.18 STONE FACINGS

- A. Accurately position stone facings to comply with requirements and in locations indicated on Shop Drawings. Install anchors, supports, and other attachments indicated or necessary to secure stone in place. Keep concrete reinforcement a minimum of **3/4 inch (19 mm)** from the back surface of stone. Use continuous spacers to obtain uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances.
 - 1. Stone to Precast Anchorages: Provide anchors in numbers, types and locations required to satisfy specified performance criteria, but not more than **24 inches (600 mm)** o.c. around perimeter of stone facing panels with a minimum of four anchors per panel.
- B. Fill anchor holes with [**sealant filler and install anchors**][**epoxy filler and install anchors with elastomeric anchor sleeve at back surface of stone**].
 - 1. Install minimum **0.006-inch- (0.15-mm-)** thick polyethylene sheet to prevent bond between back of stone facing and concrete substrate and to ensure no passage of precast matrix to stone surface.
 - 2. Install **1/8-inch (3-mm)** polyethylene-foam bond breaker to prevent bond between back of stone facing and concrete substrate and to ensure no passage of precast matrix to stone surface. Maintain minimum projection requirements of stone anchors into concrete substrate.

2.19 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
 - 1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.
- D. Cast-in openings larger than **10 inches (250 mm)** in any dimension. Do not drill or cut openings or prestressing strand without the Owner approval, as directed by the Owner.
- E. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.
 - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcement exceeds limits specified in ASTM A775/A775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
 - 2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 - 3. Place reinforcing steel and prestressing strand to maintain at least **3/4-inch (19-mm)** minimum concrete cover. Increase cover requirements for reinforcing steel to **1-1/2 inches (38 mm)** when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 - 4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
- F. Reinforce precast structural concrete units to resist handling, transportation, and erection stresses and specified in-place loads.
- G. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.
 - 1. Delay detensioning or post-tensioning of precast, prestressed structural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete unit.
 - 2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
 - 3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
 - 4. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.
 - 5. Protect strand ends and anchorages with a minimum of **1-inch- (25-mm-)** thick, nonmetallic,

nonshrink, grout mortar and sack rub surface. Coat or spray the inside surfaces of pocket with bonding agent before installing grout.

- H. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- I. Place face mixture to a minimum thickness after consolidation of the greater of **1 inch (25 mm)** or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.
- J. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.
 - 1. Place backup concrete mixture to ensure bond with face-mixture concrete.
- K. Thoroughly consolidate placed concrete by vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 116.
 - 1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants." Ensure adequate bond between face and backup concrete, if used.
- L. Comply with PCI MNL 116 procedures for hot- and cold-weather concrete placement.
- M. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast structural concrete unit on a surface that does not show in finished structure.
- N. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
- O. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 116, as directed by the Owner.

2.20 CASTING INSULATED WALL PANELS

- A. Cast, screed, and consolidate wythe supported by mold.
- B. Place insulation boards abutting edges and ends of adjacent boards. Insert wythe connectors through insulation, and consolidate concrete around connectors according to connector manufacturer's written instructions.
- C. Ensure bottom wythe and insulation layer are not disturbed after bottom wythe reaches initial set.
- D. Cast, screed, and consolidate top wythe to meet required finish.
- E. Maintain temperature below **150 deg F (65 deg C)** in bottom concrete wythe.

2.21 FABRICATION TOLERANCES

- A. Fabricate precast structural concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 116 product dimension tolerances as well as position tolerances for cast-in items.
- B. Thin-Brick-Faced Precast Structural Concrete Units: Restrict the following misalignments to 2 percent of number of thin bricks in a unit:
 - 1. Alignment of Mortar Joints:
 - a. Jog in Alignment: **1/8 inch (3 mm)**.
 - b. Alignment with Panel Centerline: Plus or minus **1/8 inch (3 mm)**.
 - 2. Variation in Width of Exposed Mortar Joints: Plus or minus **1/8 inch (3 mm)**.
 - 3. Tipping of Individual Thin Bricks from the Panel Plane of Exposed Thin-Brick Surface: Plus **0 inch (0 mm)**; minus **1/4 inch (6 mm)** less than or equal to depth of form-liner joint.
 - 4. Exposed Thin-Brick Surface Parallel to Primary Control Surface of Panel: Plus **1/4 inch (6 mm)**; minus **1/8 inch (3 mm)**.
 - 5. Individual Thin-Brick Step in Face from Panel Plane of Exposed Thin-Brick Surface: Plus **0 inch (0 mm)**; minus **1/4 inch (6 mm)** less than or equal to depth of form-liner joint.
- C. Stone Veneer-Faced Precast Structural Concrete Units:
 - 1. Variation in Cross-Sectional Dimensions: For thickness of walls from dimensions indicated: Plus or minus **1/4 inch (6 mm)**.
 - 2. Variation in Joint Width: **1/8 inch in 36 inches (3 mm in 900 mm)** or a quarter of nominal joint width, whichever is less.
 - 3. Variation in Plane between Adjacent Stone Units (Lipping): **1/16-inch (1.6-mm)** difference between planes of adjacent units.

2.22 COMMERCIAL FINISHES

- A. Commercial Grade: Remove fins and protrusions larger than **1/8 inch (3 mm)** and fill holes larger than **1/2 inch (13 mm)**. Rub or grind ragged edges. Faces must have true, well-defined surfaces. Air holes, water marks, and color variations are permitted. Limit form joint offsets to **3/16 inch (5 mm)**.
- B. Standard Grade: Normal plant-run finish produced in molds that impart a smooth finish to concrete. Surface holes smaller than **1/2 inch (13 mm)** caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls are permitted. Fill air holes greater than **1/4 inch (6 mm)** in width that occur more than once per **2 sq. in. (1300 sq. mm)**. Major or unsightly imperfections, honeycombs, or structural defects are not permitted. Limit joint offsets to **1/8 inch (3 mm)**.
- C. Grade B Finish: Fill air pockets and holes larger than **1/4 inch (6 mm)** in diameter with sand-cement paste matching color of adjacent surfaces. Fill air holes greater than **1/8 inch (3 mm)** in width that occur more than once per **2 sq. in. (1300 sq. mm)**. Grind smooth form offsets or fins larger than **1/8 inch (3 mm)**. Repair surface blemishes due to holes or dents in molds. Discoloration at form joints is permitted.
- D. Grade A Finish: Repair surface blemishes and fill air holes with the exception of air holes **1/16 inch (1.6 mm)** in width or smaller, and form marks where the surface deviation is less than **1/16 inch (1.6 mm)**. Float apply a neat cement-paste coating to exposed surfaces. Rub dried paste coat with burlap to remove loose particles. Discoloration at form joints is permitted. Grind smooth all form joints.
- E. Screed or float finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a

uniform finish. Hand screed at projections. Normal color variations, minor indentations, minor chips, and spalls are permitted. Major imperfections, honeycombing, or defects are not permitted.

- F. Smooth, steel trowel finish unformed surfaces. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.
- G. Apply roughened surface finish according to **ACI 318 (ACI 318M)** to precast concrete units that receive concrete topping after installation.

2.23 COMMERCIAL ARCHITECTURAL FINISHES

- A. Manufacture member faces free of joint marks, grain, and other obvious defects with corners, including false joints, uniform and straight. Finish exposed-face surfaces of precast concrete units to match approved [**design reference sample**][**sample panels**][**mockups**] and as follows:
 - 1. Design Reference Sample: as directed by the Owner.
 - 2. PCI's "Architectural Precast Concrete - Color and Texture Selection Guide," of plate numbers indicated.
 - 3. As-Cast-Surface Finish: Provide surfaces to match approved sample or mockup for acceptable surface, air voids, sand streaks, and honeycomb.
 - 4. Textured-Surface Finish: Impart by form liners or inserts.
 - 5. Bushhammer Finish: Use power or hand tools to remove matrix and fracture coarse aggregates.
 - 6. Exposed-Aggregate Finish: Use chemical-retarding agents applied to concrete molds and washing and brushing procedures to expose aggregate and surrounding matrix surfaces after form removal.
 - 7. Abrasive-Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
 - 8. Acid-Etched Finish: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces. Protect hardware, connections, and insulation from acid attack.
 - 9. Honed Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.
 - 10. Polished Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.
 - 11. Sand-Embedment Finish: Use selected stones placed in a sand bed in bottom of mold, with sand removed after curing.
 - 12. Thin-Brick Facing: See "Thin-Brick Facings" Article.
 - 13. Stone Facing: See "Stone Facings" Article.

2.24 SOURCE QUALITY CONTROL

- A. Testing Agency: [**as directed by the Owner**] a qualified testing agency to evaluate precast structural concrete fabricator's quality-control and testing methods.
 - 1. Allow testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with testing agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.
- B. Testing: Test and inspect precast structural concrete according to PCI MNL 116 requirements and ASTM C1610/C1610M, ASTM C1611/C1611M, ASTM C1621/C1621M, and ASTM C1712.
 - 1. Test and inspect self-consolidating concrete according to PCI TR-6.
- C. Strength of precast structural concrete units is considered deficient if units fail to comply with **ACI 318**

(ACI 318M) requirements for concrete strength.

- D. If there is evidence that strength of precast concrete units may be deficient or may not comply with **ACI 318 (ACI 318M)** requirements, employ a qualified testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C42/C42M.
1. A minimum of three representative cores to be taken from units of suspect strength, from locations, as directed by the Owner.
 2. Test cores in an air-dry condition or, if units are wet under service conditions, test cores after immersion in water in a wet condition.
 3. Strength of concrete for each series of three cores is considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
 4. Report test results in writing on same day that tests are performed, with copies to the Owner, Contractor, and precast concrete fabricator, as directed by the Owner. Test reports include the following:
 - a. Project identification name and number.
 - b. Date when tests were performed.
 - c. Name of precast concrete fabricator.
 - d. Name of concrete testing agency.
 - e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- E. Patching: If core test results are satisfactory and precast structural concrete units comply with requirements, clean and dampen core holes and solidly fill with same precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.
- F. Defective Units: Discard and replace precast structural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to the Owner approval. The Owner reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Do not install precast concrete units until supporting, cast-in-place concrete has attained minimum allowable design compressive strength and until supporting steel or other structure is structurally ready to receive loads from precast concrete units.

3.2 INSTALLATION

- A. Install clips, hangers, bearing pads, and other accessories required for connecting precast structural concrete units to supporting members and backup materials.
- B. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, shoring, and bracing as required to maintain position, stability, and alignment of units until permanent connections are complete.
 - 1. Install temporary steel or plastic spacing shims or bearing pads as precast structural concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
 - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 3. Remove projecting lifting devices and use plastic patch caps or sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
 - 4. For hollow-core slab voids used as electrical raceways or mechanical ducts, align voids between units and tape butt joint at end of slabs.
- C. Connect precast structural concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
 - 1. Do not permit connections to disrupt continuity of roof flashing.
- D. Field cutting of precast units is not permitted as directed by the Owner.
- E. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units.
- F. Welding: Comply with applicable requirements in AWS D1.1/D1.1M and AWS D1.4/D1.4M for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
 - 1. Protect precast structural concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
 - 2. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and apply a minimum **4.0-mil- (0.1-mm-)** thick coat of galvanized repair paint to galvanized surfaces according to ASTM A780/A780M.
 - 3. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and reprime damaged painted surfaces.
 - 4. Visually inspect welds and remove, reweld, or repair incomplete and defective welds.
- G. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
 - 1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
 - 2. For slip-critical connections, use one of the following methods to assure proper bolt pretension:
 - a. Turn-of-Nut: According to RCSC's "Specification for Structural Joints Using ASTM A325 or A 490 Bolts."
 - b. Calibrated Wrench: According to RCSC's "Specification for Structural Joints Using ASTM A325 or A 490 Bolts."
 - c. Twist-off Tension Control Bolt: ASTM F3125/F3125M, Grade 1852.
 - d. Direct-Tension Control Bolt: ASTM F3125/F3125M, Grade 1852.
 - 3. For slip-critical connections, use method and inspection procedure approved by as directed by

the Owner and coordinated with inspection agency.

- H. Grouting or Dry-Packing Connections and Joints: Grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled.
 - 1. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces.
 - 2. Fill joints completely without seepage to other surfaces.
 - 3. Trowel top of grout joints on roofs smooth and uniform. Finish transitions between different surface levels not steeper than 1 to 12.
 - 4. Place grout end cap or dam in voids at ends of hollow-core slabs.
 - 5. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
 - 6. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

- A. Erect precast structural concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.
- B. Minimize variations between adjacent slab members by jacking, loading, or other method recommended by fabricator, as directed by the Owner.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: **[as directed by the Owner][Engage]** a qualified special inspector to perform the following special inspections:
 - 1. Erection of precast structural concrete members.
- B. Testing Agency: **[as directed by the Owner][Engage]** a qualified testing agency to perform tests and inspections.
- C. Visually inspect field welds and test according to ASTM E165 or to ASTM E709 and ASTM E1444. High-strength bolted connections are subject to inspections.
- D. Testing agency will report test results promptly and in writing to the Owner, as directed by the Owner.
- E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- F. Additional testing and inspecting, at Contractor's expense, to be performed to determine compliance of replaced or additional work with specified requirements.
- G. Prepare test and inspection reports.

3.5 REPAIRS

- A. Repair precast structural concrete units, as directed by the Owner.

1. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units have not been impaired.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of **20 ft. (6 m)**.
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A780/A780M.
- D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- E. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as directed by the Owner.

3.6 CLEANING

- A. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
- B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 03 41 00 00

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Task	Specification	Specification Description
03 41 16 00	03 41 00 00	Precast Structural Concrete
03 41 19 00	03 41 00 00	Precast Structural Concrete
03 41 23 00	03 41 00 00	Precast Structural Concrete



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SECTION 03 41 26 00 - UNBONDED POST-TENSIONED CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Post-tensioning tendons and accessories, including pocket formers, bar chairs, slab bolsters, and nonprestressed reinforcement required for installing post-tensioning tendons, including the following:
2. Post-tensioning tendons and accessories, including pocket formers, bar chairs, slab bolsters, and nonprestressed reinforcement required for installing post-tensioning tendons, including the following:
 - a. Support bars.
 - b. Backup bars and hairpins at anchorages.
 - c. Hairpins at locations of horizontal curvature.
 - d. Supplemental reinforcement at blockouts.
3. Post-tensioning operations, including stressing, recording tendon elongations and gage pressures, and finishing tendons.

B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for concrete formwork and nonprestressed steel reinforcement, except for nonprestressed reinforcement.
2. Section 032000 "Concrete Reinforcing" for nonprestressed steel reinforcement, except for nonprestressed reinforcement required for installing post-tensioning tendons.
3. Section 033000 "Cast-in-Place Concrete" for concrete.

1.2 DEFINITIONS

- A. Strand Tail: Excess strand length extending past the anchorage device.
- B. Stressing Pocket: Void formed by pocket former at stressing-end anchorage that provides required cover over wedges and strand tail.
- C. Wedge Cavity: Cone-shaped hole in anchorage device designed to hold the wedges that anchor the strand.

1.3 COORDINATION

A. Attachments and Penetrations:

1. Attach permanent construction, such as curtain-wall systems, handrails, fire-protection equipment, lights, and security devices to the post-tensioned slab using embedded anchors.
2. Drilled anchors, power-driven fasteners, and core drilling for sleeves or other penetrations are not allowed unless, as directed by the Owner.
3. Form penetrations within [18 inches (460 mm)] of an anchorage with ASTM A53/A53M,

Schedule 40 steel pipe.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]**.
1. Review procedures related to installation and stressing of post-tensioning tendons, including, but not limited to, the following:
 - a. Construction schedule and availability of materials, personnel, and equipment needed to make progress and avoid delays.
 - b. Storage of post-tensioning materials on-site.
 - c. Structural load limitations.
 - d. Coordination of post-tensioning installation drawings and nonprestressed reinforcing steel placing drawings.
 - e. Horizontal and vertical tolerances on tendons and nonprestressed reinforcement placement.
 - f. Marking and measuring of elongations.
 - g. Submittal of stressing records and requirements for tendon finishing.
 - h. Removal of formwork.

1.5 ACTION SUBMITTALS

- A. Product Data: For the following:
1. Post-tensioning coating.
 2. Tendon sheathing.
 3. Anchorage devices.
 4. Tendon couplers.
 5. Bar and tendon supports.
 6. Pocket formers.
 7. Sheathing repair tape.
 8. Stressing-pocket patching material.
 9. Encapsulation system.
- B. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 3. Environmental Product Declaration (EPD): For each product.
 4. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
 5. Environmental Product Declaration: For each product.
 6. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
 7. Environmental Product Declaration: For each product.
 8. Environmental Product Declaration: For each product.
 9. Third-Party Certifications: For each product.

10. Third-Party Certified Life Cycle Assessment: For each product.
 - C. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing tendon layout, installation procedures, and the following:
 1. Installation drawings, including plans, elevations, sections, and details.
 2. Numbers, arrangement, and designation of post-tensioning tendons.
 3. Tendon profiles and method of tendon support, including chair heights and locations. Show tendon profiles at sufficient scale to clearly indicate all support points with their associated heights.
 4. Details for horizontal curvature around openings and at anchorages.
 5. Locations of anchorages and blockouts required for stressing.
 6. Anchorage details, including bundled tendon flaring.
 7. Tendon clearances around slab openings and penetrations.
 8. Construction joint locations and pour sequence.
 9. Details for corners and other locations where tendon layouts may conflict with one another or with nonprestressed reinforcing steel.
 10. Locations of nonprestressed reinforcement required for installing post-tensioning tendons, including, but not limited to, the following:
 - a. Support bars.
 - b. Backup bars and hairpins at anchorages.
 - c. Hairpins at locations of horizontal curvature.
 - d. Supplemental reinforcement at blockouts.
 11. Stressing procedures and jacking force to result in final effective forces used in determining number of tendons required.
 12. Calculated elongations for each tendon.
 - D. Samples: For the following products:
 1. Anchorages with **24 inches (610 mm)** of coated, sheathed strand.
 2. Couplers with **24 inches (610 mm)** of coated, sheathed strand.
 3. Components of the encapsulation system, unassembled and clearly identified.
 - E. Delegated Design Submittal: For post-tensioning system.
 1. Include sealed design calculations prepared by a qualified structural engineer indicating method of elongation calculation, including values used for friction coefficients, anchorage seating loss, elastic shortening, creep, relaxation, and shrinkage.
- 1.6 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For **[Installer][manufacturer][testing agency]**. Include resume of individual supervising installation and stressing of post-tensioning tendons.
 - B. Evaluation Reports: For each type of anchorage device and coupler, from ICC-ES:
 - C. Product Certificates: For each type of encapsulation system.
 - D. Mill Test Reports: Certified mill test reports for prestressing strand used on Project, indicating that strand is low relaxation and including the following:
 1. Coil numbers or identification.
 2. Breaking load.

3. Load at 1 percent extension.
4. Elongation at failure.
5. Modulus of elasticity.
6. Diameter and net area of strand.

- E. Field quality-control reports.
- F. Procedures Statement: Procedures for cutting excess strand tail and patching stressing pocket.
- G. Stressing Jack Calibration: Calibration certificates for jacks and gages to be used on Project. Calibrate each jack-and-gage set as a pair.
- H. Stressing Records: Submit the same day as stressing operations.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Fabricating plant certified by PTI according to procedures set forth in PTI's "Manual for Certification of Plants Producing Unbonded Single Strand Tendons."
- B. Installer Qualifications: A qualified installer whose full-time Project superintendent has successfully completed PTI's Level 1 - Field Fundamentals course or has equivalent verifiable experience and knowledge, as directed by the Owner.
1. Superintendent to be trained by post-tensioning supplier in the operation of stressing equipment to be used on Project.
- C. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
1. Testing Agency Inspector: Personnel performing field inspections and measuring elongations to have successfully completed PTI's Level 1 - Field Fundamentals course or to have equivalent verifiable experience and knowledge, as directed by the Owner.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle post-tensioning materials according to PTI's "Field Procedures Manual for Unbonded Single Strand Tendons."

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain post-tensioning materials and equipment from single source.
1. Stressing jacks not provided by post-tensioning supplier must be calibrated and approved for use on Project by post-tensioning supplier.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality

Requirements," to design post-tensioned reinforcement.

- B. Design structure to withstand the loads indicated according to governing codes, within limits and under conditions indicated.
- C. Average Precompression:
 - 1. Minimum Average Slab Precompression: **[125 psi (0.86 MPa)][200 psi (1.4 MPa)]**.
 - 2. Maximum Average Slab Precompression: **[300 psi (2.1 MPa)][500 psi (3.4 MPa)]**.
 - 3. Minimum Average Precompression in T-, L-, and Rectangular-Beam Cross Sections: **[200 psi (1.4 MPa)]**.
 - 4. Minimum Precompression in Slab Section Not Included in T- or L-Beam Section: **[100 psi (0.7 MPa)]**.
 - 5. Maximum Precompression in Transfer Girders: **[1000 psi (6.9 MPa)]**. Specify stage-stressing sequence to avoid overstress.
- D. Comply with **ACI 318 (ACI 318M)** requirements unless more stringent requirements are indicated.
 - 1. Limits on stresses at transfer of prestress and under service load.
 - 2. Minimum bonded reinforcement.
 - 3. Concrete cover over reinforcement.
- E. Fire Resistance:
 - 1. Design members such that thickness and concrete cover over reinforcement comply with the following:
 - a. Fire-resistance requirements of authorities having jurisdiction.
 - b. The following fire-resistance requirements:
 - 1) Slabs: **[Two]** hours.
 - 2) Beam: **[Two]** hours.
- F. Deflection Limits, Including Creep and Shrinkage Effects, as Follows:
 - 1. Total Dead Load: **[L/600]**.
 - 2. Total Dead Plus Live Load: **[L/360]**.
- G. Closure Strips: Locate closure strips at midspan and adjust tendon forces and profiles accordingly. Calculate moments in spans with closure strips assuming a continuous slab. Provide only nonprestressed reinforcement within closure strips. Design reinforcement in closure strip to carry ultimate moment at midspan.

2.3 PRESTRESSING TENDONS

- A. ACI Publications: Comply with ACI 423.7 unless otherwise indicated.
- B. Prestressing Strand: ASTM A416/A416M, **Grade 270 (Grade 1860)**, uncoated, seven-wire, low-relaxation, **[0.5-inch- (12.7-mm-)][0.6-inch- (15.2-mm-)]** diameter strand.
- C. Post-Tensioning Coating: Compound with friction-reducing, moisture-displacing, and corrosion-inhibiting properties; chemically stable and nonreactive with prestressing strand, nonprestressed reinforcement, sheathing material, and concrete.

1. Minimum Coating Weight: **[2.5 lb (1.14 kg) for 0.5-inch- (12.7-mm-)]****[3 lb (1.36 kg) for 0.6-inch- (15.2-mm-)]** diameter strand per **100 feet (30 m)** of strand.
2. Completely fill annular space between strand and sheathing over entire tendon length with post-tensioning coating.

D. Tendon Sheathing:

1. Material: Polyethylene or polypropylene with a minimum density of **0.034 lb/cu. in. (0.9 g/cu. cm)**.
2. Minimum Thickness: **[0.050 inch (1.25 mm)]**.
3. Continuous over length of tendon **[to provide watertight encapsulation of prestressing strand][and][between anchorages to prevent intrusion of cement paste or loss of coating for a nonencapsulated system]**.

E. Anchorage and Coupler Assemblies: Assemblies of prestressing strand, wedges, and anchor or coupler complying with static and fatigue testing requirements and capable of developing 95 percent of actual breaking strength of strand.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[General Technologies, Inc.]**
 - b. **[Hayes Specialty Machining, Ltd.]**
 - c. **[Precision Sure-Lock, Inc.]**
2. Anchorage Bearing Stresses: Comply with ACI 423.7 for stresses at transfer load and service load.
3. Fixed-End Anchorage Assemblies: Plant fabricated with wedges seated at a load of not less than 80 percent and not more than 85 percent of breaking strength of strand.

F. Encapsulation System: Watertight encapsulation of prestressing strand consisting of the following:

1. Encapsulation Caps: Attached to anchorages with a positive mechanical connection and completely filled with post-tensioning coating.
 - a. Encapsulation Caps for Fixed- and Stressing-End Anchorages: Designed to provide watertight encapsulation of wedge cavity. Sized to allow required extension of strand past the wedges.
 - 1) Attach encapsulation caps for fixed-end anchorages in fabricating plant.
 - b. Encapsulation Caps at Intermediate Anchorages: Open to allow passage of strand.
2. Sleeves: Attached to anchorage with positive mechanical connection; overlapped a minimum of **4 inches (100 mm)** with sheathing and completely filled with post-tensioning coating.

2.4 NONPRESTRESSED STEEL BARS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25][60]** percent.

B. Support Bars, Reinforcing Bars, and Hairpins:

1. Steel: ASTM A615/A615M, **Grade 60 (Grade 420)**, deformed.
2. Low-Alloy Steel: ASTM A706/A706M, deformed.
3. Galvanized Steel: [**ASTM A615/A615M, Grade 60 (Grade 420)**][**ASTM A706/A706M**], deformed bars, ASTM A767/A767M, [**Class I**][**Class II**] zinc coated after fabrication and bending.
 - a. Zinc Repair Material: ASTM A780/A780M, zinc-based solder, paint containing zinc dust, or sprayed zinc.
4. Epoxy-Coated Steel: [**ASTM A615/A615M, Grade 60 (Grade 420)**][**ASTM A706/A706M**], deformed bars, ASTM A775/A775M epoxy coated with less than 2 percent damaged coating in each **12-inch (300-mm)** bar length.
 - a. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on bars and complying with ASTM A775/A775M. After fabricating bars, repair damaged areas according to ASTM D3963/D3963M.

C. Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening tendons and tendon support bars in place. Manufacture bar supports, according to CRSI's "Manual of Standard Practice," from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:

1. For uncoated bars, use [**all-plastic**][**CRSI Class 1 plastic-protected**][**CRSI Class 2 stainless steel**] bar supports.
2. For epoxy-coated bars, use [**CRSI Class 1A epoxy-coated or other dielectric-polymer-coated-wire**][**all-plastic**] bar supports.
3. For zinc-coated bars, use [**galvanized-wire or dielectric-polymer-coated-wire**][**all-plastic**] bar supports.

2.5 ACCESSORIES

- A. Pocket Formers: Capable of completely sealing wedge cavity; sized to provide the required cover over the anchorage and allow access for cutting strand tail.
- B. Anchorage Fasteners: [**Stainless**][**Galvanized**][**Uncoated**]-steel nails, wires, and screws used to attach anchorages to formwork.
- C. Sheathing Repair Tape: Elastic, self-adhesive, moistureproof tape with minimum width of **2 inches (50 mm)**, in contrasting color to tendon sheathing; nonreactive with sheathing, coating, or prestressing steel.
 1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
 - a. [**3M**]
 - b. [**Adhesive Tape Products, Ltd**]
 - c. [**Covalence Adhesives**]

2.6 PATCHING MATERIAL

- A. Patching Material: One-component, polymer-modified, premixed patching material containing selected silica aggregates and portland cement, suitable for vertical and overhead applications. Do not use material containing chlorides or other chemicals known to be deleterious to prestressing steel or material that is reactive with prestressing steel, anchorage device material, or concrete.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
- a. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - b. **[Fox Industries, Inc.]**
 - c. **[Kaufman Products, Inc]**
 - d. **[MAPEI Corporation]**
 - e. **[Master Builders Solutions]**
 - f. **[Sika Corporation]**

PART 3 - EXECUTION**3.1 FORMWORK**

- A. Design formwork to support load redistribution that may occur during stressing operation. Ensure that formwork does not restrain elastic shortening, camber, or deflection resulting from application of prestressing force.
- B. Do not remove forms supporting post-tensioned elements until tendons have been fully stressed and elongations, as directed by the Owner.
- C. Do not place concrete in supported floors until tendons on supporting floors have been stressed and elongations, as directed by the Owner.

3.2 INSTALLATION OF NONPRESTRESSED STEEL REINFORCEMENT

- A. Placement of nonprestressed steel reinforcement is specified in Section 032000 "Concrete Reinforcing." Coordinate placement of nonprestressed steel reinforcement with installation of post-tensioning tendons.

3.3 INSTALLATION OF TENDONS

- A. Install tendons according to installation drawings and procedures stated in PTI's "Field Procedures Manual for Unbonded Single Strand Tendons."
1. Tolerances: Comply with tolerances in ACI 423.7 for beams and slabs.
- B. Tendon Supports: Provide continuous slab bolsters or bars supported on individual high chairs spaced at a maximum of **42 inches (1070 mm)** o.c. to ensure tendons remain in their designated positions during construction operations and concrete placement.

1. Support tendons as required to provide profiles shown on installation drawings. Position supports at high and low points and at intervals not exceeding **48 inches (1220 mm)**. Ensure that tendon profiles between high and low points are smooth parabolic curves.
 2. Attach tendons to supporting chairs and reinforcement without damaging tendon sheathing.
 3. Support slab tendons independent of beam reinforcement.
- C. Maintain tendon profile within maximum allowable deviations from design profile as follows:
1. **1/4 inch (6.3 mm)** for member depth less than or equal to **8 inches (200 mm)**.
 2. **3/8 inch (9.5 mm)** for member depth greater than **8 inches (200 mm)** and less than or equal to **24 inches (610 mm)**.
 3. **1/2 inch (13 mm)** for member depth greater than **24 inches (610 mm)**.
- D. Maintain minimum radius of curvature of 480-strand diameters for lateral deviations to avoid openings, ducts, and embedded items. Maintain a minimum of **2 inches (50 mm)** of separation between tendons at locations of curvature.
- E. Limit tendon bundles to **[five]** tendons. Do not twist or entwine tendons within a bundle. Maintain a minimum distance of **12 inches (300 mm)** between center of adjacent bundles.
- F. If tendon locations conflict with nonprestressed reinforcement or embedded items, tendon placement governs. Obtain the Owner approval before relocating tendons or tendon anchorages that interfere with one another, as directed by the Owner.
- G. Deviations in horizontal spacing and location of slab tendons are permitted when required to avoid openings and inserts.
- H. Installation of Anchorages:
1. Place anchorages at locations shown on approved installation drawings.
 2. Do not switch fixed- and stressing-end anchorage locations.
 3. Attach pocket formers, intermediate anchorages, and stressing-end anchorages securely to bulkhead forms. Install stressing-end and intermediate anchorages perpendicular to tendon axis.
 4. Install tendons straight, without vertical or horizontal curvature, for a minimum of **12 inches (300 mm)** behind stressing-end and intermediate anchorages.
 5. Embed intermediate anchorage devices at construction joints in first concrete placed at joint.
 6. Minimum splice length in reinforcing bars at anchorages is **24 inches (600 mm)**. Stagger splices a minimum of **60 inches (1500 mm)**.
 7. Place fixed-end anchorages in formwork at locations shown on installation drawings. Support anchorages firmly to avoid movement during concrete placement.
 8. Remove loose encapsulation caps on fixed-end anchorages, refill with post-tensioning coating, and re-attach encapsulation caps to achieve a watertight enclosure.
- I. Maintain minimum concrete cover as follows:
1. From Exterior Edge of Concrete to Wedge Cavity: **[1-1/2 inches (38 mm)][2 inches (50 mm)]**.
 2. From Exterior Edge of Concrete to Strand Tail: **[3/4 inch (19 mm)]**.
 3. From Exterior Edge of Concrete to Wedge-Cavity Cap: **[1 inch (25 mm)]**.
 4. Top, Bottom, and Edge Cover for Anchorages: **[3/4 inch (19 mm)][1-1/2 inches (38 mm)]**.
- J. Maintain minimum clearance of **6 inches (150 mm)** between tendons and openings.
- K. Prior to concrete placement, mark tendon locations on formwork with spray paint.
- L. Do not install sleeves within **[36 inches (914 mm)]** of anchorages after tendon layout has been inspected.

- M. Do not install conduit, pipe, or embeds requiring movement of tendons after tendon layout has been inspected.
- N. Do not use couplers unless location has been approved by the Owner, as directed by the Owner.

3.4 SHEATHING INSPECTION AND REPAIR

- A. Inspect sheathing for damage after installing tendons. Repair damaged areas by restoring post-tensioning coating and repairing or replacing tendon sheathing.
 - 1. Ensure that sheathing is watertight and there are no air voids.
 - 2. Follow tape repair procedures in PTI's "Field Procedures Manual for Unbonded Single Strand Tendons."
- B. Maximum length of exposed strand behind anchorages is as follows:
 - 1. Fixed End: **[12 inches (300 mm)]**.
 - 2. Intermediate and Stressing End: **[1 inch (25 mm)]**.
 - a. Cover exposed strand with sheathing repair tape to prevent contact with concrete.
- C. Immediately remove and replace tendons that have damaged strand.

3.5 CONCRETE PLACEMENT

- A. Do not place concrete until placement of tendons and nonprestressed-steel reinforcement has been inspected by **[special inspector][testing agency]**.
- B. Provide as directed by the Owner and **[special inspector][testing agency]** a minimum of 48 hours' notice before concrete placement.
- C. Ensure compaction of concrete around anchorages.
- D. Ensure that position of tendons and nonprestressed-steel reinforcement do not change during concrete placement. Reposition tendons and nonprestressed-steel reinforcement moved during concrete placement to original location.
- E. Ensure that method of concrete placement does not damage tendon sheathing. Do not support pump lines, chutes, or other concrete-placing equipment on tendons.

3.6 TENDON STRESSING

- A. Calibrate stressing jacks and gages at start of project and at least every six months thereafter. Keep copies of calibration certificates for each jack-and-gage pair on Project site that are available for inspection. Exercise care in handling stressing equipment to ensure that proper calibration is maintained.
- B. Stress tendons only under supervision of a qualified post-tensioning superintendent.
- C. Do not begin stressing operations until concrete compressive strength has reached **[3000 psi (20.7 MPa)]** as indicated by tests of field-cured cylinders.

- D. Complete stressing within [96] hours of concrete placement.
- E. If concrete has not reached required compressive strength, obtain the Owner approval to partially stress tendons and delay final stressing until concrete has reached required strength, as directed by the Owner.
- F. Stage stress [**transfer girders**][**foundation mats**] according to schedule shown on the Contract Drawings.
- G. If detensioning and restressing of tendon is required, discard wedges used in original stressing and provide new wedges.
- H. Mark and measure elongations according to PTI's "Field Procedures Manual for Unbonded Single Strand Tendons." Measure elongations to closest [**1/8 inch (3.2 mm)**].
- I. Submit stressing records within one day of completion of stressing. If discrepancies between measured and calculated elongations exceed plus or minus 7 percent, resolve these discrepancies, as directed by the Owner.
- J. Prestressing will be considered acceptable if gage pressures shown on stressing record correspond to required stressing force and calculated and measured elongations agree within 7 percent.
- K. If measured elongations deviate from calculated elongations by more than 7 percent, perform additional testing, restressing, strengthening, or replacing of affected elements, as directed by the Owner.
- L. Stressing Records: Testing agency records the following information during stressing operations:
 - 1. Name of Project.
 - 2. Date of approved installation drawings used for installation and stressing.
 - 3. Floor number and concrete placement area.
 - 4. Date of stressing operation.
 - 5. Weather conditions, including temperature and rainfall.
 - 6. Name and signature of inspector.
 - 7. Name of individual in charge of stressing operation.
 - 8. Serial or identification numbers of jack and gage.
 - 9. Date of jack-and-gage calibration certificates.
 - 10. Gage pressure to achieve required stressing force according to supplied calibration chart.
 - 11. Tendon identification mark.
 - 12. Calculated tendon elongation.
 - 13. Actual tendon elongation.
 - 14. Actual gage pressure.

3.7 TENDON FINISHING

- A. Do not cut strand tails or cover anchorages until stressing records have been reviewed, as directed by the Owner.
- B. Cut strand tails as soon as possible after approval of elongations.
- C. Cut strand tail between **1/2 and 3/4 inch (13 and 19 mm)** from wedges. Do not damage tendon or concrete during removal of strand tail. Acceptable methods of cutting strand tail include the following:
 - 1. Oxyacetylene flame.
 - 2. Abrasive wheel.
 - 3. Hydraulic shears.

4. Plasma cutting.

- D. Install encapsulation caps and sleeves on intermediate anchorages within one day of stressing.
- E. Cut strand tails and install encapsulation caps on stressing-end anchorages, as directed by the Owner.
- F. Patch stressing pockets within one day of cutting strand tail. Clean inside surface of stressing pocket to remove laitance or post-tensioning coating before installing patching material. Finish patching material flush with adjacent concrete.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: **[The Owner][Engage]** a qualified testing agency to perform tests and inspections.
 - 1. Before concrete placement, **[special inspector][testing agency]** will inspect the following for compliance with post-tensioning installation drawings and the Contract Documents:
 - a. Location and number of tendons.
 - b. Tendon profiles and cover.
 - c. Installation of backup bars, hairpins, and other nonprestressed reinforcement shown on post-tensioning installation drawings.
 - d. Installation of pocket formers and anchorage devices.
 - e. Repair of damaged sheathing.
 - f. Connections between sheathing and anchorage devices.
 - 2. **[Special inspector][Testing agency]** will record tendon elongations during stressing.
 - 3. **[Special inspector][Testing agency]** will immediately report deviations, as directed by the Owner.
- B. Prepare test and inspection reports.

3.9 PROTECTION

- A. Do not expose tendons to electric ground currents, welding sparks, or temperatures that would degrade components.
- B. Protect exposed components within one workday of their exposure during installation.
- C. Prevent water from entering tendons during installation and stressing.
- D. Provide weather protection to stressing-end anchorages if strand tails are not cut within 10 days of stressing the tendons.

3.10 REPAIRS

- A. Review repair procedures, as directed by the Owner.
- B. Repairs requiring removal of concrete, review, as directed by the Owner.

END OF SECTION 03 41 26 00



Task	Specification	Specification Description
03 41 26 00	03 41 00 00	Precast Structural Concrete
03 41 33 00	03 41 00 00	Precast Structural Concrete
03 48 29 00	03 41 00 00	Precast Structural Concrete
03 48 46 00	03 41 00 00	Precast Structural Concrete
03 48 49 00	03 41 00 00	Precast Structural Concrete



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SECTION 03 51 13 00 - CEMENTITIOUS WOOD FIBER DECKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Monolithic cementitious wood-fiber plank units.
2. Composite cementitious wood-fiber plank units.
3. Cementitious wood-fiber tile units.
4. Subpurlins and grout.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include details at supports, reinforcement at openings, and attachment to other work.
- C. Samples: Show texture, finish, and edge and end configurations of each type of cementitious wood-fiber unit, [12 inches (305 mm)][24 inches (610 mm)] long by width of unit.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Test Reports: For cementitious wood-fiber units, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For cementitious wood-fiber deck, from ICC-ES.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect cementitious wood-fiber units from moisture.
- B. Store units on elevated platforms at Project site in a dry, well-ventilated, covered space and stack according to manufacturer's written instructions.
- C. Handle units to prevent chipping, breaking, cracking, staining, soiling, warping, or other physical damage. Discard damaged units at time of installation.

1.6 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit work to be performed according to manufacturers' written instructions and warranty requirements.
- B. Protect cementitious wood-fiber deck from moisture during installation and while exposed to the weather until permanently covered with subsequent construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: **[25]** or less.
 - 2. Smoke-Developed Index: **[50][450]** or less.
- B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- C. Noise Reduction Coefficient (NRC): **[NRC 0.55][NRC 0.60][NRC 0.65][NRC 0.70][NRC 0.75][NRC 0.80]**; ASTM C423.
- D. Light Reflectance: 60 percent; ASTM E1349.

2.2 MONOLITHIC CEMENTITIOUS WOOD-FIBER PLANK UNITS

- A. Monolithic Plank: Manufacturer's standard, tongue-and-groove-edged, cementitious wood-fiber units.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Armstrong Ceiling & Wall Solutions]**
 - 2. Thickness: **[2 inches (51 mm)][2-1/2 inches (63 mm)][3 inches (76 mm)]**.
 - 3. Size: Manufacturer's standard width; length **[to span a minimum of two supports][as indicated]**.
 - 4. End Configuration: Square.
 - 5. Finish: Manufacturer's standard **[natural][or][prime-painted]** finish.
- B. Channel-Reinforced Monolithic Plank: Manufacturer's standard, tongue-and-groove-edged, cementitious wood-fiber planks with factory-installed, cold-formed, **0.060-inch- (1.5-mm-)** thick, galvanized-steel channel set in grooved edge; and as follows:

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Armstrong Ceiling & Wall Solutions]**
 2. Thickness: **[2 inches (51 mm)][2-1/2 inches (63 mm)][3 inches (76 mm)]**.
 3. Size: Manufacturer's standard width; length **[to span a minimum of two support spacings][as indicated]**.
 4. End Configuration: Square.
- C. Concealed-Tee Monolithic Plank: Manufacturer's standard cementitious wood-fiber units, **3 inches (76 mm)** thick, with edges kerfed, back rabbeted, and beveled.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Armstrong Ceiling & Wall Solutions]**
 2. Size: Manufacturer's standard width; length **[to span a minimum of two support spacings][as indicated]**.
 3. End Configuration: Square.
 4. Finish: Manufacturer's standard **[natural][or][prime-painted]** finish.

2.3 COMPOSITE CEMENTITIOUS WOOD-FIBER PLANK UNITS

- A. Insulated Composite Plank Type IV XPS: Manufacturer's standard factory-laminated composite deck units consisting of a standard tongue-and-groove-edged, cementitious wood-fiber plank base, ASTM C578, Type IV extruded-polystyrene insulation, and top layer of APA-rated oriented-strand-board sheathing, Exposure 1 complying with DOC PS 2, **7/16 inch (11 mm)** thick; and as follows:
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Armstrong Ceiling & Wall Solutions]**
 2. Cementitious Wood-Fiber Base Thickness: **[1-1/2 inches (38 mm)][2 inches (51 mm)][2-1/2 inches (63 mm)][3 inches (76 mm)]**.
 3. Insulation Thickness: **[1-1/2 inches (38 mm)][2 inches (51 mm)][3 inches (76 mm)][4 inches (102 mm)][5 inches (127 mm)][6 inches (152 mm)][7 inches (177 mm)][8 inches (202 mm)]**.
 4. Size: Manufacturer's standard width and of length indicated.
 5. End Configuration: Square.
 6. Finish: Manufacturer's standard **[natural][or][prime-painted]** finish.
- B. Insulated Composite Plank Type I XPS: Manufacturer's standard factory-laminated composite deck units consisting of a standard tongue-and-groove-edged, cementitious wood-fiber plank base, ASTM C578, Type I expanded-polystyrene insulation, and top layer of APA-rated oriented-strand-board

sheathing, Exposure 1 complying with DOC PS 2, 7/16 inch (11 mm) thick; and as follows:

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Armstrong Ceiling & Wall Solutions]**
2. Cementitious Wood-Fiber Base Thickness: **[1-1/2 inches (38 mm)][2 inches (51 mm)][2-1/2 inches (63 mm)][3 inches (76 mm)]**.
3. Insulation Thickness: **[3/4 inch (19 mm)][1-1/2 inches (38 mm)][2 inches (51 mm)][3 inches (76 mm)][3-1/2 inches (89 mm)][4 inches (102 mm)][5-1/4 inches (133 mm)][6-1/2 inches (165 mm)][7 inches (177 mm)][8 inches (202 mm)]**.
4. Size: Manufacturer's standard width and of length indicated.
5. End Configuration: Square.
6. Finish: Manufacturer's standard **[natural][or][prime-painted]** finish.

- C. Composite Nailable Surface Plank: Manufacturer's standard factory-laminated composite deck units consisting of a standard tongue-and-groove-edged, cementitious wood-fiber plank base, insulation, and top layer of APA-rated oriented-strand-board sheathing, Exposure 1 complying with DOC PS 2, 7/16 inch (11 mm) thick.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Armstrong Ceiling & Wall Solutions]**
2. Thickness: **[2-1/2 inches (63 mm)][3 inches (76 mm)][3-1/2 inches (89 mm)][4 inches (102 mm)]**.
3. Size: Manufacturer's standard width and of length indicated.
4. End Configuration: Square.
5. Finish: Manufacturer's standard **[natural][or][prime-painted]** finish.

2.4 CEMENTITIOUS WOOD-FIBER TILE UNITS

- A. Monolithic Tile: Manufacturer's standard, rabbet-edged, cementitious wood-fiber units.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Armstrong Ceiling & Wall Solutions]**
2. Thickness: **[1-1/2 inches (38 mm)][2 inches (51 mm)][2-1/2 inches (63 mm)][3 inches (76 mm)][3-1/2 inches (89 mm)][4 inches (102 mm)][5 inches (127 mm)]**.
3. Size: **[24-inch (610-mm)][32-inch (813-mm)][48-inch (1219-mm)]** nominal width and of length indicated.

4. End Configuration: **[Square][Tongue and groove]**.
5. Finish: Manufacturer's standard **[natural][or][prime-painted]** finish.

B. Insulated Composite Tile: Manufacturer's standard factory-laminated composite deck units consisting of a rabbet-edged, cementitious wood-fiber tile base, ASTM C578, Type IV extruded-polystyrene insulation, and top layer of APA-rated oriented-strand-board sheathing, Exposure 1 complying with DOC PS 2, **7/16 inch (11 mm)** thick; and as follows:

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Armstrong Ceiling & Wall Solutions]**
2. Cementitious Wood-Fiber Tile Base Thickness: **[1-1/2 inches (38 mm)][2 inches (51 mm)][2-1/2 inches (63 mm)][3 inches (76 mm)]**.
3. Insulation Thickness: **[1-1/2 inches (38 mm)][2 inches (51 mm)][3 inches (76 mm)][4 inches (102 mm)][5 inches (127 mm)][6 inches (152 mm)][7 inches (177 mm)][8 inches (202 mm)]**.
4. Size: **[24-inch (610-mm)][32-inch (813-mm)][48-inch (1219-mm)]** nominal width and of length indicated.
5. End Configuration: **[Square][Tongue and groove]**.
6. Finish: Manufacturer's standard **[natural][or][prime-painted]** finish.

2.5 SUBPURLINS AND GROUT

- A. Bulb-Tee Subpurlins: Hot-rolled steel bulb tees, complying with ASTM A499, of length required to span three support spacings; shop painted with metal primer.
- B. Gypsum Concrete Grout: Factory-packaged, gypsum concrete grout formulation recommended by cementitious wood-fiber unit manufacturer with a minimum compressive strength of **500 psi (3.45 MPa)**.

2.6 ACCESSORIES

- A. Anchor Clips: Manufacturer's standard formed anchor clips of **0.0478-inch- (1.21-mm-)** thick minimum, galvanized-steel sheet, of type and configuration required for deck system indicated.
- B. Screws: Manufacturer's recommended corrosion-resistant screw fasteners and washers, self-drilling, self-tapping, of length required for deck and structural framing indicated.
- C. Nails: Manufacturer's recommended corrosion-resistant nails of size and length required for deck and structural framing indicated.
- D. Adhesive: Manufacturer's recommended construction adhesive complying with APA AFG-01.
- E. Filler Strips: Insulation strips, same as used in manufacture of insulated composite cementitious wood-fiber units.
- F. Polyethylene Film: **0.004 inch (0.10 mm)** thick, complying with ASTM D4397.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine structural support framing for compliance with requirements, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing cementitious wood-fiber deck.
 - 1. Install fastenings **[according to manufacturer's written instructions unless otherwise indicated][as indicated]**.
- B. Deck Interruptions: Provide barrier seals or blocking at overhangs to form wind seals and at partitions and walls to form sound seals unless otherwise indicated.

3.3 ROOF DECK INSTALLATION

- A. Plank Roof Deck: Install planks progressively with long dimension perpendicular to supports and with end joints in alternate rows, staggered and centered over supports unless otherwise indicated. Tightly nest tongue-and-groove edges and tightly butt end joints.
 - 1. Cut panels to provide starter units.
 - 2. Continuously support plank edges and ends at perimeter of building and at openings in deck.
 - 3. Mechanically fasten planks to supports and perimeter members.
 - 4. Adhesively and mechanically fasten planks to supports and perimeter members. Apply adhesive to tongue-and-groove edges.
- B. Concealed-Tee Plank Roof Deck: Install planks progressively with long dimension perpendicular to supports and with end joints in alternate rows, staggered and centered over supports unless otherwise indicated. Install flange of bulb tee into kerfed edge and tightly butt adjoining plank to engage other flange. Tightly **[nest tongue-and-groove][butt square]** end joints.
 - 1. Cut panels to provide starter units.
 - 2. Continuously support plank edges and ends at perimeter of building and at openings in deck.
 - 3. Mechanically fasten planks to supports and perimeter members.
 - 4. Adhesively and mechanically fasten planks to supports and perimeter members. Apply adhesive to tongue-and-groove edges.
 - 5. Fill void with gypsum concrete grout where edge joints meet subpurlins. Strike grout flush with top of plank and feather uneven top surfaces to a plane.
- C. Monolithic Tile and Subpurlin Roof Deck: Space subpurlin members as indicated. Attach subpurlins to each support with **3/4-inch- (19-mm-)** long minimum, fillet welds on both sides of flanges at ends of members and on alternate sides at intermediate structural supports.
 - 1. Lay tile with rabbeted edges supported on subpurlins.
 - 2. Lay tile with square-cut ends concealed **[and supported on cross subpurlins][over supporting purlins or beams]**.

3. Lay tile with tongue-and-groove ends exposed in pattern indicated.
 4. Fill void with gypsum concrete grout where edge joints meet subpurlins. Strike grout flush with top of tile and feather uneven top surfaces to a plane.
- D. Composite Tile and Subpurlin Roof Deck: Space subpurlin members as indicated. Attach subpurlins to each support with **3/4-inch- (19-mm-)** long minimum, fillet welds on both sides of flanges at ends of members and on alternate sides at intermediate structural supports.
1. Lay tile with rabbeted edges supported on subpurlins.
 2. Lay tile with square-cut ends concealed [**and supported on cross subpurlins**][**over supporting purlins or beams**].
 3. Lay tile with tongue-and-groove ends exposed in pattern indicated.
 4. Fill void with gypsum concrete grout where edge joints meet subpurlins. Strike grout flush with top surface of cementitious wood-fiber base. Fill remainder of joint with filler strips of insulation.

3.4 FORM-DECK INSTALLATION

- A. Plank Form Deck: Install planks progressively with long dimension perpendicular to supports and with end joints in alternate rows, staggered and centered over supports unless otherwise indicated. Tightly nest tongue-and-groove edges and tightly butt end joints.
1. Cut panels to provide starter units.
 2. Continuously support plank edges and ends at perimeter of building and at openings in deck.
 3. Cover exposed edges and ends of form planks with polyethylene film before pouring cast-in-place fill to prevent paste or mixing water from penetrating deck and seeping through to bottom face. Remove exposed film after cast-in-place fill has set.
- B. Shoring: Provide shoring of sufficient strength to withstand weight of cast-in-place fill and construction traffic.
1. Comply with **ACI 318 (ACI 318M)** and ACI 301 for design, installation, and removal of shoring and reshoring.
 - a. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
 2. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 CLEANING AND PROTECTION

- A. Protect top surfaces of deck from damage caused by construction operations.
- B. Protect exposed bottom surfaces of deck from soiling and damage during handling and construction.
- C. Clean exposed bottom surfaces of completed deck and touch up minor damage to surfaces, as directed by the Owner.
- D. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that cementitious wood-fiber deck is without damage or deterioration at time of Substantial Completion.
- E. Remove and replace deteriorated and damaged deck units.



03 - Concrete

END OF SECTION 03 51 13 00

SECTION 03 53 00 00 - CONCRETE TOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Emery-aggregate concrete floor topping.
2. Iron-aggregate concrete floor topping.
3. Concrete floor topping for standard applications.
4. Decorative concrete floor topping.
5. Polishable concrete floor topping.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]**.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each concrete floor topping, for tests performed by **[manufacturer and witnessed by a qualified testing agency][a qualified testing agency]**.
- B. Field quality-control reports **[by as directed by the Owner]**.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1.6 MOCKUPS

- A. Build mockups **[to demonstrate aesthetic effects][to set quality standards for materials and execution][to set quality standards for fabrication and installation][and][for preconstruction testing]**.
1. Build mockups approximately **100 sq. ft. (9.3 sq. m)** in the location indicated or, if not indicated, as directed by the Owner.
- B. Concrete floor topping mockups are to demonstrate typical joints where applicable, surface finish, bonding, texture, tolerances, and standard of workmanship.
1. Subject to compliance with requirements, approved mockups may become part of the completed

Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage, mixing with other components, and application.
- B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting concrete floor topping performance.
 - 1. Place concrete floor topping only when ambient temperature and temperature of base slabs are between **50 and 86 deg F (10 and 30 deg C)**.
- B. Close areas to traffic during topping application and, after application, for time period recommended in writing by manufacturer.

PART 2 - PRODUCTS**2.1 CONCRETE FLOOR TOPPINGS**

- A. Emery-Aggregate Concrete Floor Topping: Factory-prepared and dry-packaged mixture of graded, crushed emery aggregate containing not less than 50 percent aluminum oxide, not less than 24 percent ferric oxide, and not more than 8 percent silica; portland cement or blended hydraulic cement; plasticizers; and other admixtures to which only water needs to be added at Project site.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Anti-Hydro International, Inc]**
 - b. **[Laticrete International, Inc.]**
 - c. **[Metalcrete Industries]**
 - d. **[Vulcan Materials Company]**
 - 2. Performance Criteria:
 - a. Set Time: ASTM C403/C403M.
 - b. Impact Resistance: ACI 544.2.
 - c. Flexural Strength: ASTM C78/C78M.
 - d. Abrasion Resistance: ASTM C944/C944M.
 - 3. Compressive Strength Minimum (28 Days): **[10,000 psi (69 MPa)]**; ASTM C109/C109M.

- B. Iron-Aggregate Concrete Floor Topping: Factory-prepared and dry-packaged mixture of graded iron aggregate, portland cement, plasticizers, and other admixtures to which only water needs to be added at Project site.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Anti-Hydro International, Inc]**
 - b. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - c. **[Master Builders Solutions]**
 - d. **[Metalcrete Industries]**
 - e. **[Vulcan Materials Company]**
 2. Performance Criteria:
 - a. Set Time: ASTM C403/C403M.
 - b. Impact Resistance: ACI 544.2.
 - c. Flexural Strength: ASTM C78/C78M.
 - d. Abrasion Resistance: ASTM C944/C944M.
 3. Compressive Strength (28 Days): Minimum **[12,000 psi (83 MPa)]**; ASTM C109/C109M.
- C. Concrete Floor Topping for Standard Applications: Non-industrial, cement-based self-leveling interior concrete topping or resurfacing.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[ARDEX Americas]**
 - b. **[Laticrete International, Inc.]**
 - c. **[Schonox HPS North America, Inc.]**
 - d. **[Sika Corporation]**
 2. Performance Criteria:
 - a. Application: Barrel mix or pump.
 - b. Flow Time: Minimum 10 minutes.
 - c. Initial Set: Not less than 10 minutes.
 - d. Final Set: Not less than 45 minutes.
 - e. Compressive Strength (28 Days): Minimum **[4,000 psi (27.58 MPa)][6,000 psi (41.37 MPa)][7,000 psi (48 MPa)]**; ASTM C109/C109M.
 3. Materials:
 - a. Normal-Weight Aggregate: ASTM C33/C33M. Provide from single source. Well-graded, washed gravel.
 - b. Coloring: as directed by the Owner.
 - c. Primer: As recommended by manufacturer.
 - d. Sealer: As recommended by manufacturer.

-
4. Thickness: **[As indicated on Drawings][1/8 inch to 2 inches (3.175 mm to 50.8 mm)][1/4 inch to 2 inches (6.35 mm to 50.8 mm)][Up to 5 inches (127 mm) with aggregates]**.
- D. Decorative Concrete Floor Topping: Non-industrial cement-based self-leveling interior concrete topping as a decorative overlay or micro-topping.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ARDEX Americas]**
 - b. **[Laticrete International, Inc.]**
 - c. **[Schonox HPS North America, Inc.]**
 - d. **[Sika Corporation]**
 2. Performance Criteria:
 - a. Abrasion Resistance: ASTM C779/C779M.
 - b. Impact Strength: ASTM C805/C805M.
 3. Co-efficient of Friction: ASTM C1679, materials meet levels of finish as recommended in writing by manufacturer.
 4. Materials:
 - a. Polymer-modified, cementitious, single-component topping.
 - b. Coloring: as directed by the Owner.
 - c. Primer: As recommended by manufacturer.
 - d. Sealer: As recommended by manufacturer.
 5. Thickness: **[As indicated on Drawings][1/16 inch to 2 inches (1.58 mm to 50.8 mm)]**.
- E. Polishable Concrete Floor Topping: Non-industrial, cement-based self-leveling interior concrete topping suitable to receive a mechanical polish process.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ARDEX Americas]**
 - b. **[Laticrete International, Inc.]**
 - c. **[Schonox HPS North America, Inc.]**
 - d. **[Sika Corporation]**
 2. Description: Polymer-modified cementitious single component topping.
 - a. Coloring: Materials as recommended in writing by manufacturer, as directed by the Owner.
 - b. Primer: As recommended in writing by manufacturer.
 - c. Sealer: As recommended in writing by manufacturer.
 3. Performance Criteria:

- a. Compressive Strength (28 Days): Minimum **[6,000 psi (41.37 MPa)][7,000 psi (48 MPa)]**; ASTM C109/C109M.
 - b. Flexural Strength: Minimum **1,000 psi (70 kg/cm²)** at 28 days, ASTM C348.
 - c. Abrasion Resistance: ASTM D4060.
 - d. Tensile Strength: ASTM C1583/C1583M.
4. Thickness: **[As indicated on Drawings][3/8 inch to 2 inches (9.52 mm to 50.8 mm)]**.

2.2 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately **9 oz./sq. yd. (305 g/sq m)** when dry.
- C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, 25 percent solids content, minimum.

2.3 RELATED MATERIALS

- A. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids **[epoxy resin with a Type A Shore durometer hardness of 80][aromatic polyurea with a Type A Shore durometer hardness range of 90 to 95]** in accordance with ASTM D2240.
- B. Joint-Filler Strips: **[ASTM D1751, asphalt-saturated cellulosic fiber][or][ASTM D1752, cork or self-expanding cork]**.
- C. Portland Cement: ASTM C150/C150M, Type I or II.
- D. Sand: ASTM C404, fine aggregate passing **No. 16 (1.18 mm)** sieve.
- E. Water: Potable.
- F. Acrylic-Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- G. Cement Binder: ASTM C150/C150M, portland cement or hydraulic or blended hydraulic cement as defined by ASTM C219.
- H. Bond-Breaker Membrane: ASTM D2178/D2178M, asphalt-glass felt, Type III, standard ply sheet.
- I. Crack and Joint Repair:
 - 1. Crack repair materials as recommended in writing by concrete topping manufacturer.
 - 2. Joint sealant materials as recommended in writing by concrete topping manufacturer.
- J. Epoxy Adhesive: ASTM C881/C881M, Type V, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements.

- K. Power-Actuated Fasteners: Fastener systems with an evaluation report based on ICC-ES AC70.
- L. Nonslip Aggregate Materials: As recommended in writing by concrete topping manufacturer.
- M. Concrete Hardener and Dustproofer: Chemical clear liquid hardener which produces a dense, hard and dustproof concrete surface.
- N. Moisture Control System: As required for Project, and as recommended in writing by manufacturer.
- O. Low-Viscosity Rigid Polyurethane Crack and Joint Repair: As recommended in writing by manufacturer.
- P. Semi-Rigid Joint Sealant: As recommended in writing by manufacturer.
- Q. Topical Color: as directed by the Owner.
- R. Resilient Emulsion: As recommended in writing by manufacturer.
- S. Integral Color: as directed by the Owner. Pigment type as recommended in writing by manufacturer.

2.4 MIXING

- A. Bonding Slurry:
 - 1. Mix portland cement with water to a thick paint consistency.
 - 2. Mix 1 part portland cement and [1-1/2][2][2-1/2] parts sand with water[**and an acrylic-bonding agent in accordance with manufacturer's written instructions**] to a thick paint consistency.
- B. Floor Topping: Mix concrete floor topping materials and water in appropriate drum-type batch machine mixer or truck mixer in accordance with manufacturer's written instructions.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates, with Installer present, for conditions affecting performance of the Work.
- B. Verify that base concrete slabs comply with scratch finish requirements specified in Section 033000 "Cast-in-Place Concrete."
- C. Verify that base slabs are visibly dry and free of moisture. Test for capillary moisture by the plastic sheet method in accordance with ASTM D4263.
- D. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Existing Concrete: Remove existing surface treatments and deteriorated and unsound concrete. Mechanically abrade base slabs to produce a heavily scarified surface profile with an amplitude of 1/4 inch (6 mm).

1. Prepare and clean existing base slabs in accordance with concrete floor topping manufacturer's written instructions. Fill voids, cracks, and cavities in base slabs.
 2. Mechanically remove contaminants from existing concrete that might impair bond of floor topping.
 3. Saw cut contraction and construction joints in existing concrete to a depth of **1/2 inch (13 mm)** and fill with semirigid joint filler.
 4. To both sides of joint edges and at perimeter of existing base slab, **[mechanically remove a 4-inch- (100-mm-) wide and 0- to 1-inch- (0- to 25-mm-) deep, tapered wedge of concrete and retexture surface][install concrete nails in manufacturer's recommended staggered pattern]**.
- B. Install joint-filler strips where topping abuts vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated on Drawings.
1. Extend joint-filler strips full width and depth of joint, terminating flush with topping surface unless otherwise indicated on Drawings.
 2. Terminate full-width, joint-filler strips **1/2 inch (13 mm)** below topping surface where joint sealants are indicated, in accordance with Section 079200 "Joint Sealants."
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- C. Install power-actuated fasteners in accordance with written directions of floor topping manufacturer at perimeter of areas that are to receive floor topping, including both edges of locations where joints will be formed in floor topping.
- D. Primers: Provide priming at locations indicated on Drawings, and as recommended in writing by manufacturer.

3.3 APPLICATION OF FLOOR TOPPING

- A. Begin floor topping application in presence of manufacturer's technical representative.
- B. Monolithic Floor Topping: After textured float finish is applied to fresh concrete of base slabs installed in accordance with Section 033000 "Cast-in-Place Concrete," place concrete floor topping while concrete is still plastic.
- C. Deferred Floor Topping: Within 72 hours of placing base slabs, mix and scrub bonding slurry into dampened concrete to a thickness of **1/16 to 1/8 inch (1.6 to 3 mm)**, without puddling. Place floor topping while slurry is still tacky.
- D. Existing Concrete: Apply epoxy-bonding adhesive, mixed in accordance with manufacturer's written instructions, and scrub into dry base slabs to a thickness of **1/16 to 1/8 inch (1.6 to 3 mm)**, without puddling. Place floor topping while adhesive is still tacky.
- E. Aggregate Concrete Topping: Place concrete floor topping continuously in a single layer, tamping and consolidating to achieve tight contact with bonding surface. Do not permit cold joints or seams to develop within pour strip.
1. Screed surface with a straightedge and strike off to correct elevations.
 2. Slope surfaces uniformly where indicated.
 3. Begin initial floating, using bull floats to form a uniform and open-textured surface plane free of humps or hollows.
- F. Overlay or Micro-Topping: Apply in strict compliance with manufacturer's written installation instructions. Mix and spread material on to the surface with recommended squeegees and trowels.

- G. Finishing: Consolidate surface with power-driven floats as soon as concrete floor topping can support equipment and operator. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until concrete floor topping surface has a uniform, smooth, granular texture.
1. Hard Trowel Finish: After floating surface, apply first trowel finish and consolidate concrete floor topping by power-driven trowel without allowing blisters to develop. Continue troweling passes and restraighten until surface is smooth and uniform in texture.
 - a. Finish surfaces to specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15, and **[measure][notify independent testing agency to permit measurement]** within 24 hours in accordance with ASTM E1155 for a randomly trafficked floor surface.
 - b. Finish and measure surface, so gap at any point between surface and an unleveled freestanding **10-ft.- (3-m-)** long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed **1/4 inch (6 mm)**.
- H. Construction Joints: Construct joints true to line with faces perpendicular to surface plane of concrete floor topping, at locations indicated or as directed by the Owner.
1. Coat face of construction joint with epoxy adhesive at locations where concrete floor topping is placed against hardened or partially hardened concrete floor topping.
- I. Contraction Joints: Form weakened-plane contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut **1/8-inch- (3-mm-)** wide joints into concrete floor topping when cutting action will not tear, abrade, or otherwise damage surface and before random contraction cracks develop.
1. Form joints in concrete floor topping over contraction joints in base slabs unless otherwise indicated.
 2. Construct contraction joints for a combined depth equal to topping thickness and not less than one-fourth of base-slab thickness.
 3. Construct contraction joints for a depth equal to one-half of concrete floor topping thickness, but not less than **1/2 inch (13 mm)** deep.

3.4 PROTECTING AND CURING

- A. General: Protect freshly placed concrete floor topping from premature drying and excessive cold or hot temperatures.
- B. Evaporation Retarder: Apply evaporation retarder to concrete floor topping surfaces in hot, dry, or windy conditions before and during finishing operations. Apply in accordance with manufacturer's written instructions after placing, screeding, and bull floating or darbying floor topping, but before float finishing.
- C. Begin curing immediately after finishing concrete floor topping. Cure by one or a combination of the following methods, in accordance with concrete floor topping manufacturer's written instructions:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with **[water][continuous water-fog spray][or][absorptive cover, water saturated and kept continuously wet. Cover topping surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers]**.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least **12 inches (300 mm)**, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof

- tape.
3. Curing Compound: Apply uniformly in two coats in continuous operations by power spray or roller in accordance with manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.5 JOINT FILLING

- A. Prepare and clean contraction joints and install semirigid joint filler, in accordance with manufacturer's written instructions, once topping has fully cured.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth of contraction joints. Overfill joint and trim semirigid joint filler flush with top of joint after hardening.

3.6 REPAIR

- A. Defective Topping: Repair and patch defective concrete floor topping areas, including areas that have not bonded to concrete substrate.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: **[as directed by the Owner will engage][Engage]** a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing and inspecting of completed applications of concrete floor toppings to take place in successive stages, in areas of extent and using methods as follows:
 1. Sample Sets: At point of placement, a set of three molded-cube samples to be taken from the topping mix for the first **1000 sq. ft. (93 sq. m)**, plus one set of samples for each subsequent **5000 sq. ft. (464 sq. m)** of topping, or fraction thereof, but not less than six samples for each day's placement. Samples to be tested in accordance with ASTM C109/C109M for compliance with compressive-strength requirements.
 2. Concrete floor topping to be tested for delamination by dragging a steel chain over the surface.
 3. Concrete floor topping to be tested for compliance with surface flatness and levelness tolerances.
- C. Remove and replace applications of concrete floor topping where test results indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 03 53 00 00

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Task	Specification	Specification Description
03 53 14 00	03 53 00 00	Concrete Topping
03 53 19 00	03 53 00 00	Concrete Topping



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SECTION 03 54 00 00 - GYPSUM CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Self-leveling, gypsum cement underlayment for application below interior floor coverings.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]**.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum cement underlayment.
2. Reinforcement.
3. Primer.
4. Corrosion-resistant coating.
5. Surface sealer.
6. Sound control mat.

B. Sustainable Design Submittals:

1. Product Data: For coatings, indicating VOC content.
2. Laboratory Test Reports: For coatings, indicating compliance with requirements for low-emitting materials.

- C. Shop Drawings: Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Test Reports:

1. For fire-resistant ratings, from a qualified testing agency.
2. For STC-rated assemblies, from a qualified testing agency.
3. For IIC-rated assemblies, from a qualified testing agency.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
 - 1. Place gypsum cement underlayments only when ambient temperature and temperature of substrates are between **50 and 80 deg F (10 and 27 deg C)**.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
 - 1. STC Rating: **[60][55][50][As indicated on Drawings]**.
- C. IIC-Rated Assemblies: For IIC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E492 and classified according to ASTM E989 by an independent testing agency.
 - 1. IIC Rating: **[60][55][50][As indicated on Drawings]**.

2.2 GYPSUM CEMENT UNDERLAYMENTS

- A. Gypsum Cement Underlayment: Self-leveling, gypsum cement product that can be applied in minimum uniform thickness of **[1/8 inch (3 mm)]** to match adjacent floor elevations.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Arcosa Inc.]**
 - b. **[ARDEX Americas]**
 - c. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - d. **[Hacker Industries, Inc.]**
 - e. **[MAPEI Corporation]**
 - f. **[Maxxon Corporation]**
 - g. **[Schonox HPS North America, Inc.]**
 - h. **[USG Corporation]**

2. Cement Binder: Gypsum or blended gypsum cement as defined by ASTM C219.
 3. Compressive Strength: Not less than [2500 psi (17.2 MPa)][4000 psi (27.6 MPa)][5000 psi (34.5 MPa)] at 28 days when tested according to ASTM C472.
 4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.
- B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm); or coarse sand as recommended by underlayment manufacturer.
1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.
- C. Water: Potable and at a temperature of not more than 70 deg F (21 deg C).
- D. Reinforcement: For underlayment applied to wood substrates, provide galvanized metal lath or other corrosion-resistant reinforcement recommended in writing by underlayment manufacturer.
- E. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.
1. VOC Content: Provide coating with VOC content of 250 g/L or less.
 2. Low-Emitting Materials: Coating shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 3. VOC Content: Provide coating with VOC content of 100 g/L or less.
 4. Low-Emitting Materials: Coating shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 5. Material Emissions and Pollutant Control: Coating shall comply with either of the following:
 - a. Low-Emitting Materials: VOC emissions shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 - b. VOC Content: Provide coating with VOC content of 250 g/L or less.
 6. Emissions Requirements: Coating shall comply with either of the following:
 - a. Low-Emitting Materials: VOC emissions shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - b. VOC Content: Provide coating with VOC content of 100 g/L or less.
- F. Corrosion-Resistant Coating: Recommended in writing by underlayment manufacturer for metal substrates.
1. VOC Content: Provide coating with VOC content of 250 g/L or less.
 2. Low-Emitting Materials: Coating shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 3. VOC Content: Provide coating with VOC content of 100 g/L or less.
 4. Low-Emitting Materials: Coating shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

5. Material Emissions and Pollutant Control: Coating shall comply with either of the following:
 - a. Low-Emitting Materials: VOC emissions shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 - b. VOC Content: Provide coating with VOC content of 250 g/L or less.
6. Emissions Requirements: Coating shall comply with either of the following:
 - a. Low-Emitting Materials: VOC emissions shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - b. VOC Content: Provide coating with VOC content of 100 g/L or less.
- G. Surface Sealer: Designed to reduce porosity as recommended by manufacturer for type of floor covering to be applied to underlayment.

2.3 ACCESSORIES

- A. Sound Control Mat: As required to meet STC and IIC ratings, manufactured by gypsum cement underlayment manufacturer.
 1. Thickness: [1/8 inch (3 mm)][1/4 inch (6 mm)][3/8 inch (10 mm)][3/4 inch (19 mm)].

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance of the Work.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare and clean substrate according to manufacturer's written instructions.
 1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
 2. Fill substrate voids to prevent underlayment from leaking.
- B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.
 1. Moisture Testing: Perform tests so that each test area does not exceed [200 sq. ft. (18.6 sq. m)][1000 sq. ft. (304.8 sq. m)], and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

- a. Anhydrous Calcium Chloride Test, ASTM F1869: Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of **[3 lb of water/1000 sq. ft. (1.36 kg of water/100 sq. m)]** in 24 hours.
 - b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum **[85]** percent relative humidity level measurement, or as recommended by gypsum cement underlayment manufacturer.
- C. Wood Substrates: Mechanically fasten loose boards and panels to eliminate substrate movement and squeaks. Sand to remove coatings that might impair underlayment bond and remove sanding dust.
- 1. Install underlayment reinforcement recommended in writing by manufacturer.
- D. Metal Substrates: Mechanically remove, according to manufacturer's written instructions, rust, foreign matter, and other contaminants that might impair underlayment bond. Apply corrosion-resistant coating compatible with underlayment if recommended in writing by underlayment manufacturer.
- E. Nonporous Substrates: For ceramic tile, quarry tile, and terrazzo substrates, remove waxes, sealants, and other contaminants that might impair underlayment bond; prepare surfaces according to manufacturer's written instructions.
- F. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.
- G. Sound Control **[Mat][and][Board]**: Install sound control materials according to manufacturer's written instructions.
- 1. Do not install mechanical fasteners that penetrate through the sound control materials.

3.3 INSTALLATION

- A. Mix and install underlayment components according to manufacturer's written instructions.
- 1. Close areas to traffic during underlayment installation and for time period after installation recommended in writing by manufacturer.
 - 2. Coordinate installation of components to provide optimum adhesion to substrate and between coats.
 - 3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Install underlayment to produce uniform, level surface.
- 1. Install a final layer without aggregate to product surface.
 - 2. Feather edges to match adjacent floor elevations.
- D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during installation and curing processes.
- E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.
- F. Apply surface sealer at rate recommended by manufacturer.

- G. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 INSTALLATION TOLERANCES

- A. Finish and measure surface, so gap at any point between gypsum cement underlayment surface and an unlevelled, freestanding, **10-foot- (3.05-m-)** long straightedge resting on two high spots and placed anywhere on the surface does not exceed **[1/4 inch (6 mm)][3/16 inch (4.8 mm)][1/8 inch (3 mm)][1/8 inch (3 mm) and 1/16 inch (1.6 mm) in 2 feet (610 mm)]**.

3.5 PROTECTION

- A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 03 54 00 00

SECTION 03 54 16 00 - HYDRAULIC CEMENT UNDERLAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polymer-modified, self-leveling, hydraulic cement underlayment for application below interior floor coverings.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]**.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Hydraulic cement underlayment.
2. Reinforcement.
3. Primer.
4. Corrosion-resistant coating.
5. Surface sealer.
6. Sound control mat.

B. Sustainable Design Submittals:

1. Product Data: For coatings, indicating VOC content.
2. Laboratory Test Reports: For coatings, indicating compliance with requirements for low-emitting materials.

- C. Shop Drawings: Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Test Reports:

1. For fire-resistant ratings, from a qualified testing agency.
2. For STC-rated assemblies, from a qualified testing agency.
3. For IIC-rated assemblies, from a qualified testing agency.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment

products required for this Project.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
 - 1. Place hydraulic cement underlayments only when ambient temperature and temperature of substrates are between **50 and 80 deg F (10 and 27 deg C)**.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
 - 1. STC Rating: **[60][55][50][As indicated on Drawings]**.
- C. IIC-Rated Assemblies: For IIC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E492 and classified according to ASTM E989 by an independent testing agency.
 - 1. IIC Rating: **[60][55][50][As indicated on Drawings]**.

2.2 HYDRAULIC CEMENT UNDERLAYMENTS

- A. Hydraulic Cement Underlayment: Polymer-modified, self-leveling, hydraulic cement product that can be applied in minimum uniform thickness of **1/4 inch (6 mm)** and that can be feathered at edges to match adjacent floor elevations.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Arcosa Inc.]**
 - b. **[ARDEX Americas]**
 - c. **[Atlas Construction Supply, Inc]**
 - d. **[CMP Specialty Products; a Bostik Brand]**
 - e. **[Combimix Inc.]**
 - f. **[Custom Building Products]**

- g. [Dayton Superior Corporation]
 - h. [Dependable, LLC]
 - i. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - j. [H.B. Fuller Construction Products Inc. / TEC]
 - k. [Hacker Industries, Inc.]
 - l. [J.E. Tomes]
 - m. [KOSTER American Corporation]
 - n. [Lambert Corporation]
 - o. [Laticrete International, Inc.]
 - p. [MAPEI Corporation]
 - q. [Master Builders Solutions]
 - r. [Maxxon Corporation]
 - s. [Metalcrete Industries]
 - t. [Schonox HPS North America, Inc.]
 - u. [Silpro Corporation]
 - v. [US SPEC, Division of US MIX Company]
 - w. [USG Corporation]
 - x. [Uzin Utz North America, Inc.]
2. Cement Binder: ASTM C150/C150M, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C219.
 3. Compressive Strength: Not less than **[4000 psi (27.6 MPa)][5000 psi (34.5 MPa)][6000 psi (41.4 MPa)]** at 28 days when tested according to ASTM C109/C109M.
 4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.
- B. Aggregate: Well-graded, washed gravel, **1/8 to 1/4 inch (3 to 6 mm)**; or coarse sand as recommended by underlayment manufacturer.
1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.
- C. Water: Potable and at a temperature of not more than **70 deg F (21 deg C)**.
- D. Reinforcement: For underlayment applied to wood substrates, provide galvanized metal lath or other corrosion-resistant reinforcement recommended in writing by underlayment manufacturer.
- E. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.
1. VOC Content: Provide coating with VOC content of 250 g/L or less.
 2. Low-Emitting Materials: Coating shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 3. VOC Content: Provide coating with VOC content of 100 g/L or less.
 4. Low-Emitting Materials: Coating shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 5. Material Emissions and Pollutant Control: Coating shall comply with either of the following:
 - a. Low-Emitting Materials: VOC emissions shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

- b. VOC Content: Provide coating with VOC content of 250 g/L or less.
- 6. Emissions Requirements: Coating shall comply with either of the following:
 - a. Low-Emitting Materials: VOC emissions shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - b. VOC Content: Provide coating with VOC content of 100 g/L or less.

F. Corrosion-Resistant Coating: Recommended in writing by underlayment manufacturer for metal substrates.

- 1. VOC Content: Provide coating with VOC content of 250 g/L or less.
- 2. Low-Emitting Materials: Coating shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- 3. VOC Content: Provide coating with VOC content of 100 g/L or less.
- 4. Low-Emitting Materials: Coating shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- 5. Material Emissions and Pollutant Control: Coating shall comply with either of the following:
 - a. Low-Emitting Materials: VOC emissions shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 - b. VOC Content: Provide coating with VOC content of 250 g/L or less.
- 6. Emissions Requirements: Coating shall comply with either of the following:
 - a. Low-Emitting Materials: VOC emissions shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - b. VOC Content: Provide coating with VOC content of 100 g/L or less.

G. Surface Sealer: Designed to reduce porosity as recommended by manufacturer for type of floor covering to be applied to underlayment.

2.3 ACCESSORIES

- A. Sound Control Mat: As required to meet STC and IIC ratings, manufactured by hydraulic cement underlayment manufacturer.
 - 1. Thickness: [1/8 inch (3 mm)][1/4 inch (6 mm)][3/8 inch (10 mm)][3/4 inch (19 mm)].

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance of the Work.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare and clean substrate according to manufacturer's written instructions.
 - 1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
 - 2. Fill substrate voids to prevent underlayment from leaking.
- B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.
 - 1. Moisture Testing: Perform tests so that each test area does not exceed **[200 sq. ft. (18.6 sq. m)][1000 sq. ft. (304.8 sq. m)]**, and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test, ASTM F1869: Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of **[3 lb of water/1000 sq. ft. (1.36 kg of water/100 sq. m)]** in 24 hours.
 - b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum **[85]** percent relative humidity level measurement, or as recommended by hydraulic cement underlayment manufacturer.
- C. Wood Substrates: Mechanically fasten loose boards and panels to eliminate substrate movement and squeaks. Sand to remove coatings that might impair underlayment bond and remove sanding dust.
 - 1. Install underlayment reinforcement recommended in writing by manufacturer.
- D. Metal Substrates: Mechanically remove, according to manufacturer's written instructions, rust, foreign matter, and other contaminants that might impair underlayment bond. Apply corrosion-resistant coating compatible with underlayment if recommended in writing by underlayment manufacturer.
- E. Nonporous Substrates: For ceramic tile, quarry tile, and terrazzo substrates, remove waxes, sealants, and other contaminants that might impair underlayment bond, and prepare surfaces according to manufacturer's written instructions.
- F. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.
- G. Sound Control **[Mat][and][Board]**: Install sound control materials according to manufacturer's written instructions.
 - 1. Do not install mechanical fasteners that penetrate through the sound control materials.

3.3 INSTALLATION

- A. Mix and install underlayment components according to manufacturer's written instructions.
 - 1. Close areas to traffic during underlayment installation and for time period after installation recommended in writing by manufacturer.
 - 2. Coordinate installation of components to provide optimum adhesion to substrate and between coats.
 - 3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
- B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- C. Install underlayment to produce uniform, level surface.
 - 1. Install a final layer without aggregate to product surface.
 - 2. Feather edges to match adjacent floor elevations.
- D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during installation and curing processes.
- E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.
- F. Apply surface sealer at rate recommended by manufacturer.
- G. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 INSTALLATION TOLERANCES

- A. Finish and measure surface, so gap at any point between hydraulic cement underlayment surface and an unlevelled, freestanding, **10-foot- (3.05-m-)** long straightedge resting on two high spots and placed anywhere on the surface does not exceed **[1/4 inch (6 mm)][3/16 inch (4.8 mm)][1/8 inch (3 mm)][1/8 inch (3 mm) and 1/16 inch (1.6 mm) in 2 feet (610 mm)]**.

3.5 PROTECTION

- A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 03 54 16 00



Task	Specification	Specification Description
03 54 16 00	03 54 00 00	Gypsum Cement Underlayment
03 61 16 00	01 11 19 00	No Specification Required
03 62 13 00	03 41 00 00	Precast Structural Concrete
03 62 16 00	03 41 00 00	Precast Structural Concrete
03 63 00 00	03 37 13 00	Shotcrete
03 64 23 00	03 41 00 00	Precast Structural Concrete
03 64 26 00	01 11 19 00	No Specification Required
03 81 00 00	02 41 19 13	Cutting and Patching
03 81 13 00	02 41 19 13	Cutting and Patching
03 81 16 00	02 41 19 13	Cutting and Patching



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SECTION 04 01 00 00 - MASONRY CLEANING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Paint removers.
 - 2. Cleaning materials.
 - 3. Liquid strippable masking agent.

1.2 ALLOWANCES

- A. Allowances for cleaning masonry are specified in Section 012100 "Allowances."

1.3 UNIT PRICES

- A. See Section 012200 "Unit Prices" for description of unit prices affecting items specified in this Section.

1.4 DEFINITIONS

- A. Very Low-Pressure Spray: Under [100 psi (690 kPa)].
- B. Low-Pressure Spray: [100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s)].
- C. Medium-Pressure Spray: [400 to 800 psi (2750 to 5510 kPa); 4 to 6 gpm (0.25 to 0.4 L/s)].
- D. High-Pressure Spray: [800 to 1200 psi (5510 to 8250 kPa); 4 to 6 gpm (0.25 to 0.4 L/s)].

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at [Project site].
 - 1. Review methods and procedures related to cleaning masonry, including, but not limited to, the following:
 - a. Scheduling a pre-mockup meeting.
 - b. Manufacturer's representative of cleaning materials to be present during testing for consultation.
 - c. Mockup locations.
 - d. Masonry types.
 - e. Soiling types.
 - f. Verify masonry-cleaning equipment and facilities needed to make progress and avoid delays.
 - g. Materials, material application, and sequencing.
 - h. Cleaning types and cleaning methods.
 - i. Quality-control program.

- j. Review cleaning program.
- k. Coordination with building occupants.

1.6 SEQUENCING AND SCHEDULING

- A. Work Sequence: Perform masonry-cleaning Work in the following sequence:
 - 1. Remove plant growth and any other biological growth.
 - 2. Inspect for open mortar joints. Where repairs are required, delay further cleaning Work until after repairs are completed, cured, and dried to prevent the intrusion of water and other cleaning materials into the wall.
 - 3. Remove paint or graffiti.
 - 4. Clean masonry surfaces.
 - 5. Where water repellents are to be used on or near masonry, delay application of these chemicals until after cleaning.
- B. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in masonry units and joints in accordance with masonry repair Sections.

1.7 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include material descriptions and application instructions.
 - 2. Include test data substantiating that products comply with requirements.
- B. Material certificates signed by manufacturer and Contractor certifying that each material complies with requirements.
- C. Each type of chemical cleaning material.
- D. Qualification data for firms and specialists to demonstrate their capabilities and experience. Include list of five completed projects with project names and references.
- E. Cleaning Program:
 - 1. Describe cleaning protocol, materials, methods, and equipment to be used.
 - 2. Indicate protection of surrounding materials on people, vehicles, buildings, and site items.
 - 3. Describe control method of runoff during operations.
 - 4. Create written report of final cleaning methods and process used.

1.8 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[paint-remover manufacturer][and][chemical-cleaner manufacturer]**.
- B. Preconstruction Test Reports: For cleaning materials and methods.
- C. Cleaning program.

1.9 QUALITY ASSURANCE

- A. Source of Materials: Obtain materials for masonry cleaning from a single source for each type of substrate required to ensure quality of cleaning.
- B. Paint-Remover Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, who employs factory-authorized service representatives who are available for consultation and Project-site inspection, preconstruction product testing, and on-site assistance.
- C. Masonry-Cleaning Specialist Firms: A firm that provides masonry cleaning, including masonry cleaners that have been used for similar applications with successful results, and is manufacturer authorized for consultation and Project-site inspection, preconstruction product testing, and on-site assistance.
- D. Chemical-Cleaner Manufacturer Qualifications: A firm regularly engaged in producing masonry cleaners that have been used for similar applications with successful results, who employs factory-authorized service representatives who are available for consultation and Project-site inspection, preconstruction product testing, and on-site assistance.
- E. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage.
- F. Cleaning Program: Prepare a written cleaning program that describes cleaning process in detail, including materials, methods, and equipment to be used; protection of surrounding materials; and control of runoff during operations. Include provisions for supervising worker performance and preventing damage.
 - 1. If materials and methods other than those indicated are proposed for any phase of cleaning Work, add a written description of such materials and methods, including evidence of successful use on comparable projects and demonstrations to show their effectiveness for this Project.

1.10 MOCKUPS

- A. Prepare mockups of cleaning on existing surfaces to evaluate and establish cleaning materials and processes. Consult cleaning manufacturer for project applications.
 - 1. Masonry Substrate: **[Clay masonry][Glazed masonry][Marble][Concrete masonry units][Stone veneer][Terra cotta][Glazed terra cotta][Slate][Stone][Limestone][Sandstone][Granite][Polished granite][Travertine].**
 - 2. Cleaning: Clean an existing area **[approximately 25 sq. ft. (2.3 sq. m)][as indicated]** for each type of masonry and surface condition.
 - a. Test cleaners and methods on samples of adjacent materials for possible adverse reactions. Do not test cleaners and methods known to have deleterious effect.
 - b. Consult with chemical cleaning product manufacturer to verify what products require pre-wetting of substrate before cleaner application.
 - c. Dilute chemical cleaners with water to produce solutions not exceeding concentration recommended in writing by chemical-cleaner manufacturer.
 - d. Allow a waiting period of not less than seven days after completion of sample cleaning to permit a study of sample panels for negative reactions.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.11 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage one or more chemical-cleaner[**and paint-remover**] manufacturers to perform preconstruction testing on masonry surfaces.
 - 1. Use test areas as indicated and representative of proposed materials and existing construction.
 - 2. Propose changes to materials and methods to suit Project.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry materials to Project in undamaged condition.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

1.13 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit masonry-cleaning Work to be performed in accordance with product manufacturers' written instructions and specified requirements.
- B. Clean masonry surfaces only when air temperature is **40 deg F (4 deg C)** and above and is predicted to remain so for at least seven days after completion of cleaning.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is **40 deg F (4 deg C)** and above and will remain so until masonry has thawed and dried out, but not less than seven days after completion of cleaning.
 - 2. Hot-Weather Requirements: Protect unit masonry Work when temperature and humidity conditions produce excessive evaporation of water from masonry. Provide artificial shade and wind breaks and use cooled materials as required.
- C. Refer to chemical cleaner manufacturer's recommendations for application techniques when hot-weather conditions exist.

PART 2 - PRODUCTS**2.1 PAINT REMOVERS**

- A. Alkaline Paste Paint Remover: Manufacturer's standard alkaline paste or gel formulation, for removing paint from masonry; containing no methylene chloride.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[American Building Restoration Products, Inc.]**
 - b. **[Cathedral Stone Products, Inc.]**
 - c. **[Diedrich Technologies, Inc.; a Hohmann & Barnard company]**
 - d. **[EaCo Chem, Inc.]**

- e. **[Hydroclean; Hydrochemical Techniques, Inc]**
 - f. **[PROSOCO, Inc]**
 - g. **[Shore Corporation]**
2. Masonry Substrate: **[Clay masonry][Glazed masonry][Marble][Concrete masonry units][Stone veneer][Terra cotta][Glazed terra cotta][Slate][Stone][Limestone][Sandstone][Granite][Polished granite][Travertine].**
- B. Covered or Skin-Forming Alkaline Paint Remover: Manufacturer's standard covered or skin-forming, alkaline paste or gel formulation, for removing paint from masonry; containing no methylene chloride.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
- a. **[American Building Restoration Products, Inc.]**
 - b. **[Diedrich Technologies, Inc.; a Hohmann & Barnard company]**
 - c. **[Dumond Chemicals, Inc]**
2. Masonry Substrate: **[Clay masonry][Glazed masonry][Marble][Concrete masonry units][Stone veneer][Terra cotta][Glazed terra cotta][Slate][Stone][Limestone][Sandstone][Granite][Polished granite][Travertine].**
- C. Solvent-Type Paste Paint Remover: Manufacturer's standard water-rinsable, solvent-type paste or gel formulation, for removing paint from masonry.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
- a. **[Diedrich Technologies, Inc.; a Hohmann & Barnard company]**
 - b. **[Hydroclean; Hydrochemical Techniques, Inc]**
 - c. **[PROSOCO, Inc]**
 - d. **[Shore Corporation]**
2. Masonry Substrate: **[Clay masonry][Glazed masonry][Marble][Concrete masonry units][Stone veneer][Terra cotta][Glazed terra cotta][Slate][Stone][Limestone][Sandstone][Granite][Polished granite][Travertine].**
- D. Low-Odor, Solvent-Type Paste Paint Remover: Manufacturer's standard low-odor, water-rinsable, solvent-type paste, gel, or foamed emulsion formulation, for removing paint from masonry; containing no methanol or methylene chloride.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
- a. **[American Building Restoration Products, Inc.]**
 - b. **[Cathedral Stone Products, Inc.]**
 - c. **[Dumond Chemicals, Inc]**

- d. [EaCo Chem, Inc.]
- e. [PROSOCO, Inc]

- 2. Masonry Substrate: [Clay masonry][Glazed masonry][Marble][Concrete masonry units][Stone veneer][Terra cotta][Glazed terra cotta][Slate][Stone][Limestone][Sandstone][Granite][Polished granite][Travertine].

- E. Covered, Solvent-Type Paste Paint Remover: Manufacturer's standard, low-odor, covered, water-rinsable, solvent-type paste or gel formulation, for removing paint coatings from masonry; containing no methanol or methylene chloride.

- 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Dumond Chemicals, Inc]
- b. [PROSOCO, Inc]

- 2. Masonry Substrate: [Clay masonry][Glazed masonry][Marble][Concrete masonry units][Stone veneer][Terra cotta][Glazed terra cotta][Slate][Stone][Limestone][Sandstone][Granite][Polished granite][Travertine].

2.2 CLEANING MATERIALS

- A. Water: Potable.
- B. Hot Water: Water heated to a temperature of **140 to 160 deg F (60 to 71 deg C)**.
- C. Detergent Solution, Job Mixed: Solution prepared by mixing **2 cups (0.5 L)** of tetrasodium pyrophosphate (TSPP), **1/2 cup (125 mL)** of laundry detergent, and **20 quarts (20 L)** of hot water for every **5 gal. (20 L)** of solution required.
- D. Mold, Mildew, and Algae Remover, Job Mixed: Solution prepared by mixing **2 cups (0.5 L)** of tetrasodium pyrophosphate (TSPP), **5 quarts (5 L)** of 5 percent sodium hypochlorite (bleach), and **15 quarts (15 L)** of hot water for every **5 gal. (20 L)** of solution required.
- E. Nonacidic Gel Cleaner: Manufacturer's standard gel formulation, with pH between 6 and 9, that contains detergents with chelating agents and is specifically formulated for cleaning masonry surfaces.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Cathedral Stone Products, Inc.]
 - b. [Price Research, Ltd. dba Charles Paint Research]
 - c. [PROSOCO, Inc]
 - 2. Masonry Substrate: [Clay masonry][Glazed masonry][Marble][Concrete masonry units][Stone veneer][Terra cotta][Glazed terra

cotta][Slate][Stone][Limestone][Sandstone][Granite][Polished granite][Travertine].

- F. Nonacidic Liquid Cleaner: Manufacturer's standard mildly alkaline liquid cleaner formulated for removing mold, mildew, and other organic soiling from ordinary building materials, including polished stone, brick, aluminum, plastics, and wood.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[American Building Restoration Products, Inc.]**
 - b. **[Cathedral Stone Products, Inc.]**
 - c. **[Diedrich Technologies, Inc.; a Hohmann & Barnard company]**
 - d. **[Dumond Chemicals, Inc]**
 - e. **[Hydroclean; Hydrochemical Techniques, Inc]**
 - f. **[Price Research, Ltd. dba Charles Paint Research]**
 - g. **[PROSOCO, Inc]**
 2. Masonry Substrate: **[Clay masonry][Glazed masonry][Marble][Concrete masonry units][Stone veneer][Terra cotta][Glazed terra cotta][Slate][Stone][Limestone][Sandstone][Granite][Polished granite][Travertine].**
- G. Mild-Acid Cleaner: Manufacturer's standard mild-acid cleaner containing no muriatic (hydrochloric), hydrofluoric, or sulfuric acid; or ammonium bifluoride or chlorine bleaches.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[American Building Restoration Products, Inc.]**
 - b. **[Cathedral Stone Products, Inc.]**
 - c. **[Diedrich Technologies, Inc.; a Hohmann & Barnard company]**
 - d. **[PROSOCO, Inc]**
 2. Masonry Substrate: **[Clay masonry][Glazed masonry][Marble][Concrete masonry units][Stone veneer][Terra cotta][Glazed terra cotta][Slate][Stone][Limestone][Sandstone][Granite][Polished granite][Travertine].**
- H. Acidic Cleaner: Manufacturer's standard acidic masonry cleaner composed of hydrofluoric acid or ammonium bifluoride blended with other acids, detergents, wetting agents, and inhibitors.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[American Building Restoration Products, Inc.]**
 - b. **[Cathedral Stone Products, Inc.]**
 - c. **[Diedrich Technologies, Inc.; a Hohmann & Barnard company]**
 - d. **[Dumond Chemicals, Inc]**
 - e. **[EaCo Chem, Inc.]**
 - f. **[Hydroclean; Hydrochemical Techniques, Inc]**

- g. [Price Research, Ltd. dba Charles Paint Research]
 - h. [PROSOCO, Inc]
2. Masonry Substrate: [Clay masonry][Glazed masonry][Marble][Concrete masonry units][Stone veneer][Terra cotta][Glazed terra cotta][Slate][Stone][Limestone][Sandstone][Granite][Polished granite][Travertine].
- I. One-Part Limestone Acidic Cleaner: Manufacturer's standard one-part acidic formulation for cleaning limestone.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- a. [American Building Restoration Products, Inc.]
 - b. [Cathedral Stone Products, Inc.]
 - c. [EaCo Chem, Inc.]
 - d. [Hydroclean; Hydrochemical Techniques, Inc]
 - e. [Price Research, Ltd. dba Charles Paint Research]
 - f. [PROSOCO, Inc]
2. Masonry Substrate: [Clay masonry][Glazed masonry][Marble][Concrete masonry units][Stone veneer][Terra cotta][Glazed terra cotta][Slate][Stone][Limestone][Sandstone][Granite][Polished granite][Travertine].
- J. Two-Part Chemical Cleaner: Manufacturer's standard system consisting of potassium- or sodium-hydroxide-based, alkaline prewash cleaner and acidic afterwash cleaner that does not contain hydrofluoric acid.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- a. [American Building Restoration Products, Inc.]
 - b. [Diedrich Technologies, Inc.; a Hohmann & Barnard company]
 - c. [Hydroclean; Hydrochemical Techniques, Inc]
 - d. [Price Research, Ltd. dba Charles Paint Research]
 - e. [PROSOCO, Inc]
2. Masonry Substrate: [Clay masonry][Glazed masonry][Marble][Concrete masonry units][Stone veneer][Terra cotta][Glazed terra cotta][Slate][Stone][Limestone][Sandstone][Granite][Polished granite][Travertine].
- K. Poultices Cleaners: Manufacturer's temporary cleaning coating designed to remove dirt and stains without water in its application or removal. Consult manufacturer for strength level to fit project masonry substrates.
1. Masonry Substrate: [Clay masonry][Glazed masonry][Marble][Concrete masonry units][Stone veneer][Terra cotta][Glazed terra cotta][Slate][Stone][Limestone][Sandstone][Granite][Polished granite][Travertine].

2.3 LIQUID STRIPPABLE MASKING AGENT

- A. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, glazed masonry, and polished stone surfaces from damaging effects of acidic and alkaline masonry cleaners.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[American Building Restoration Products, Inc.]**
 - b. **[Price Research, Ltd. dba Charles Paint Research]**
 - c. **[PROSOCO, Inc]**

2.4 ACCESSORY MATERIALS

- A. Retain materials of use based on the approval of a mockup.
 - 1. Provide materials with previous effectiveness in performing the Work involved.
 - a. Include materials with minimal possibility of damaging exposed surfaces.
 - b. Materials with consistency of each application.
 - c. Materials that provide uniformity of the resulting overall appearance.
- B. Do not use products or tools that could do the following:
 - 1. Remove, alter, or harm the present condition or future preservation of existing surfaces, including surrounding surfaces.
 - 2. Leave residue on surfaces.
- C. Equipment: Provide equipment for controlled spray application of water and chemical cleaners.
 - 1. For chemical cleaner spray applications, provide a low-pressure tank or chemical pump suitable for the chemical cleaner indicated, equipped with spray tip for cleaning method applications.
- D. Natural bristles brushes only.
- E. Wood scrapers.
- F. Trowels.
- G. Provide additional accessories applicable to project conditions, including tapes, sheets, etc., to suit Project.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate conditions with specialist present, for compliance with approved mockup requirements for cleaning type, methods, products, and other conditions affecting performance.

3.2 PREPARATION

- A. General: Comply with each manufacturer's written instructions for protecting people, motor vehicles, surrounding buildings, masonry areas not to be cleaned, nonmasonry surfaces, landscaping, equipment, and other surfaces that could be injured or harmed by such Work.
 - 1. Provide temporary protective covers over pedestrian walkway areas and at points of entrance and exit for people, motor vehicles, and equipment that must remain during duration of cleaning procedures.
 - 2. Cover adjacent surfaces with materials that are proven to resist paint removers and chemical cleaners used unless products being used will not damage adjacent surfaces. Use protective materials that are waterproof and UV resistant.
 - 3. Temporarily protect all open joints to prevent intrusion of washing waters into the wall structure or building interior.
 - 4. Remove all extraneous items no longer in use on face of surface unless indicated to remain, as directed by the Owner.
 - 5. Apply masking agents in accordance with manufacturer's written instructions. Do not apply liquid strippable masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
 - 6. Neutralize alkaline and acid wastes before disposal where applicable.
- B. Provide disposal of runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
- C. Remove[**gutters and**] downspouts and associated hardware adjacent to immediate work area and store during masonry cleaning. Reinstall when masonry cleaning is complete.
 - 1. Provide temporary rain drainage during work to direct water away from building.

3.3 APPLICATION OF PRELIMINARY CLEANING MATERIALS

- A. Preliminary Cleaning: Before beginning general cleaning, remove extraneous substances that are resistant to planned cleaning methods.
 - 1. Carefully remove heavy accumulations of rigid materials from masonry surface with sharp chisel. Do not scratch or chip masonry surface.
 - 2. Removing Biological Growth: Completely remove visible biological, moss, and shrub growth from masonry surfaces. Carefully remove biological growths, creepers, and vegetation by cutting at roots and allowing remaining growth to dry as long as possible before removal. Remove loose soil and biological debris from open joints to whatever depth they occur.
 - 3. Mold, Mildew, and Algae Removal:
 - a. Wet surface with [**cold**][**hot**] water applied by low-pressure spray.
 - b. Apply mold, mildew, and algae remover by brush[**or low-pressure spray**].
 - c. Scrub surface with medium-soft brushes until mold, mildew, and algae are thoroughly dislodged and can be removed by rinsing. Use small brushes for mortar joints and crevices. Dip brush in mold, mildew, and algae remover often to ensure that adequate fresh cleaner is used and that surface remains wet.
 - d. Rinse with [**cold**][**hot**] water applied by [**low**][**medium**][**high**]-pressure spray to remove mold, mildew, and algae remover and soil.
- B. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

3.4 APPLICATION OF PAINT REMOVER

- A. Paint-Remover Application, General: Apply paint removers in accordance with paint-remover manufacturer's written instructions. Do not allow paint removers to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.
- B. Paint Removal with Alkaline Paste Paint Remover:
1. Remove loose and peeling paint using [low][medium][high]-pressure water spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 2. Apply paint remover to dry, painted surface with brushes.
 3. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
 4. Rinse with [cold][hot] water applied by [low][medium][high]-pressure spray to remove chemicals and paint residue.
 5. Repeat process if necessary to remove all paint.
 6. Apply acidic cleaner or manufacturer's recommended afterwash to surface, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended in writing by chemical-cleaner or afterwash manufacturer.
 7. Rinse with cold water applied by [low][medium][high]-pressure spray to remove chemicals and soil.
 8. Remove asphalt and tar with [solvent-type paste paint remover].
 - a. Apply paint remover only to asphalt and tar by brush without prewetting.
 - b. Allow paint remover to remain on surface for 10 to 30 minutes.
 - c. Repeat application if needed.
- C. Paint Removal with Covered or Skin-Forming Alkaline Paint Remover:
1. Remove loose and peeling paint using [low][medium][high]-pressure water spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 2. Apply paint remover to dry, painted surface with trowel, spatula, or as recommended in writing by manufacturer.
 3. Apply cover in accordance with manufacturer's written instructions.
 4. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
 5. Scrape off paint and remover.
 6. Rinse with [cold][hot] water applied by [low][medium][high]-pressure spray to remove chemicals and paint residue.
 7. Apply acidic cleaner or manufacturer's recommended afterwash to surface, while surface is still wet, using low-pressure spray equipment or soft-fiber brush. Let cleaner or afterwash remain on surface as a neutralizing agent for period recommended in writing by chemical-cleaner or afterwash manufacturer.
 8. Rinse with cold water applied by [low][medium][high]-pressure spray to remove chemicals and soil.
- D. Paint Removal with Solvent-Type Paste Paint Remover: .
1. Remove loose and peeling paint using [low][medium][high]-pressure water spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
 2. Apply thick coating of paint remover to painted surface with natural-fiber cleaning brush, deep-nap roller, or large paint brush. Apply in one or two coats in accordance with manufacturer's written instructions.
 3. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.

4. Rinse with **[cold][hot]** water applied by **[low][medium][high]**-pressure spray to remove chemicals and paint residue.

E. Paint Removal with Covered, Solvent-Type Paste Paint Remover: .

1. Remove loose and peeling paint using **[low][medium][high]**-pressure water spray, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply paint remover to dry, painted surface with trowel, spatula, or as recommended in writing by manufacturer.
3. Apply cover in accordance with manufacturer's written instructions.
4. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
5. Scrape off paint and remover.
6. Rinse with **[cold][hot]** water applied by **[low][medium][high]**-pressure spray to remove chemicals and paint residue.

F. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

3.5 GENERAL APPLICATION OF CLEANING METHODS

A. Chemical Cleaning: Do not apply during winds of enough force to spread them to unprotected surfaces.

B. Cleaning Appearance Standard: Cleaned surfaces are to have a uniform appearance as viewed from **[20 ft. (6 m)][50 ft. (15 m)]**, as directed by the Owner.

C. Proceed with cleaning in an orderly manner; work from **[bottom to top][top to bottom]** of each scaffold width and from one end of each elevation to the other. Ensure that dirty residues and rinse water do not wash over dry, cleaned surfaces.

D. Use only those cleaning methods indicated for each masonry material and location.

1. Brushes: Do not use wire brushes or brushes that are not resistant to chemical cleaner being used.
2. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that cleaning methods do not damage surfaces, including joints.
 - a. Equip units with pressure gages.
 - b. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with nozzle having a cone-shaped spray.
 - c. For water-spray application, use fan-shaped spray that disperses water at an angle of 25 to 50 degrees.
 - d. For high-pressure water-spray application, use fan-shaped spray that disperses water at an angle of at least 40 degrees.
 - e. For heated water-spray application, use equipment capable of maintaining temperature between **140 and 160 deg F (60 and 71 deg C)** at flow rates indicated.
 - f. For steam application, use steam generator capable of delivering live steam at nozzle.

E. Poultices: Where needed, provide a paste or slurry made with absorbent material or powder-inert clay, such as kaolin or sepiolite, diatomaceous earth (fuller's earth), or cellulose products such as pulp cellulose or shredded paper that is mixed with a cleaning solution (a liquid reagent such as water, organic solvent, among others).

F. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces,

including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces. Keep wall wet below area being cleaned to prevent streaking from runoff.

- G. Perform additional general cleaning, paint and stain removal, and spot cleaning of small areas that are noticeably different when viewed in accordance with "Cleaning Appearance Standard" Paragraph, so that cleaned surfaces blend smoothly into surrounding areas.
- H. Remove minor stains (cuprous, ferrous, etc.) if any.
- I. Repeat cleaning procedure above where required to produce cleaning effect established by mockup.

3.6 WATER-CLEANING TYPE

A. Water Application Methods:

- 1. Water-Soak Application: Soak masonry surfaces by applying water continuously and uniformly to limited area for time indicated. Apply water at low pressures and low volumes in multiple fine sprays using perforated hoses or multiple spray nozzles. Erect a protective enclosure constructed of polyethylene sheeting to cover area being sprayed.
- 2. Water-Spray Applications: Unless otherwise indicated, hold spray nozzle at least **6 inches (150 mm)** from masonry surface and apply water in horizontal back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.

B. Cold-Water Soak:

- 1. Apply cold water by intermittent spraying to keep surface moist.
- 2. Use perforated hoses or other means that apply a fine water mist to entire surface being cleaned.
- 3. Apply water in cycles of **[five minutes]** on and **[20 minutes]** off.
- 4. Continue spraying **[until surface encrustation has softened enough to permit its removal by water wash, as indicated by cleaning tests][for 72 hours]**.
- 5. Remove soil and softened surface encrustation from surface with cold water applied by low-pressure spray.

C. Cold-Water Wash: Use cold water applied by **[low][medium][high]**-pressure spray.

D. Hot-Water Wash: Use hot water applied by **[low][medium][high]**-pressure spray.

E. Steam Cleaning: Apply steam at very low pressures not exceeding **[30 psi (207 kPa)][80 psi (550 kPa)]**. Remove dirt softened by steam with wood scrapers, stiff-nylon or -fiber brushes, or cold-water wash, as indicated by cleaning tests.

3.7 CHEMICAL-CLEANING TYPE

A. Chemical-Cleaner Application Methods: Apply chemical cleaners to masonry surfaces in accordance with chemical-cleaner manufacturer's written instructions; use brush **[or spray]** application. **[Do not spray apply at pressures exceeding 50 psi (345 kPa).]** Do not allow chemicals to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.

- 1. Consult with cleaning product manufacturer to verify what products require pre-wetting of substrate before cleaner application.

B. Dilute chemical cleaners with water when required to produce solutions not exceeding concentration recommended in writing by chemical-cleaner manufacturer.

- C. Rinse off chemical residue and soil by working upward from bottom to top of each treated area at each stage or scaffold setting. Periodically during each rinse, test pH of rinse water running off of cleaned area to determine that chemical cleaner is completely removed.
1. Apply neutralizing agent and repeat rinse if necessary to produce tested pH of between 6.7 and 7.5.
- D. After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.
- E. Detergent Cleaning:
1. Wet surface with **[cold][hot]** water applied by low-pressure spray.
 2. Scrub surface with detergent solution using medium-soft brushes until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from mortar joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet.
 3. Rinse with **[cold][hot]** water applied by **[low][medium][high]**-pressure spray to remove detergent solution and soil.
- F. Nonacidic Gel Chemical Cleaning:
1. Wet surface with **[cold][hot]** water applied by low-pressure spray.
 2. Apply gel cleaner in **1/8-inch (3-mm)** thickness by brush, working into joints and crevices. Apply quickly and do not brush out excessively, so area is uniformly covered with fresh cleaner and dwell time is uniform throughout area being cleaned.
 3. Let cleaner remain on surface for period **[recommended in writing by chemical-cleaner manufacturer][established by mockup]**.
 4. Remove bulk of gel cleaner.
 5. Rinse with **[cold][hot]** water applied by **[low][medium][high]**-pressure spray to remove chemicals and soil.
 6. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
- G. Nonacidic Liquid Chemical Cleaning:
1. Wet surface with **[cold][hot]** water applied by low-pressure spray.
 2. Apply cleaner to surface **[in two applications]** by brush **[or low-pressure spray]**.
 3. Let cleaner remain on surface for period **[recommended in writing by chemical-cleaner manufacturer][established by mockup][of 2 to 3 minutes]**.
 4. Rinse with **[cold][hot]** water applied by **[low][medium][high]**-pressure spray to remove chemicals and soil.
 5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.
- H. Mild-Acid Chemical Cleaning:
1. Wet surface with cold water applied by low-pressure spray.
 2. Apply cleaner to surface **[in two applications]** by brush **[or low-pressure spray]**.
 3. Let cleaner remain on surface for period **[recommended in writing by chemical-cleaner manufacturer][established by mockup][of 2 to 3 minutes]**.
 4. Rinse with cold water applied by **[low][medium][high]**-pressure spray to remove chemicals and soil.
 5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

I. Acidic Chemical Cleaning:

1. Wet surface with cold water applied by low-pressure spray.
2. Apply cleaner to surface [**in two applications**] by brush [**or low-pressure spray**].
3. Let cleaner remain on surface for period [**recommended in writing by chemical-cleaner manufacturer**] [**established by mockup**] [**of 2 to 3 minutes**].
4. Rinse with cold water applied by [**low**] [**medium**] [**high**] -pressure spray to remove chemicals and soil. Rinse until all foaming, if any, stops and suds disappear.
5. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once. If additional cleaning is required, use steam cleaning.

J. One-Part Limestone Chemical Cleaning:

1. Wet surface with [**cold**] [**hot**] water applied by low-pressure spray.
2. Apply cleaner to surface by brush [**or low-pressure spray**].
3. Let cleaner remain on surface for period [**recommended in writing by chemical-cleaner manufacturer**] [**established by mockup**].
4. Immediately repeat application of one-part limestone cleaner as indicated above over the same area.
5. Rinse with [**cold**] [**hot**] water applied by medium-pressure spray to remove chemicals and soil.

K. Two-Part Chemical Cleaning: .

1. Wet surface with [**cold**] [**hot**] water applied by low-pressure spray.
2. Apply alkaline prewash cleaner to surface by brush or roller.
3. Let cleaner remain on surface for period recommended in writing by chemical-cleaner manufacturer unless otherwise indicated.
4. Rinse with [**cold**] [**hot**] water applied by medium-pressure spray to remove chemicals and soil.
5. Apply acidic afterwash cleaner to surface [**in two applications**], while surface is still wet, using [**low-pressure spray equipment**], deep-nap roller or soft-fiber brush. Let neutralizer remain on surface for period recommended in writing by manufacturer unless otherwise indicated.
6. Rinse with cold water applied by medium-pressure spray to remove chemicals and soil. [**Rinse until surface reaction value is between pH 5 and pH 9 according to pH-measuring paper, pen, or indicator solution.**]
7. Repeat cleaning procedure above where required to produce cleaning effect established by mockup. Do not repeat more than once.

3.8 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage [**paint-remover manufacturer's and**] chemical-cleaner manufacturer's factory-authorized service representatives for consultation and Project-site inspection, to perform preconstruction product testing, and provide on-site assistance as directed by the Owner. Have [**paint-remover manufacturer's and**] chemical-cleaner manufacturer's factory-authorized service representatives visit Project site not less than [**once**] [**twice**] to observing progress and quality of the work.

3.9 FINAL CLEANING

- A. Clean adjacent nonmasonry surfaces of spillage and debris. Use detergent and soft brushes or cloths.
- B. Remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
- C. Remove masking materials, leaving no residues that could trap dirt.



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- D. Clean landscaping areas of debris.

3.10 PROTECTION

- A. Provide final protection and maintain conditions in a manner as directed by the Owner, which ensures cleaning Work without being soiled at time of substantial completion.

END OF SECTION 04 01 00 00



Task	Specification	Specification Description
04 01 20 00	04 01 00 00	Masonry Cleaning
04 01 20 41	04 01 00 00	Masonry Cleaning



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SECTION 04 01 20 51 - BRICK MASONRY REPAIR

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Masonry materials.
2. Mortar materials.
3. Manufactured repair materials.

B. Related Requirements:

1. Section 013516 "Alteration Project Procedures" for general remodeling, renovation, repair, and maintenance requirements.
2. Section 040110 "Masonry Cleaning" for cleaning and paint removal existing masonry.
3. Section 040120.64 "Brick Masonry Repointing" for repointing existing brickwork.
4. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and sealant-joint preparation for repaired masonry.

1.2 DEFINITIONS

- A. Existing to Remain: Existing items of construction that are not to be removed.
- B. Low-Pressure Spray: [100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s)].
- C. Remove: Detach items from existing construction and legally dispose of off-site unless indicated to be removed and salvaged or removed and reinstalled.
- D. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to the Owner or storage, as directed by the Owner.
- E. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage; prepare for reuse; and reinstall where indicated.
- F. Rebuilding (Setting) Mortar: Mortar used to set and anchor masonry in a structure, distinct from pointing mortar installed after masonry is set in place.
- G. Saturation Coefficient: Ratio of the weight of water absorbed during immersion in cold water to weight absorbed during immersion in boiling water; used as an indication of resistance of bricks to freezing and thawing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [Project site].

1. Review methods and procedures related to brick masonry repair including, but not limited to, the following:

- a. Verify brick masonry repair specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
- b. Materials, material application, sequencing, tolerances, and required clearances.
- c. Cleaning types and cleaning methods.
- d. Quality-control program.
- e. Review cleaning program.
- f. Coordination with building occupants.
- g. Protection and barriers for the public.

1.4 SEQUENCING AND SCHEDULING

- A. Order sand[**and gray portland cement**] for colored mortar immediately after approval of [Samples][mockups]. Take delivery of and store at Project site enough quantity to complete Project.
- B. Work Sequence: Perform brick masonry repair work in the following sequence, which includes work specified in this and other Sections:
 1. Remove plant growth.
 2. Inspect masonry for open mortar joints and point them before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
 3. Remove paint.
 4. Clean masonry.
 5. Rake out mortar from joints surrounding masonry to be replaced and from joints adjacent to masonry repairs along joints.
 6. Repair masonry, including replacing existing masonry with new masonry materials.
 7. Rake out mortar from joints to be repointed.
 8. Point mortar and sealant joints.
 9. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.
 10. Where water repellents are to be used on or near masonry work, delay application of these chemicals until after pointing and cleaning.
- C. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in bricks in accordance with "Brick Masonry Patching" Article. Patch holes in mortar joints according to Section 040120.64 "Brick Masonry Repointing."

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 2. Include recommendations for product application and use.
 3. Include test data substantiating that products comply with requirements.
- B. Shop Drawings:
 1. Include plans, elevations, sections, and locations of replacement bricks on the structure, showing relation of existing and new or relocated units.
 2. Show provisions for expansion joints or other sealant joints.
 3. Show provisions for flashing, lighting fixtures, conduits, and weep holes as required.
 4. Show locations of scaffolding and points of scaffolding in contact with masonry. Include details of

each point of contact or anchorage.

C. Samples for Initial Selection: For the following:

1. Colored Mortar: Submit sets of mortar that will be left exposed in the form of sample mortar strips, **6 inches (150 mm)** long by **[1/4 inch (6 mm)][1/2 inch (13 mm)]** wide, set in aluminum or plastic channels.
 - a. Have each set contain a close color range of at least **[three][six]** Samples of different mixes of colored sands and cements that produce a mortar matching existing, cleaned mortar when cured and dry.
 - b. Submit with precise measurements on ingredients, proportions, gradations, and source of colored sands from which each Sample was made.
2. Sand Types Used for Mortar: Minimum **8 oz. (240 mL)** of each in plastic screw-top jars.
3. Patching Compound: Submit sets of patching compound Samples in the form of plugs (patches in drilled holes) in sample units of masonry representative of the range of masonry colors on the building.
 - a. Have each set contain a close color range of at least **[three][six]** Samples of different mixes of patching compound that matches the variations in existing masonry when cured and dry.
4. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For the following:

1. Each type of brick unit to be used for replacing existing units. Include sets of Samples to show the full range of shape, color, and texture to be expected. For each brick type, provide straps or panels containing at least four bricks. Include multiple straps for brick with a wide range.
2. Each type of patching compound in the form of briquettes, at least **3 inches (75 mm)** long by **1-1/2 inches (38 mm)** wide. Document each Sample with manufacturer and stock number or other information necessary to order additional material.
3. Accessories: Each type of accessory and miscellaneous support.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[brick masonry repair specialist][including field supervisors and workers][and][testing service]**.
- B. Preconstruction Test Reports: For **[existing bricks and mortar][and][replacement bricks]**.
- C. Quality-control program.

1.7 QUALITY ASSURANCE

- A. Brick Masonry Repair Specialist Qualifications: Engage an experienced brick masonry repair firm to perform Work of this Section. Firm is to have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing masonry is insufficient experience for masonry repair work.
 1. Field Supervision: Brick masonry repair specialist firm is to maintain experienced full-time supervisors on Project site during times that brick masonry repair work is in progress.

2. Brick Masonry Repair Workers: When bricks are being patched, at least one worker per crew should be trained and certified by manufacturer of patching compound to apply its products performing the work of brick repairs.

- B. Brick-Cleaning Specialist Firms: A firm that provides masonry cleaning, including masonry cleaners that have been used for similar applications with successful results, and is manufacturer authorized for consultation and Project-site inspection, preconstruction product testing, and on-site assistance.
- C. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage.

1.8 MOCKUPS

- A. Prepare mockups of brick masonry repair to demonstrate aesthetic effects and to set quality standards for materials and execution, and for fabrication and installation, as directed by the Owner.
 1. Masonry Repair: Prepare sample areas for each type of masonry repair work performed. If not otherwise indicated, size each mockup not smaller than two adjacent whole units or approximately **48 inches (1200 mm)** in least dimension. Construct sample areas in locations in existing walls, as directed by the Owner. Demonstrate quality of materials, workmanship, and blending with existing work. Include the following as a minimum:
 - a. Replacement: **[Four]** brick units replaced.
 - b. Patching: Three small holes **[at least 1 inch (25 mm) in diameter]****[as directed]** for each type of brick indicated to be patched.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, as directed by the Owner.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: **[the Owner will engage]****[Engage]** a qualified testing agency to perform preconstruction testing on brick masonry as follows:
 1. Provide test specimens as indicated and representative of proposed materials and existing construction.
 2. Replacement Brick: Test each proposed type of replacement brick in accordance with sampling and testing methods in ASTM C67/C67M for compressive strength, 24-hour cold-water absorption, five-hour boil absorption, saturation coefficient, and initial rate of absorption (suction).
 3. Existing Brick: Test each type of existing brick indicated for replacement in accordance with testing methods in ASTM C67/67M for compressive strength, 24-hour cold-water absorption, five-hour boil absorption, saturation coefficient, and initial rate of absorption (suction). Carefully remove **[five]** existing units from locations, as directed by the Owner. Take testing samples from these units.
 4. Existing Mortar: Test in accordance with ASTM C1324, modified as directed by the Owner, to determine proportional composition of original ingredients, sizes and colors of aggregates, and approximate strength.
 5. Temporary Patch: As directed by the Owner, provide temporary materials followed by permanent repairs at locations from which existing samples were taken.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver bricks to Project site strapped together in suitable packs or pallets or in heavy-duty cartons and protected against impact and chipping.
- B. Deliver packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
- E. Store sand where grading and other required characteristics can be maintained and contamination avoided.
- F. Handle bricks to prevent overstressing, chipping, defacement, and other damage.

1.11 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit brick masonry repair work to be performed in accordance with product manufacturers' written instructions and specified requirements.
- B. Temperature Limits: Repair brick masonry only when air temperature is between **40 and 90 deg F (4 and 32 deg C)** and is predicted to remain so for at least seven days after completion of the Work unless otherwise indicated.
- C. Cold-Weather Requirements: Comply with the following procedures for masonry repair unless otherwise indicated:
 - 1. When air temperature is below **40 deg F (4 deg C)**, heat mortar ingredients, masonry repair materials, and existing masonry walls to produce temperatures between **40 and 120 deg F (4 and 49 deg C)**.
 - 2. When mean daily air temperature is below **40 deg F (4 deg C)**, provide enclosure and heat to maintain temperatures above **32 deg F (0 deg C)** within the enclosure for seven days after repair.
- D. Hot-Weather Requirements: Protect masonry repairs when temperature and humidity conditions produce excessive evaporation of water from mortar and repair materials. Provide artificial shade and wind breaks, and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of **90 deg F (32 deg C)** and above unless otherwise indicated.
- E. For manufactured repair materials, perform work within the environmental limits set by each manufacturer.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain **[brick units][cementitious mortar components][and][sand]** from single **[source][producer][or][manufacturer]**.

- B. For **[exposed masonry units][and][cementitious mortar components]**, obtain each color and grade from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]**.

2.3 MASONRY MATERIALS

- A. Masonry Materials: Face brick, required to complete brick masonry repair work.
 - 1. Brick Matching Existing: Units with colors, color variation within units, surface texture, size, and shape that match existing brickwork and with physical properties **[within 10 percent of those determined from preconstruction testing of selected existing units.][as listed below:]**
 - a. Physical Properties: In accordance with ASTM C67/C67M.
 - b. For existing brickwork that exhibits a range of colors or color variation within units, provide brick that proportionally matches that range and variation rather than brick that matches an individual color within that range.
 - 2. Brick Matching Architect's Sample: Units with colors, color variation within units, surface texture, and physical properties that match Architect's sample. Match existing units in size and shape, as directed by the Owner.
 - a. Physical Properties: In accordance with ASTM C67C67M.
 - b. For Architect's sample that exhibits a range of colors or color variation within units, provide brick that proportionally matches that range rather than brick that matches an individual color within that range.
 - 3. Special Shapes:
 - a. Provide molded, 100 percent solid shapes for applications where core holes or "frogs" could be exposed to view or weather when in final position and where shapes produced by sawing would result in sawed surfaces being exposed to view.
 - b. Provide specially ground units, shaped to match patterns, for arches and where indicated.
 - c. Mechanical chopping or breaking brick, or bonding pieces of brick together by adhesive, are unacceptable procedures for fabricating special shapes.
 - 4. Tolerances as Fabricated: **[In accordance with tolerance requirements in ASTM C216, Type FBX][In accordance with tolerance requirements in ASTM C216, Type FBS]**.
- B. Building Brick: ASTM C62, of same vertical dimension as face brick, for masonry work concealed from view.
 - 1. Grade SW where in contact with earth.
 - 2. **[Grade SW or Grace MW][Grade SW, Grade MW, or Grade NW]** for concealed backup.

2.4 MORTAR MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or Type II, except Type III may be used for cold-weather construction; white[**or gray, or both**] where required for color matching of mortar.
 - 1. Provide cement containing not more than 0.60 percent total alkali when tested in accordance with ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Masonry Cement: ASTM C91/C91M.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Cemex S.A.B. de C.V.]**
 - b. **[Heidelberg Materials]**
 - c. **[Holcim (US) Inc]**
 - d. **[Quikrete; The QUIKRETE Companies, LLC]**
- D. Mortar Cement: ASTM C1329/C1329M.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Holcim (US) Inc]**
- E. Mortar Sand: ASTM C144.
 - 1. Exposed Mortar: Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
 - 2. Colored Mortar: Natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
- F. Mortar Pigments: ASTM C979/C979M, compounded for use in mortar mixes, and having a record of satisfactory performance in masonry mortars.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Davis Colors]**
 - b. **[Lanxess Corporation]**
 - c. **[Solomon Colors Inc.]**
- G. Water: Potable.

2.5 MANUFACTURED REPAIR MATERIALS

- A. Brick Patching Compound: Factory-mixed cementitious product that is custom manufactured for patching brick masonry.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Cathedral Stone Products, Inc.]**
 - b. **[Conproco Corporation]**
 - c. **[Edison Coatings, Inc.]**
 2. Use formulation that is vapor and water permeable (equal to or more than the brick), exhibits low shrinkage, has lower modulus of elasticity than bricks being repaired, and develops high bond strength to all types of masonry.
 3. Use formulation having working qualities and retardation control to permit forming and sculpturing where necessary.
 4. Formulate patching compound in colors and textures to match each brick being patched. Provide **[sufficient number of][no fewer than three]** colors to enable matching of the color, texture, and variation of each unit.

2.6 ACCESSORY MATERIALS

- A. Setting Buttons and Shims: Resilient plastic, nonstaining to masonry, sized to suit joint thicknesses and bed depths of bricks, less the required depth of pointing materials unless removed before pointing.
- B. Masking Tape: Nonstaining, nonabsorbent material; compatible with mortar, joint primers, sealants, and surfaces adjacent to joints; and that easily comes off entirely, including adhesive.
- C. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer in accordance with **[MPI #23 (surface-tolerant, anticorrosive metal primer)][or][SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating]**.
1. Surface Preparation: Use coating requiring no better than **[SSPC-SP 2, "Hand Tool Cleaning"]****[SSPC-SP 3, "Power Tool Cleaning"]****[or][SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning"]** surface preparation in accordance with manufacturer's literature or certified statement.
 2. VOC Limit: Use coating with a VOC content of **[400 g/L (3.3 lb/gal.)]** or less.
- D. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:
1. Previous effectiveness in performing the work involved.
 2. Minimal possibility of damaging exposed surfaces.
 3. Consistency of each application.
 4. Uniformity of the resulting overall appearance.
 5. Do not use products or tools that could leave residue on surfaces.

2.7 MORTAR MIXES

- A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
- B. Colored Mortar: Produce mortar of color required by using specified ingredients, as directed by the Owner.
 - 1. Mortar Pigments: Where mortar pigments are indicated, do not add pigment exceeding 10 percent by weight of the cementitious or binder materials, except for carbon black which is limited to 2 percent, unless otherwise demonstrated by a satisfactory history of performance.
- C. Do not use admixtures in mortar unless otherwise indicated.
- D. Mixes: Mix mortar materials in the following proportions:
 - 1. Rebuilding (Setting) Mortar by Volume: ASTM C270, Proportion Specification, [**1 part portland cement, 1 part lime, and 6 parts sand**].
 - 2. Rebuilding (Setting) Mortar by Type: ASTM C270, Proportion Specification, [**Type N**] unless otherwise indicated; with cementitious material limited to [**portland cement and lime**][**masonry cement**][**or**][**mortar cement**].
 - 3. Rebuilding (Setting) Mortar by Property: ASTM C270, Property Specification, [**Type N**] unless otherwise indicated; with cementitious material limited to [**portland cement and lime**][**masonry cement**][**or**][**mortar cement**].
 - 4. Pigmented, Colored Mortar: Add mortar pigments to produce exposed, setting (rebuilding) mortar of colors required.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate conditions with specialist present, for compliance with approved mockup requirements for brick units, repair methods, products, and other conditions affecting performance of the Work.

3.2 PREPARATION

- A. General: Comply with each manufacturer's written instructions for protecting people, motor vehicles, surrounding buildings, masonry areas not to be cleaned, nonmasonry surfaces, landscaping, equipment, and other surfaces that could be injured or harmed by such Work.
 - 1. Provide temporary protective covers over pedestrian walkway areas and at points of entrance and exit for people, motor vehicles, and equipment that must remain during duration of repairing procedures.
 - 2. Cover adjacent surfaces with materials that are proven to resist paint removers and chemical cleaners used unless products being used will not damage adjacent surfaces. Use protective materials that are waterproof and UV resistant.
 - 3. Temporarily protect all open joints to prevent intrusion of washing waters into the wall structure or building interior.
 - 4. Remove all extraneous items no longer in use on face of surface unless indicated to remain, as directed by the Owner.

3.3 PROTECTION

- A. Prevent mortar from staining face of surrounding masonry and other surfaces.
 - 1. Cover sills, ledges, and other projecting items to protect them from mortar droppings.
 - 2. Keep wall area wet below rebuilding and repair work to discourage mortar from adhering.
 - 3. Immediately remove mortar splatters in contact with exposed masonry and other surfaces.

3.4 MASONRY REPAIR, GENERAL

- A. Appearance Standard: Repaired surfaces are to have a uniform appearance as viewed from [20 ft. (6 m)][50 ft. (15 m)] away, as directed by the Owner.

3.5 ABANDONED ANCHOR REMOVAL

- A. Remove abandoned anchors, brackets, wood nailers, and other extraneous items [**no longer in use unless indicated to remain**][**indicated to be removed**].
 - 1. Remove items carefully to avoid spalling or cracking masonry.
 - 2. If an item cannot be removed without damaging surrounding masonry, review, as directed by the Owner. Do the following where directed:
 - a. Cut or grind off item approximately [3/4 inch (20 mm)] beneath surface and core drill a recess of same depth in surrounding masonry as close around item as practical.
 - b. Immediately paint exposed end of item with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended dry film thickness per coat. Keep paint off sides of recess.
 - 3. Patch hole where each item was removed unless directed to remove and replace bricks.

3.6 BRICK REMOVAL AND REPLACEMENT

- A. At locations indicated, remove bricks that are damaged, spalled, or deteriorated[**or are to be reused**]. Carefully remove entire units from joint to joint, without damaging surrounding masonry, in a manner that permits replacement with full-size units.
 - 1. When removing single bricks, remove material from center of brick and work toward outside edges.
- B. Support and protect remaining masonry that surrounds removal area.
- C. Maintain flashing, reinforcement, lintels, and adjoining construction in an undamaged condition.[**Coordinate with new flashing, reinforcement, and lintels, which are specified in other Sections.**]
- D. Notify the Owner of unforeseen detrimental conditions, including voids, cracks, bulges, and loose units in existing masonry backup, rotted wood, rusted metal, and other deteriorated items.
- E. Remove in an undamaged condition as many whole bricks as possible.
 - 1. Remove mortar, loose particles, and soil from brick by cleaning with hand chisels, brushes, and water.

2. Remove sealants by cutting close to brick with utility knife and cleaning with solvents.
 3. Store brick for reuse. Store off ground, on skids, and protected from weather.
 4. Deliver cleaned brick not required for reuse to the Owner, as directed by the Owner.
- F. Clean masonry surrounding removal areas by removing mortar, dust, and loose particles in preparation for brick replacement.
- G. Replace removed damaged brick with other removed brick in good condition, where possible, **[or with new brick]** matching existing brick. Do not use broken units unless they can be cut to usable size.
- H. Install replacement brick into bonding and coursing pattern of existing brick. If cutting is required, use a motor-driven saw designed to cut masonry with clean, sharp, unchipped edges.
1. Maintain joint width for replacement units to match existing joints.
 2. Use setting buttons or shims to set units accurately spaced with uniform joints.
- I. Lay replacement brick with rebuilding (setting) mortar and with completely filled bed, head, and collar joints. Butter ends with enough mortar to fill head joints and shove into place. Wet both replacement and surrounding bricks that have ASTM C67/C67M initial rates of absorption (suction) of more than **30 g/30 sq. in. per min. (30 g/194 sq. cm per min.)** Use wetting methods that ensure that units are nearly saturated but surface is dry when laid.
1. Tool exposed mortar joints in repaired areas to match joints of surrounding existing brickwork.
 2. Rake out mortar used for laying brick before mortar sets in accordance with Section 040120.64 "Brick Masonry Repointing." Point at same time as repointing of surrounding area.
 3. When mortar is hard enough to support units, remove shims and other devices interfering with pointing of joints.
- J. Curing: Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.
1. Hairline cracking within the mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

3.7 PAINTING STEEL UNCOVERED DURING THE WORK

- A. Notify the Owner if steel is exposed during masonry removal. Where Architect determines that steel is structural, or for other reasons cannot be totally removed, prepare and paint it as follows:
1. Surface Preparation: Remove paint, rust, and other contaminants in accordance with **[SSPC-SP 2, "Hand Tool Cleaning"]****[SSPC-SP 3, "Power Tool Cleaning"]****[or]****[SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning"]**, as applicable to comply with paint manufacturer's recommended preparation.
 2. Antirust Coating: Immediately paint exposed steel with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended rate of application (dry film thickness per coat).
- B. If on inspection and rust removal, the thickness of a steel member is found to be reduced from rust by more than **[1/16 inch (1.6 mm)]**, notify the Owner before proceeding.

3.8 BRICK MASONRY PATCHING

- A. Patch the following bricks unless another type of repair or replacement is indicated:

1. Bricks indicated to be patched.
2. Bricks with holes.
3. Bricks with chipped edges or corners.[**Patch chipped edges or corners measuring more than 3/4 inch (19 mm) in least dimension.**]
4. Bricks with small areas of deep deterioration.[**Patch deep deteriorations measuring more than 3/4 inch (19 mm) in least dimension and more than 1/4 inch (6 mm) deep.**]

B. Remove and replace existing patches [**where indicated**][**unless otherwise indicated or as directed by the Owner**].

C. Patching Bricks:

1. Remove loose material from masonry surface. Carefully remove additional material so patch does not have feathered edges but has square or slightly undercut edges on area to be patched and is at least [**1/4 inch (6 mm)**] thick, but not less than recommended in writing by patching compound manufacturer.
2. Mask adjacent mortar joint or rake out for repointing if patch extends to edge of brick.
3. Mix patching compound in individual batches to match each unit being patched. Combine one or more colors of patching compound, as needed, to produce exact match.
4. Rinse surface to be patched and leave damp, but without standing water.
5. Brush-coat surfaces with slurry coat of patching compound in accordance with manufacturer's written instructions.
6. Place patching compound in layers as recommended in writing by patching compound manufacturer, but not less than **1/4 inch (6 mm)** or more than **2 inches (50 mm)** thick. Roughen surface of each layer to provide a key for next layer.
7. Trowel, scrape, or carve surface of patch to match texture and surrounding surface plane or contour of brick. Shape and finish surface before or after curing, as determined by testing, to best match existing brick.
8. Keep each layer damp for 72 hours or until patching compound has set.
9. Remove and replace patches with hairline cracks or that show separation from brick at edges, and those that do not match adjoining brick in color or texture.

3.9 FINAL CLEANING

A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water applied by low-pressure spray.

1. Do not use metal scrapers or brushes.
2. Do not use acidic or alkaline cleaners.

B. Clean adjacent nonmasonry surfaces. Use detergent and soft brushes or cloths.

C. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.

D. Remove masking materials, leaving no residues that could trap dirt.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: The Owner will engage a qualified testing agency to perform tests and inspections, as directed by the Owner. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.

- B. Architect's Project Representatives: Architect will assign Project representatives to help carry out Architect's responsibilities at the site, including observing progress and quality of portion of the Work completed. Allow Architect's Project representatives use of lift devices and scaffolding, as needed, to observe progress and quality of portion of the Work completed, as directed by the Owner.
- C. Notify **[inspectors][and][the Owner]** in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until **[inspectors][and][the Owner]** have had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.

3.11 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property.
- B. Masonry Waste: Remove masonry waste and legally dispose of off the Owner property, as directed by the Owner.

END OF SECTION 04 01 20 51

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Task	Specification	Specification Description
04 01 20 51	03 01 30 00	Maintenance of Cast-in-Place Concrete
04 01 20 51	04 01 00 00	Masonry Cleaning
04 01 20 52	04 01 00 00	Masonry Cleaning



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SECTION 04 01 20 91 - BRICK MASONRY REPOINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mortar materials.
2. Mortar mixes.

B. Related Requirements:

1. Section 012100 "Allowances" for brick repointing allowances.
2. Section 012200 "Unit Prices" for brick repointing unit prices. Indicate the percentage, if any, by which actual quantities may deviate upward or downward from estimated quantities before the unit price may be adjusted by a change order.
3. Section 040110 "Masonry Cleaning" for cleaning and paint removal from both clay masonry and stone.

1.2 DEFINITIONS

- A. Low-Pressure Spray: [100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s)] <Insert range of values>.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at [Project site] <Insert location>.

1. Review methods and procedures related to repointing brick masonry including, but not limited to, the following:
 - a. Verify brick masonry repointing specialist's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Materials, material application, sequencing, tolerances, and required clearances.
 - c. Quality-control program.
 - d. Coordination with building occupants.
 - e. <Insert agenda items>.

1.4 SEQUENCING AND SCHEDULING

- A. Order sand[and gray portland cement] for pointing mortar immediately after approval of [Samples] [mockups]. Take delivery of and store at Project site enough quantity to complete Project.
- B. Work Sequence: Perform brick masonry repointing Work in the following sequence, which includes Work specified in this and other Sections:
1. Remove plant growth.

2. Inspect masonry for open mortar joints and permanently or temporarily point them before cleaning to prevent the intrusion of water and other cleaning materials into the wall.
 3. Remove paint.
 4. Clean masonry.
 5. Rake out mortar from joints surrounding masonry to be replaced and from joints adjacent to masonry repairs along joints.
 6. Repair masonry, including replacing existing masonry with new masonry materials.
 7. Rake out mortar from joints to be repointed.
 8. Point mortar and sealant joints.
 9. After repairs and repointing have been completed and cured, perform a final cleaning to remove residues from this work.
 10. Where water repellents are to be used on or near masonry work, delay application of these chemicals until after pointing and cleaning.
- C. As scaffolding is removed, patch anchor holes used to attach scaffolding. Patch holes in bricks in accordance with Section 040120.63 "Brick Masonry Repair." Patch holes in mortar joints in accordance with "Repointing" Article.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 2. Include recommendations for product application and use.
 3. Include test data substantiating that products comply with requirements.
- B. Shop Drawings:
1. Include plans, elevations, sections, and locations of repointing work on the structure.
 2. Show provisions for expansion joints or other sealant joints.
 3. Show locations of scaffolding and points of scaffolding in contact with masonry. Include details of each point of contact or anchorage.
- C. Samples for Initial Selection: For the following:
1. Pointing Mortar: Submit sets of mortar for pointing in the form of sample mortar strips, 6 inches (150 mm) long by **[1/4 inch (6 mm)] [1/2 inch (13 mm)]** wide, set in aluminum or plastic channels.
 - a. Have each set contain a close color range of at least **[three] [six] <Insert number>** Samples of different mixes of colored sands and cements that produce a mortar matching existing, cleaned mortar when cured and dry.
 - b. Submit with precise measurements on ingredients, proportions, gradations, and source of colored sands from which each Sample was made.
 2. Sand Type Used for Pointing Mortar: Minimum 8 oz. (240 mL) of each in plastic screw-top jars.
 3. Sealant materials.
 4. Include similar Samples of accessories involving color selection.
- D. Samples for Verification: For the following:

1. Each type, color, and texture of pointing mortar in the form of sample mortar strips, 6 inches (150 mm) long by **[1/4 inch (6 mm)] [1/2 inch (13 mm)]** wide, set in aluminum or plastic channels.
 - a. Include with each Sample a list of ingredients with proportions of each. Identify sources, both supplier and quarry, of each type of sand and brand names of cementitious materials and pigments if any.
2. Sealant materials.
3. Accessories: Each type of accessory and miscellaneous support.

1.6 INFORMATIONAL SUBMITTALS

- A. Preconstruction Test Reports: For existing bricks and mortar.
- B. Quality-control program.
- C. Qualification Statements: For **[brick masonry repointing specialist] [field supervisors and workers] [and] [testing service]**.

1.7 QUALITY ASSURANCE

- A. Brick Masonry Repointing Specialist Qualifications: Engage an experienced brick masonry repointing firm to perform work of this Section. Firm is to have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance. Experience in only installing masonry is insufficient experience for masonry repointing work.
 1. Field Supervision: Brick masonry repointing specialist firms are to maintain experienced full-time supervisors on Project site during times that brick masonry repointing work is in progress.
- B. Quality-Control Program: Prepare a written quality-control program for this Project to systematically demonstrate the ability of personnel to properly follow methods and use materials and tools without damaging masonry. Include provisions for supervising performance and preventing damage.

1.8 MOCKUPS

- A. Prepare mockups of brick masonry repointing to demonstrate aesthetic effects and to set quality standards for materials and execution.
 1. Repointing: Rake out joints in two separate areas, **each approximately 36 inches (900 mm) high by 48 inches (1200 mm) wide** **[as indicated on Drawings]** **<Insert dimensions>** for each type of repointing required, and repoint one of the areas.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: **[Owner will engage] [Engage]** a qualified testing agency to perform preconstruction testing on masonry units as follows:

1. Provide test specimens as indicated and representative of proposed materials and existing construction.
2. Existing Brick: Test each type of existing brick indicated for repointing in accordance with testing methods in ASTM C67/C67M for compressive strength, 24-hour cold-water absorption, five-hour boil absorption, saturation coefficient, and initial rate of absorption (suction). Carefully remove **[five]** <Insert number> existing units from locations designated by Architect. Take testing samples from these units.
3. Existing Mortar: Test in accordance with ASTM C1324, modified as agreed by testing service and Architect for Project requirements, to determine proportional composition of original ingredients, sizes and colors of aggregates, and approximate strength.
4. Temporary Patch: As directed by Architect, provide temporary materials followed by permanent repairs at locations from which existing samples were taken.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver packaged materials to Project site in manufacturer's original and unopened containers, labeled with manufacturer's name and type of products.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store hydrated lime in manufacturer's original and unopened containers. Discard lime if containers have been damaged or have been opened for more than two days.
- D. Store sand where grading and other required characteristics can be maintained and contamination avoided.

1.11 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit repointing work to be performed in accordance with product manufacturers' written instructions and specified requirements.
- B. Temperature Limits: Repoint mortar joints only when air temperature is between 40 and 90 deg F (4 and 32 deg C) and is predicted to remain so for at least seven days after completion of the Work unless otherwise indicated.
- C. Cold-Weather Requirements: Comply with the following procedures for mortar-joint pointing unless otherwise indicated:
 1. When air temperature is below 40 deg F (4 deg C), heat mortar ingredients and existing masonry walls to produce temperatures between 40 and 120 deg F (4 and 49 deg C).
 2. When mean daily air temperature is below 40 deg F (4 deg C), provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for seven days after pointing.
- D. Hot-Weather Requirements: Protect mortar-joint pointing when temperature and humidity conditions produce excessive evaporation of water from mortar materials. Provide artificial shade and wind breaks, and use cooled materials as required to minimize evaporation. Do not apply mortar to substrates with temperatures of 90 deg F (32 deg C) and above unless otherwise indicated.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of material for repointing brick masonry (cement, sand, etc.) from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 MORTAR MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or Type II, except Type III may be used for cold-weather construction; white[**or gray, or both**] where required for color matching of mortar.
 - 1. Provide cement containing not more than 0.60 percent total alkali when tested in accordance with ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Masonry Cement: ASTM C91/C91M.
 - 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- D. Mortar Cement: ASTM C1329/C1329M.
 - 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- E. Mortar Sand: ASTM C144.
 - 1. Match size, texture, and gradation of existing mortar sand as closely as possible. Blend several sands if necessary to achieve suitable match.
 - 2. Color: Natural sand or ground marble, granite, or other sound stone of color necessary to produce required mortar color.
- F. Mortar Pigments: ASTM C979/C979M, compounded for use in mortar mixes, and having a record of satisfactory performance in masonry mortars.
 - 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- G. Water: Potable.

2.3 MORTAR MIXES

- A. Measurement and Mixing: Measure cementitious materials and sand in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean, mechanical batch mixer.
 - 1. Mixing Pointing Mortar: Thoroughly mix cementitious materials and sand together before adding any water. Then mix again, adding only enough water to produce a damp, unworkable mix that retains its form when pressed into a ball. Maintain mortar in this dampened condition for 15 to 30 minutes. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within one hour of final mixing; do not retemper or use partially hardened material.

- B. Colored Mortar: Produce mortar of color required by using specified ingredients. Do not alter specified proportions without Architect's written approval.
 - 1. Mortar Pigments: Where mortar pigments are indicated, do not add pigment exceeding 10 percent by weight of the cementitious or binder materials, except for carbon black which is limited to 2 percent, unless otherwise demonstrated by a satisfactory history of performance.
- C. Do not use admixtures in mortar unless otherwise indicated.
- D. Mixes: Mix mortar materials in the following proportions:
 - 1. Pointing Mortar by Volume: ASTM C270, Proportion Specification, **[1 part portland cement, 1 part lime, and 6 parts sand]** <Insert proportions>.[**Add mortar pigments to produce mortar colors required.**]
 - 2. Pointing Mortar by Type: ASTM C270, Proportion Specification, **[Type N]** <Insert Type> unless otherwise indicated; with cementitious material limited to **[portland cement and lime]** **[masonry cement]** **[or]** **[mortar cement]**.[**Add mortar pigments to produce mortar colors required.**]
 - 3. Pointing Mortar by Property: ASTM C270, Property Specification, **[Type N]** <Insert Type> unless otherwise indicated; with cementitious material limited to **[portland cement and lime]** **[masonry cement]** **[or]** **[mortar cement]**.[**Add mortar pigments to produce mortar colors required.**]

2.4 ACCESSORY MATERIALS

- A. Sealant Materials:
 - 1. Sealant manufacturer's standard elastomeric sealant(s) of base polymer and characteristics in accordance with applicable requirements in Section 079200 "Joint Sealants."
- B. Masking Tape: Nonstaining, nonabsorbent material; compatible with mortar, joint primers, sealants, and surfaces adjacent to joints; and that easily comes off entirely, including adhesive.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Prevent mortar from staining face of surrounding masonry and other surfaces.
 - 1. Cover sills, ledges, and other projecting items to protect them from mortar droppings.
 - 2. Keep wall area wet below pointing work to discourage mortar from adhering.
 - 3. Immediately remove mortar splatters in contact with exposed masonry and other surfaces.
- B. Remove[**gutters and**] downspouts and associated hardware adjacent to masonry and store during masonry repointing. Reinstall when repointing is complete.
 - 1. Provide temporary rain drainage during work to direct water away from building.

3.2 MASONRY REPOINTING, GENERAL

- A. Appearance Standard: Repointed surfaces are to have a uniform appearance as viewed from **[20 ft. (6 m)] [50 ft. (15 m)]** <Insert distance> away by Architect.

3.3 REPOINTING

- A. Rake out and repoint joints to the following extent:
1. All joints in areas indicated.
 2. Joints indicated as sealant-filled joints.
 3. Joints at locations of the following defects:
 - a. Holes and missing mortar.
 - b. Cracks that can be penetrated 1/4 inch (6 mm) or more by a knife blade 0.027 inch (0.7 mm) thick.
 - c. Cracks **[1/16 inch (1.6 mm)] [1/8 inch (3 mm)] <Insert dimension>** or more in width and of any depth.
 - d. Hollow-sounding joints when tapped by metal object.
 - e. Eroded surfaces 1/4 inch (6 mm) deep or deeper.
 - f. Deterioration to point that mortar can be easily removed by hand, without tools.
 - g. Joints filled with substances other than mortar.
- B. Do not rake out and repoint joints where not required.
- C. Rake out joints as follows, in accordance with procedures demonstrated in approved mockup:
1. Remove mortar from joints to depth of **[joint width plus 1/8 inch (3 mm)] [2 times joint width] [2-1/2 times joint width] [not less than 1/2 inch (13 mm)] [not less than 3/4 inch (20 mm)] [and] [not less than that required to expose sound, unweathered mortar] <Insert requirement>**. Do not remove unsound mortar more than **[2 inches (50 mm)] <Insert dimension>** deep; consult Architect for direction.
 2. Remove mortar from brick and other masonry surfaces within raked-out joints to provide reveals with square backs and to expose masonry for contact with pointing mortar. Brush, vacuum, or flush joints to remove dirt and loose debris.
 3. Do not spall edges of brick or other masonry units or widen joints. Replace or patch damaged brick or other masonry units as directed by Architect.
- D. Notify Architect of unforeseen detrimental conditions including voids in mortar joints, cracks, loose masonry units, rotted wood, rusted metal, and other deteriorated items.
- E. Pointing with Mortar:
1. Rinse joint surfaces with water to remove dust and mortar particles. Time rinsing application so, at time of pointing, joint surfaces are damp but free of standing water. If rinse water dries, dampen joint surfaces before pointing.
 2. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding areas. Apply in layers not greater than **[3/8 inch (9 mm)] <Insert dimension>** until a uniform depth is formed. Fully compact each layer, and allow it to become thumbprint hard before applying next layer.
 3. After deep areas have been filled to same depth as remaining joints, point joints by placing mortar in layers not greater than **[3/8 inch (9 mm)] <Insert dimension>**. Fully compact each layer and allow to become thumbprint hard before applying next layer. Where existing masonry units have worn or rounded edges, slightly recess finished mortar surface below face of masonry to avoid widened joint faces. Take care not to spread mortar beyond joint edges onto exposed masonry surfaces or to featheredge the mortar.
 4. When mortar is thumbprint hard, tool joints to match original appearance of joints as demonstrated in approved mockup. Remove excess mortar from edge of joint by brushing.
 5. Cure mortar by maintaining in thoroughly damp condition for at least 72 consecutive hours, including weekends and holidays.

6. Hairline cracking within mortar or mortar separation at edge of a joint is unacceptable. Completely remove such mortar and repoint.

F. Pointing with Sealant: Comply with Section 079200 "Joint Sealants" and as follows:

1. After raking out, keep joints dry and free of mortar and debris.
2. Clean and prepare joint surfaces. [**Prime joint surfaces unless sealant manufacturer recommends against priming.**] Do not allow primer to spill or migrate onto adjoining surfaces.
3. Fill sealant joints with specified joint sealant.
 - a. Install cylindrical sealant backing beneath the sealant. Where space is insufficient for cylindrical sealant backing, install bond-breaker tape.
 - b. Install sealant using only proven installation techniques that ensure that sealant is deposited in a uniform, continuous ribbon, without gaps or air pockets, and with complete wetting of the joint bond surfaces equally on both sides. Fill joint flush with surrounding masonry and matching the contour of adjoining mortar joints.
 - c. Install sealant as recommended in writing by sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead:
 - 1) Fill joints to a depth equal to joint width, but not more than 1/2 inch (13 mm) deep or less than 1/4 inch (6 mm) deep.
 - d. Tool sealant to form smooth, uniform beads, slightly concave. Remove excess sealant from surfaces adjacent to joint.
 - e. Do not allow sealant to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces, particularly rough textures. Remove excess and spillage of sealant promptly as the work progresses. Clean adjoining surfaces by the means necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes, as demonstrated in an approved mockup.

- G. Where repointing work precedes cleaning of existing masonry, allow mortar to harden at least 30 days before beginning cleaning work.

3.4 FINAL CLEANING

- A. After mortar has fully hardened, thoroughly clean exposed masonry surfaces of excess mortar and foreign matter; use wood scrapers, stiff-nylon or -fiber brushes, and clean water applied by low-pressure spray.
1. Do not use metal scrapers or brushes.
 2. Do not use acidic or alkaline cleaners.
- B. Clean adjacent nonmasonry surfaces. Use detergent and soft brushes or cloths.
- C. Clean mortar and debris from roof; remove debris from gutters and downspouts. Rinse off roof and flush gutters and downspouts.
- D. Remove masking materials, leaving no residues that could trap dirt.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage qualified testing agency to perform tests and inspections. Allow inspectors use of lift devices and scaffolding, as needed, to perform inspections.
- B. Architect's Project Representatives: Architect will assign Project representatives to help carry out Architect's responsibilities at the site, including observing progress and quality of portion of the Work completed. Allow Architect's Project representatives use of lift devices and scaffolding, as needed, to observe progress and quality of portion of the Work completed.
- C. Notify **[inspectors] [and] [Architect's Project representatives]** in advance of times when lift devices and scaffolding will be relocated. Do not relocate lift devices and scaffolding until **[inspectors] [and] [Architect's Project representatives]** have had reasonable opportunity to make inspections and observations of work areas at lift device or scaffold location.

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Task	Specification	Specification Description
04 01 20 91	04 01 00 00	Masonry Cleaning
04 01 50 00	04 01 00 00	Masonry Cleaning
04 01 50 52	04 01 00 00	Masonry Cleaning
04 05 13 26	04 20 00 00	Unit Masonry
04 05 16 26	04 20 00 00	Unit Masonry
04 05 19 13	04 20 00 00	Unit Masonry
04 05 19 16	04 20 00 00	Unit Masonry
04 05 23 13	04 20 00 00	Unit Masonry
04 05 23 16	01 11 19 00	No Specification Required
04 05 23 16	07 62 00 00	Sheet Metal Flashing And Trim



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SECTION 04 20 00 00 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Clay masonry units.
3. Structural clay facing tile.
4. Fireplace and chimney lining units.
5. Lintels
6. Mortar and grout materials
7. Reinforcement.
8. Ties and anchors.
9. Embedded flashing.
10. Accessories.
11. Mortar and grout mixes.

B. Products Installed, but Not Furnished, under This Section:

1. Cast-stone trim in unit masonry.
2. Stone trim units in unit masonry.
3. Steel lintels in unit masonry.
4. Steel shelf angles for supporting unit masonry.
5. Cavity wall insulation adhered to masonry backup.

C. Related Requirements:

1. Section 014339 "Mockups" for integrated exterior mockup requirements.
2. Section 019119.43 "Exterior Enclosure Commissioning."
3. Section 033000 "Cast-in-Place Concrete" for [**installing**] dovetail or channel slots for masonry-veneer anchors.
4. Section 042300 "Glass Unit Masonry" for glass block.
5. Section 042613 "Masonry Veneer" for unit masonry set as veneer.
6. Section 044200 "Exterior Stone Cladding" for stone trim secured with stone anchors.
7. Section 044313.13 "Anchored Stone Masonry Veneer" for thin stone trim set as anchored veneer.
8. Section 044313.16 "Adhered Stone Masonry Veneer" for thin stone trim set as adhered veneer.
9. Section 047200 "Cast Stone Masonry" for cast stone trim units.
10. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
11. Section 071900 "Water Repellents" for water repellents topically applied to unit masonry assemblies.
12. Section 072100 "Thermal Insulation" for cavity wall insulation.
13. Section 076200 "Sheet Metal Flashing and Trim" for [**exposed**] sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.
14. Section 089516 "Wall Vents" for wall vents (brick vents).
15. Section 096313 "Brick Flooring" for interior brick flooring.
16. Section 096313.35 "Chemical-Resistant Brick Flooring" for chemical-resistant, interior brick flooring.
17. Section 097519 "Stone Trim" for interior stone window stools.
18. Section 321400 "Unit Paving" for exterior unit masonry paving.

19. Section 323223 "Segmental Retaining Walls" for dry-laid, concrete unit retaining walls.

1.2 ALLOWANCES

- A. See Section 012100 "Allowances" for description of allowances affecting items specified in this Section.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Exposed: Weather-exposed side of a constructed wall.
- C. Reinforced Masonry: Masonry containing reinforcing steel within grouted cells.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference **[at Project site][by web conference]<Insert location>** .

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
- B. Shop Drawings:
1. Masonry Units: Indicate sizes, profiles, coursing, and locations of special shapes.
 2. Reinforcing Steel: Indicate bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI PRC 315R. **[Indicate elevations of reinforced walls.]**
 3. Lintel design and types required.
 4. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Initial Selection:
1. Architectural CMUs: **[Small-scale units][Full-size units, minimum of five]** .
 2. Prefaced CMUs: **[Small-scale units][Full-size units, minimum of five]** .
 3. Acoustical CMUs: **[Small-scale units][Full-size units, minimum of five]** .
 4. Rigid, Cellular Thermal Insulation CMUs: **[Small-scale units][Full-size units, minimum of five]** .
 5. Low carbon CMUs: **[Small-scale units][Full-size units, minimum of five]** .
 6. Concrete Facing Brick: **[Small-scale units][Full-size units, minimum of five]** .
 7. Hollow Clay Facing Brick: **[Small-scale units][Full-size units, minimum of five]** .
 8. Solid Clay Facing Brick: **[Small-scale units][Full-size units, minimum of five]** .
 9. Glazed Brick: **[Small-scale units][Full-size units, minimum of five]** .
 10. Glazed Structural Clay Facing Tile: **[Small-scale units][Full-size units, minimum of five]** .
 11. Colored Mortar: Full range of manufacturer's standard colors.
 12. Aggregate for Mortar: Range of aggregate colors for colored-aggregate mortar.
 13. Weep/cavity vents.
- D. Samples for Verification: For each type and color of the following:
1. Architectural CMUs: **[Small-scale units][Full-size units, minimum of five]** .

2. Prefaced CMUs: **[Small-scale units][Full-size units, minimum of five]** .
 3. Acoustical CMUs: **[Small-scale units][Full-size units, minimum of five]** .
 4. Rigid, Cellular Thermal Insulation CMUs: **[Small-scale units][Full-size units, minimum of five]** .
 5. Low carbon CMUs: **[Small-scale units][Full-size units, minimum of five]** .
 6. Concrete Facing Brick: **[Small-scale units][Full-size units, minimum of five]** .
 7. Hollow Clay Facing Brick: **[Small-scale units][Full-size units, minimum of five]** .
 8. Solid Clay Facing Brick: **[Small-scale units][Full-size units, minimum of five]** .
 9. Glazed Brick: **[Small-scale units][Full-size units, minimum of five]** .
 10. Glazed Structural Clay Facing Tile: **[Small-scale units][Full-size units, minimum of five]** .
 11. Colored mortar.
 12. Weep/cavity vents.
 13. Special Masonry Shapes: One of each unique shape.
 14. Pigmented Mortar: Make Samples using same sand and mortar ingredients to be used on Project.
 15. Colored-Aggregate Mortar: Make Samples using same sand and mortar ingredients to be used on Project.
 16. Cavity drainage material.
 17. Accessories embedded in masonry.
- E. Delegated Design Submittals: For **[masonry anchors and ties]<Insert engineered items>** , including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. Sustainable Design Submittals:
1. Environmental Product Declaration (EPD): For each product.
 2. Health Product Declaration (HPD): For each product.
 3. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
 4. Environmental Product Declaration (EPD): For each product.
 5. Health Product Declaration (HPD): For each product.
 6. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
 7. Environmental Product Declaration (EPD): For each product.
 8. Environmental Product Declaration (EPD): For each product.
 9. Environmental Product Declaration (EPD): For each product.
 10. Third-Party Certifications: For each product.
 11. Third-Party-Certified Life-Cycle Assessment: For each product.
 12. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.

1.6 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- B. Material Certificates: For each type of the following:
1. Masonry units.
 - a. Include **[data on material properties][material test reports substantiating compliance**

with requirements] .

- b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
- c. For exposed brick, include test report for efflorescence in accordance with ASTM C67/C67M.
- d. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing in accordance with ASTM C67/C67M [**or a list of addresses of buildings in Project's area where proposed brick has been used successfully and with a history of durability]** .
- e. For masonry units [**used in structural masonry]** , include data and calculations establishing average net-area compressive strength of units.

- 2. Integral water repellent used within CMUs.
- 3. Cementitious materials. Include name of manufacturer, brand name, and type.
- 4. Mortar admixtures.
- 5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
- 6. Grout mixes. Include description of type and proportions of ingredients.
- 7. Reinforcing bars.
- 8. Joint reinforcement.
- 9. Anchors, ties, and metal accessories.

C. Mix Designs: For each type of mortar [**and grout]** . Include description of type and proportions of ingredients.

- 1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
- 2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

D. Qualification Statements: For testing agency.

E. Delegated Design Engineer Qualifications: For [**masonry anchors and ties**] <Insert engineered items> .

F. Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements for [**cold**] [**and**] [**hot**] weather.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: All masonry flashing installers must complete the International Masonry Institute Flashing Upgrade training course.
- B. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in [**state**] <Insert jurisdiction> where Project is located and who is experienced in providing engineering services of the type indicated.
- C. Testing Agency: Qualified in accordance with ASTM C1093 for testing indicated.

1.8 MOCKUPS

- A. Sample Panel Mockups: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for

mockups.

1. Build sample panels for **[each type of exposed unit masonry construction][typical exterior wall][typical interior wall][typical exterior and interior walls]** in sizes approximately **[48 inches (1219 mm)][60 inches (1524 mm)]<Insert dimension>** long by **[36 inches (914 mm)][48 inches (1219 mm)]<Insert dimension>** high **[by full thickness]** .
2. Build sample panels facing south.
3. Where masonry is to match existing, build panels adjacent and parallel to existing surface.
4. Clean **[one-half of]** exposed faces of panels with masonry cleaner indicated.
5. Protect approved sample panels from the elements with weather-resistant membrane.
6. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless Owner specifically approves such deviations by Change Order.

B. Wall Mockups: Build mockups **[to verify selections made under Sample submittals][to demonstrate aesthetic effects][to set quality standards for materials and execution][and][to set quality standards for installation] . **[See Section 014339 "Mockups" for additional construction requirements for integrated exterior mockups.]****

1. Build mockup **[as indicated on Drawings]<Insert mockup requirements>** .
2. Build mockups for **[each type of exposed unit masonry construction][typical exterior wall][typical interior wall][typical exterior and interior walls]** in sizes approximately **[48 inches (1219 mm)][60 inches (1524 mm)][72 inches (1829 mm)][96 inches (2438 mm)]<Insert dimension>** long by **[36 inches (914 mm)][48 inches (1219 mm)][60 inches (1524 mm)][72 inches (1829 mm)]<Insert dimension>** high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least **16 inches (406 mm)** long in **[each][exterior wall]** mockup.
 - b. Include lower corner of window opening **[, framed with stone trim,]** at upper corner of exterior wall mockup. Make opening approximately **12 inches (305 mm)** wide by **16 inches (406 mm)** high.
 - c. Include through-wall flashing installed for a **24-inch (610-mm)** length in corner of exterior wall mockup approximately **16 inches (406 mm)** down from top of mockup, with a **12-inch (305-mm)** length of flashing left exposed to view (omit masonry above half of flashing).
 - d. Include wall substrate and cavity materials, veneer anchors, flashing **[, cavity drainage material]** , and weep holes in exterior masonry-veneer wall mockup.
 - e. Include specified unit masonry on one face of interior unit masonry wall mockup.
3. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
4. Clean **[one-half of]** exposed faces of mockups with masonry cleaner as indicated.
5. Protect accepted mockups from the elements with weather-resistant membrane.
6. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
7. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed

location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of **24 inches (610 mm)** down both sides of walls, and hold cover securely in place.
 - 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of **24 inches (610 mm)** down face next to unconstructed wythe, and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 402/602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is **40 deg F (4 deg C)** and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 402/602.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain **[exposed masonry units][cementitious mortar components][and][mortar aggregate]** from single **[source][producer][or][manufacturer]** .
- B. For **[exposed masonry units][and][cementitious mortar components]** , obtain each color and grade from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design **<Insert engineered items>** .
- B. Seismic Performance: Masonry to withstand the effects of earthquake motions determined in accordance with **[ASCE/SEI 7]<Insert requirement>** .
- C. Provide **[structural]** unit masonry that develops indicated net-area compressive strengths at 28 days.
 - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) in accordance with TMS 402/602.
 - 2. Determine net-area compressive strength of masonry by testing masonry prisms in accordance with ASTM C1314.

2.3 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 402/602, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work **[and will be within 20 ft. (6 m) vertically and horizontally of a walking surface]** .
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, units are listed by UL or a qualified testing agency acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

- A. Regional Materials: Verify CMUs are manufactured within **100 miles (160 km)** of Project site from aggregates **[and cement]** that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- B. Regional Materials: Verify CMUs are manufactured within **500 miles (800 km)** of Project site from aggregates **[and cement]** that have been extracted, harvested, or recovered, as well as manufactured,

within **500 miles (800 km)** of Project site. If materials are transported by rail or water, multiply the distance by 0.25 to determine the distance to Project site.

- C. General: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 2. Provide **[square-edged][bullnose]** units for outside corners unless otherwise indicated.
- D. CMUs: ASTM C90, **[normal weight][medium weight][lightweight][unless otherwise indicated]** .
1. Size (Width): Manufactured to dimensions **3/8 inch (10 mm)** less than nominal dimensions.
 2. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
 3. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.
- E. Architectural CMUs: ASTM C90, **[normal-weight][medium-weight][lightweight]** architectural units.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Angelus Block Co., Inc.]**
 - b. **[Echelon Masonry, an Oldcastle APG brand]**
 - c. **[York Building Products]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Angelus Block Co., Inc.]**
 - b. **[Echelon Masonry, an Oldcastle APG brand]**
 - c. **[York Building Products]**
 - d. **<Insert manufacturer's name>**
 3. Size (Width): Manufactured to dimensions **3/8 inch (10 mm)** less than nominal dimensions.
 4. Pattern and Texture: **[Standard pattern, ground-face finish][Standard pattern, split-face finish][Standard pattern, split-ribbed finish][Scored vertically to appear square in stacked bond, standard finish][Triple scored vertically to appear as soldier courses in stacked bond, standard finish]<Insert pattern> . [Match Architect's samples.]**
 5. Colors: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]** .
 6. Special Aggregate: Provide units made with aggregate matching aggregate in Architect's sample.
- F. Prefaced CMUs: ASTM C90, lightweight, with manufacturer's standard smooth resinous facing complying with ASTM C744.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- a. **[Echelon Masonry, an Oldcastle APG brand]**
 - b. **[York Building Products]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Echelon Masonry, an Oldcastle APG brand]**
 - b. **[York Building Products]**
 - c. **<Insert manufacturer's name>**
 3. Composition: **[Hollow][Solid]** units.
 4. Size: Manufactured to dimensions specified in "CMUs" Paragraph but with prefaced surfaces having **1/16-inch- (1.6-mm-)** wide returns of facing to create **1/4-inch- (6.2-mm-)** wide mortar joints with modular coursing.
 5. Colors and Patterns: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]** .
- G. Acoustical CMUs: ASTM C90, **[lightweight][medium-weight][normal-weight]** sound-absorbing units.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Acme Brick Company]**
 - b. **[Echelon Masonry, an Oldcastle APG brand]**
 - c. **[RPG Acoustical Systems, Inc.]**
 - d. **[Sound Seal]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Acme Brick Company]**
 - b. **[Echelon Masonry, an Oldcastle APG brand]**
 - c. **[RPG Acoustical Systems, Inc.]**
 - d. **[Sound Seal]**
 - e. **<Insert manufacturer's name>**
 3. Surface Characteristics: **[Slotted][Textured]** .
 4. Size: **<Insert dimensions>** .
 5. Cavity Fill: **[Fibrous filler][Galvanized steel septum][Unfilled]<Insert filler>** .
 6. Sound Transmission Classification (STC): **<Insert STC>** , minimum as measured **[by an independent, accredited NVLAP facility]** in accordance with ASTM E90 and ASTM E413.
 7. Noise Reduction Coefficient (NRC): Not less than **<Insert NRC>** as measured **[by an independent, accredited NVLAP facility]** in accordance with ASTM C423 and ASTM E795.
- H. Rigid, Cellular Thermal Insulation CMUs: ASTM C90, **[lightweight][medium-weight][normal-weight]** units containing rigid, specially shaped, molded-polystyrene insulation complying with ASTM C578, Type I, designed for installing in cores of CMUs.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering**

products that may be incorporated into the Work include, but are not limited to, the following] :

- a. [Concrete Block Insulating Systems]
- b. [Echelon Masonry, an Oldcastle APG brand]
- c. [Shelter Enterprises Inc.]
- d. [York Building Products]
- e. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Concrete Block Insulating Systems]
- b. [Echelon Masonry, an Oldcastle APG brand]
- c. [Shelter Enterprises Inc.]
- d. [York Building Products]
- e. <Insert manufacturer's name>

3. Size (Width): Manufactured to dimensions **3/8 inch (10 mm)** less than nominal dimensions.
4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

- I. Low-Carbon CMUs: ASTM C90, [lightweight][medium-weight][normal-weight] units with low embodied carbon.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :

- a. [CarbonBuilt]
- b. [CarbonCure]
- c. [CarbonKind]
- d. [CarbonX]
- e. [Pozzotive (Glenwood Mason Supply)]
- f. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [CarbonBuilt]
- b. [CarbonCure]
- c. [CarbonKind]
- d. [CarbonX]
- e. [Pozzotive (Glenwood Mason Supply)]
- f. <Insert manufacturer's name>

3. Size: Manufactured to dimensions specified in "CMUs" Paragraph but with prefaced surfaces having **1/16-inch- (1.5-mm-)** wide returns of facing to create **1/4-inch- (6-mm-)** wide mortar joints with modular coursing.
4. Colors and Patterns: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range] .

- J. Concrete Building Brick: ASTM C55, [normal-weight][medium-weight][lightweight] solid units.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Acme Brick Company]**
 - b. **[Belden Brick Company (The)]**
 - c. **[Bilco Brick Company]**
 - d. **[Echelon Masonry, an Oldcastle APG brand]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Acme Brick Company]**
 - b. **[Belden Brick Company (The)]**
 - c. **[Bilco Brick Company]**
 - d. **[Echelon Masonry, an Oldcastle APG brand]**
 - e. **<Insert manufacturer's name>**
 3. Size (Actual Dimensions): **3-5/8 inches (92 mm)** wide by **[2-1/4 inches (57 mm)][2-3/4 inches (70 mm)][3-5/8 inches (92 mm)]** high by **7-5/8 inches (194 mm)** long.
- K. Concrete Facing Brick: ASTM C1634, **[normal-weight][medium-weight][lightweight]** solid units.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Acme Brick Company]**
 - b. **[Belden Brick Company (The)]**
 - c. **[Bilco Brick Company]**
 - d. **[Echelon Masonry, an Oldcastle APG brand]**
 - e. **[Westbrook Concrete Block Co., Inc.]**
 - f. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Acme Brick Company]**
 - b. **[Belden Brick Company (The)]**
 - c. **[Bilco Brick Company]**
 - d. **[Echelon Masonry, an Oldcastle APG brand]**
 - e. **[Westbrook Concrete Block Co., Inc.]**
 - f. **<Insert manufacturer's name>**
 3. Size (Actual Dimensions): **3-5/8 inches (92 mm)** wide by **[2-1/4 inches (57 mm)][2-3/4 inches (70 mm)][3-5/8 inches (92 mm)]** high by **[7-5/8 inches (194 mm)][11-5/8 inches (295 mm)][15-5/8 inches (397 mm)]** long.
 4. Texture: **[Smooth-face][Split-face][Ground-face]<Insert description>** finish. **[Match Architect's samples]** .
 5. Colors: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]** .

6. Special Aggregate: Provide units made with aggregate matching aggregate in Architect's sample.

L. Concrete Masonry Unit Admixtures:

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested in accordance with ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, will show no visible water or leaks on the back of test specimen.

a. Location: **[For exposed units][and][where indicated on Drawings]** .

2.5 CLAY MASONRY UNITS

A. Regional Materials: Verify brick is manufactured within 100 miles (160 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles (160 km) of Project site.

B. Regional Materials: Verify brick is manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site. If materials are transported by rail or water, multiply the distance by 0.25 to determine the distance to Project site.

C. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications **[where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels][requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing][where shapes produced by sawing would result in sawed surfaces being exposed to view]** .

D. Hollow Clay Facing Brick: ASTM C652, Grade **[SW][MW]** , Type **[HBA][HBB][HBX][HBS]** , Class **[H40V][H60V]** .

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- a. **[Acme Brick Company]**
- b. **[Belden Brick Company (The)]**
- c. **[Bilco Brick Company]**
- d. **[Echelon Masonry, an Oldcastle APG brand]**
- e. **[Endicott Clay Products Co]**
- f. **[General Shale, Inc.]**
- g. **[Glen-Gery Corporation]**
- h. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Acme Brick Company]**
 - b. **[Belden Brick Company (The)]**
 - c. **[Bilco Brick Company]**
 - d. **[Echelon Masonry, an Oldcastle APG brand]**
 - e. **[Endicott Clay Products Co]**
 - f. **[General Shale, Inc.]**
 - g. **[Glen-Gery Corporation]**
 - h. **<Insert manufacturer's name>**
3. Initial Rate of Absorption: Less than **30 g/30 sq. in. (30 g/194 sq. cm)** per minute when tested in accordance with ASTM C67/C67M.
 4. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."
 5. Surface Coating: Brick with colors or textures produced by application of coatings withstand 50 cycles of freezing and thawing in accordance with ASTM C67/C67M with no observable difference in the applied finish when viewed from **10 ft. (3 m)** **[or have a history of successful use in Project's area]** .
 6. Size (Actual Dimensions): **[2-3/4 inches (70 mm)][3 inches (76 mm)][3-1/2 inches (89 mm)][3-5/8 inches (92 mm)]<Insert dimension>** wide by **[2-1/4 inches (57 mm)][2-3/4 inches (70 mm)][2-5/8 inches (67 mm)][2-13/16 inches (71 mm)][3-1/2 inches (89 mm)][3-5/8 inches (92 mm)][7-1/2 inches (190 mm)][7-5/8 inches (194 mm)]<Insert dimension>** high by **[7-1/2 inches (190 mm)][7-5/8 inches (194 mm)][8 inches (203 mm)][9-5/8 inches (244 mm)][11-1/2 inches (292 mm)][11-5/8 inches (295 mm)]<Insert dimension>** long.
 7. Application: Use for exposed brick unless otherwise indicated.
 8. **[Where indicated to "match existing,"]** provide facing brick matching color range, texture, and size of existing adjacent brickwork.
 9. Color and Texture: **[Medium brown, wire cut][Full-range red, sand molded][Buff, velour]<Insert color and texture>[Match Architect's samples][As selected by Architect]** .
- E. Solid Clay Facing Brick: ASTM C216, Grade **[SW][MW]** , Type **[FBX][FBS][FBA]** .
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Acme Brick Company]**
 - b. **[Belden Brick Company (The)]**
 - c. **[Bilco Brick Company]**
 - d. **[Boral Bricks, Inc; Boral Limited]**
 - e. **[Echelon Masonry, an Oldcastle APG brand]**
 - f. **[Endicott Clay Products Co]**
 - g. **[General Shale, Inc.]**
 - h. **[Glen-Gery Corporation]**
 - i. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Acme Brick Company]**
 - b. **[Belden Brick Company (The)]**
 - c. **[Bilco Brick Company]**
 - d. **[Boral Bricks, Inc; Boral Limited]**
 - e. **[Echelon Masonry, an Oldcastle APG brand]**
 - f. **[Endicott Clay Products Co]**

- g. **[General Shale, Inc.]**
- h. **[Glen-Gery Corporation]**
- i. **<Insert manufacturer's name>**

3. Initial Rate of Absorption: Less than **30 g/30 sq. in. (30 g/194 sq. cm)** per minute when tested in accordance with ASTM C67/C67M.
4. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."
5. Surface Coating: Brick with colors or textures produced by application of coatings withstand 50 cycles of freezing and thawing in accordance with ASTM C67/C67M with no observable difference in the applied finish when viewed from **10 ft. (3 m)** **[or have a history of successful use in Project's area]** .
6. Size (Actual Dimensions): **[2-3/4 inches (70 mm)][3 inches (76 mm)][3-1/2 inches (89 mm)][3-5/8 inches (92 mm)]<Insert dimension>** wide by **[2-1/4 inches (57 mm)][2-3/4 inches (70 mm)][2-5/8 inches (67 mm)][2-13/16 inches (71 mm)][3-1/2 inches (89 mm)][3-5/8 inches (92 mm)][7-1/2 inches (190 mm)][7-5/8 inches (194 mm)]<Insert dimension>** high by **[7-1/2 inches (190 mm)][7-5/8 inches (194 mm)][8 inches (203 mm)][9-5/8 inches (244 mm)][11-1/2 inches (292 mm)][11-5/8 inches (295 mm)]<Insert dimension>** long.
7. Application: Use for exposed brick unless otherwise indicated.
8. **[Where indicated to "match existing,"]** provide facing brick matching color range, texture, and size of existing adjacent brickwork.
9. Color and Texture: **[Medium brown, wire cut][Full-range red, sand molded][Buff, velour]<Insert color and texture>[Match Architect's samples][As selected by Architect]** .

F. Solid Building Brick: ASTM C62, Grade **[SW][MW][NW]** .

1. Size (Actual Dimensions): **[3-1/2 inches (89 mm) wide by 2-1/4 inches (57 mm) high by 7-1/2 inches (190 mm) long][or][3-5/8 inches (92 mm) wide by 2-1/4 inches (57 mm) high by 7-5/8 inches (194 mm) long]<Insert dimensions>** .
2. Application: Use for concealed brick unless otherwise indicated.

G. Glazed Brick: ASTM C1405, Grade **[S][SS]** , Class **[Exterior][Interior]** , Division **[Solid][H40V][H60V]** .

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Belden Brick Company (The)]**
 - b. **[Elgin Butler Company]**
 - c. **[Glen-Gery Corporation]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Belden Brick Company (The)]**
 - b. **[Elgin Butler Company]**
 - c. **[Glen-Gery Corporation]**
 - d. **<Insert manufacturer's name>**
3. Size (Actual Dimensions): **3-5/8 inches (92 mm) wide by [2-1/4 inches (57 mm)][2-3/4 inches (70 mm)][3-5/8 inches (92 mm)][7-5/8 inches (194 mm)] high by [7-5/8 inches (194 mm)][8 inches (203 mm)][11-5/8 inches (295 mm)] long.**

4. Provide Type I (single-faced units) where only one finished face is exposed when units are installed, and provide Type II (double-faced units) where two opposite finished faces are exposed when units are installed.
5. Application: Use where [**brick is exposed unless otherwise**] indicated.
6. Colors: [**As indicated by manufacturer's designations**][**Match Architect's samples**][**As selected by Architect from manufacturer's full range**] .
7. [**Where indicated to "match existing,"**] provide glazed brick matching color range, texture, and size of existing adjacent brickwork.

2.6 STRUCTURAL CLAY FACING TILE

- A. General: Provide solid, multicored, or hollow units, with shape and direction of cores optional unless otherwise indicated.
 1. Where reinforced masonry is indicated, provide multicored units designed for use in reinforced, grouted masonry, either with vertical cores and with webs notched to receive horizontal reinforcement, or with horizontal cores and with holes in bed shells for placement of grout and to receive vertical reinforcement.
 2. Where indicated for exterior applications, provide units recommended by manufacturer for exterior use in Project's location.
 3. Provide special shapes where required for corners, jambs, coved bases, sills, and other special conditions indicated, including applications that cannot be produced by sawing standard units.
 - a. Provide [**bullnose**][**square-edged**] units for outside corners unless otherwise indicated.
 - b. Provide coved internal corners.
 - c. Provide recessed, coved base units.
 4. Where direct application of plaster is indicated or where bonded to backup masonry, provide units with rough, combed, or scored faces.
- B. Glazed Structural Clay Facing Tile: ASTM C126, Grade [**S**][**SS**] .
 1. Sizes: [**6P Series with actual face dimensions of 3-5/8 inches (92 mm) high by 11-5/8 inches (295 mm)**][**6T Series with actual face dimensions of 5 inches (127 mm) high by 11-11/16 inches (297 mm)**][**4W Series (8-Square) with actual face dimensions of 7-5/8 inches (194 mm) high by 7-5/8 inches (194 mm)**][**4S Series with actual face dimensions of 2-1/4 inches (57 mm) high by 7-5/8 inches (194 mm)**][**8W Series with actual face dimensions of 7-5/8 inches (194 mm) high by 15-5/8 inches (397 mm)**]<Insert dimension> long by widths indicated.
 2. Width: Manufactured to dimensions [**5/16 inch (8 mm)**][**3/8 inch (10 mm)**] less than nominal dimensions.
 3. Provide Type I (single-faced units) where only one finished face is exposed when units are installed, and Type II (double-faced units) where two opposite finished faces are exposed when units are installed.
 4. Provide special units glazed on ends and tops, as well as faces for corners, jambs, sills, pilasters, columns, and other applications indicated, where glazed units are exposed on other surfaces and faces.
 5. Colors and Patterns: [**As indicated by manufacturer's designations**][**Match Architect's samples**][**As selected by Architect from manufacturer's full range**] .
 6. [**Where shown to "match existing,"**] provide glazed structural clay facing tile matching color range, texture, and size of existing adjacent glazed structural clay facing tile.
- C. Unglazed Structural Clay Facing Tile: ASTM C212, Type [**FTX**][**FTS**] , Class [**Standard**][**Special-Duty**] .
 1. Number of Faces: Single faced [, **where only one finished face is exposed when units are**

2. installed; double faced, where both finished faces are exposed when units are installed] .
Size: [As indicated][Match existing]<Insert size> .

2.7 FIREPLACE AND CHIMNEY LINING UNITS

- A. Firebox Brick: ASTM C1261, size required to produce lining thickness indicated.
- B. Clay Flue Lining Units: ASTM C315.

2.8 LINTELS

- A. Solid Concrete Masonry Lintels: ASTM C1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. [**Provide lintels with net-area compressive strength of not less than that of CMUs.**][**Provide lintels with net-area compressive strength as indicated.**]
 - B. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Section 033000 "Cast-in-Place Concrete" and with reinforcing bars indicated.
 - C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.
 - D. Offset Angle Supports: Steel plate brackets anchored to structure, allowing continuous insulation behind shelf angle supporting veneer. Component and anchor size and spacing engineered by manufacturer.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [FERO Corporation]
 - b. [Halfen USA, Inc.]
 - c. [Hohmann & Barnard, Inc]
 - d. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [FERO Corporation]
 - b. [Halfen USA, Inc.]
 - c. [Hohmann & Barnard, Inc]
 - d. <Insert manufacturer's name>
 3. Stainless Steel: ASTM A240/A240M or ASTM A666/A666M, [Type 304][Type 316] .
 4. Carbon Steel: ASTM A1008/A1008M [, with ASTM A153/A153M, Class B coating] .

2.9 Masonry-Joint Reinforcement Accessories

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[3GEN Masonry Products, Inc.]**
 2. **<Insert manufacturer's name>**

2.10 MORTAR AND GROUT MATERIALS

- A. Regional Materials: Verify aggregate for mortar and grout [, **cement, and lime**] is manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- B. Regional Materials: Verify aggregate for mortar and grout [, **cement, and lime**] is manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, multiply the distance by 0.25 to determine the distance to Project site.
- C. General: Provide mortar and grout materials to achieve performance requirements as specified in mortar and grout mixes.
- D. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.
- E. Hydrated Lime: ASTM C207, Type S.
- F. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- G. Masonry Cement: ASTM C91/C91M.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Argos USA LLC]**
 - b. **[Cemex S.A.B. de C.V.]**
 - c. **[Fairborn Cement Company]**
 - d. **[Federal White Cement, Ltd.]**
 - e. **[Heidelberg Materials]**
 - f. **[Holcim (US) Inc]**
 - g. **[Lafarge North America Inc.]**
 - h. **[Lehigh White Cement Company]**
 - i. **[Quikrete; The QUIKRETE Companies, LLC]**
 - j. **[Sakrete; CRH Americas, Oldcastle APG]**
 - k. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. [Argos USA LLC]
- b. [Cemex S.A.B. de C.V.]
- c. [Fairborn Cement Company]
- d. [Federal White Cement, Ltd.]
- e. [Heidelberg Materials]
- f. [Holcim (US) Inc]
- g. [Lafarge North America Inc.]
- h. [Lehigh White Cement Company]
- i. [Quikrete; The QUIKRETE Companies, LLC]
- j. [Sakrete; CRH Americas, Oldcastle APG]
- k. <Insert manufacturer's name>

H. Mortar Cement: ASTM C1329/C1329M.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. [Lafarge North America Inc.]
 - b. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. [Lafarge North America Inc.]
 - b. <Insert manufacturer's name>

I. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. [Davis Colors]
 - b. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - c. [Lanxess Corporation]
 - d. [Solomon Colors Inc.]
 - e. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. [Davis Colors]
 - b. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - c. [Lanxess Corporation]
 - d. [Solomon Colors Inc.]
 - e. <Insert manufacturer's name>

J. Colored Mortar: Packaged blend made from **[portland cement-lime mix][or][masonry cement]** and

mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - 1) **[Argos USA LLC]**
 - 2) **[Heidelberg Materials]**
 - 3) **[Holcim (US) Inc]**
 - 4) **[Lafarge North America Inc.]**
 - 5) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[Argos USA LLC]**
 - 2) **[Heidelberg Materials]**
 - 3) **[Holcim (US) Inc]**
 - 4) **[Lafarge North America Inc.]**
 - 5) **<Insert manufacturer's name>**
2. Colored Masonry Cement:
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - 1) **[Argos USA LLC]**
 - 2) **[Cemex S.A.B. de C.V.]**
 - 3) **[Fairborn Cement Company]**
 - 4) **[Heidelberg Materials]**
 - 5) **[Holcim (US) Inc]**
 - 6) **[Lafarge North America Inc.]**
 - 7) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[Argos USA LLC]**
 - 2) **[Cemex S.A.B. de C.V.]**
 - 3) **[Fairborn Cement Company]**
 - 4) **[Heidelberg Materials]**
 - 5) **[Holcim (US) Inc]**
 - 6) **[Lafarge North America Inc.]**
 - 7) **<Insert manufacturer's name>**
3. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
4. Pigments do not exceed 10 percent of portland cement by weight.
5. Pigments do not exceed 5 percent of **[masonry cement][or][mortar cement]** by weight.

K. Preblended Dry Mortar Mix: Packaged blend complying with ASTM C1714/C1714M.

1. Preblended Dry Portland Cement Mortar Mix:

a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- 1) **[Amerimix is a trademark of Bonsal American, an Oldcastle company]**
- 2) **[Quikrete; The QUIKRETE Companies, LLC]**
- 3) **[Sakrete; CRH Americas, Oldcastle APG]**
- 4) **[SPEC MIX, LLC]**
- 5) **<Insert manufacturer's name>**

b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- 1) **[Amerimix is a trademark of Bonsal American, an Oldcastle company]**
- 2) **[Quikrete; The QUIKRETE Companies, LLC]**
- 3) **[Sakrete; CRH Americas, Oldcastle APG]**
- 4) **[SPEC MIX, LLC]**
- 5) **<Insert manufacturer's name>**

c. Dry Mortar Mix Materials: Made from **[portland cement-lime mix][masonry cement][or][mortar cement]** , sand, **[mortar pigments,][water repellent admixture]** and **<Insert admixture>** .

2. Preblended Dry Masonry Cement Mortar Mix:

a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- 1) **[Amerimix is a trademark of Bonsal American, an Oldcastle company]**
- 2) **[SPEC MIX, LLC]**
- 3) **<Insert manufacturer's name>**

b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- 1) **[Amerimix is a trademark of Bonsal American, an Oldcastle company]**
- 2) **[SPEC MIX, LLC]**
- 3) **<Insert manufacturer's name>**

L. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than **1/4 inch (6.4 mm)** thick, use aggregate graded with 100 percent passing the **No. 16 (1.18-mm)** sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.

4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- M. Aggregate for Grout: ASTM C404.
- N. Epoxy Pointing Mortar: ASTM C395, epoxy-resin-based material formulated for use as pointing mortar for glazed or prefaced masonry units (and approved for use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.
- O. Refractory Mortar Mix: Ground fireclay or nonwater-soluble, calcium aluminate, medium-duty refractory mortar that passes ASTM C199 test; or an equivalent product acceptable to authorities having jurisdiction.
- P. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with **[ASTM C494/C494M, Type C][ASTM C1384]** , and recommended by manufacturer for use in masonry mortar of composition indicated.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
- a. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
b. **[GCP Applied Technologies Inc.]**
c. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
b. **[GCP Applied Technologies Inc.]**
c. **<Insert manufacturer's name>**
- Q. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
- a. **[ACM Chemistries]**
b. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
c. **[GCP Applied Technologies Inc.]**
d. **[Master Builders Solutions]**
e. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[ACM Chemistries]**
b. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
c. **[GCP Applied Technologies Inc.]**
d. **[Master Builders Solutions]**

e. <Insert manufacturer's name>

R. Water: Potable.

2.11 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, **Grade 60 (Grade 420)**.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold or lock more securely reinforcing bars in center of cells. Units are formed from minimum **0.148-inch (3.77-mm)** diameter steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- a. **[3GEN Masonry Products, Inc.]**
- b. **[Heckmann Building Products, Inc.]**
- c. **[Hohmann & Barnard, Inc]**
- d. **[Wire-Bond]**
- e. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert **manufacturer's name; product name or designation**> or comparable product by one of the following:

- a. **[3GEN Masonry Products, Inc.]**
- b. **[Heckmann Building Products, Inc.]**
- c. **[Hohmann & Barnard, Inc]**
- d. **[Wire-Bond]**
- e. <Insert manufacturer's name>

C. Masonry-Joint Reinforcement: ASTM A951/A951M.

- 1. Interior Walls: **[Mill-][Hot-dip]** galvanized carbon steel.
- 2. Exterior Walls: **[Hot-dip galvanized carbon][Stainless]** steel.
- 3. Wire Size for Side Rods: **[0.148-inch (3.77-mm)][0.187-inch (4.76-mm)]** diameter.
- 4. Wire Size for Cross Rods: **[0.148-inch (3.77-mm)][0.187-inch (4.76-mm)]** diameter.
- 5. Wire Size for Veneer Ties: **[0.148-inch (3.77-mm)][0.187-inch (4.76-mm)]** diameter.
- 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than **16 inches (406 mm)** o.c.
- 7. Provide in lengths of not less than **10 ft. (3 m)**, **[with prefabricated corner and tee units]** .

D. Masonry-Joint Reinforcement for Single-Wythe Masonry:

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- a. **[3GEN Masonry Products, Inc.]**
- b. **[Hohmann & Barnard, Inc]**
- c. **[Wire-Bond]**

- d. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [3GEN Masonry Products, Inc.]
 - b. [Hohmann & Barnard, Inc]
 - c. [Wire-Bond]
 - d. <Insert manufacturer's name>
3. Type: Ladder [or truss] with single pair of side rods.
- E. Masonry-Joint Reinforcement for Multiwythe Masonry:
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [3GEN Masonry Products, Inc.]
 - b. [Heckmann Building Products, Inc.]
 - c. [Hohmann & Barnard, Inc]
 - d. [Wire-Bond]
 - e. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [3GEN Masonry Products, Inc.]
 - b. [Heckmann Building Products, Inc.]
 - c. [Hohmann & Barnard, Inc]
 - d. [Wire-Bond]
 - e. <Insert manufacturer's name>
 3. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches (102 mm) wide, plus [one side rod][two side rods] at each wythe of masonry 4 inches (102 mm) wide or less.
 4. Tab type, either ladder or truss design, with one side rod at each face shell of backing wythe and with rectangular tabs sized to extend at least halfway through facing wythe, but with at least 5/8-inch (16-mm) cover on outside face.
 5. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch (1.6 mm) and maximum vertical adjustment of 1-1/4 inches (32 mm). Size ties to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face. [Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.]
- F. Masonry-Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch- (4.76-mm-) diameter, [hot-dip galvanized carbon][stainless] steel continuous wire.

2.12 TIES AND ANCHORS

- A. General: Ties and anchors extend at least 1-1/2 inches (38 mm) into veneer but with at least a 5/8-inch

(16-mm) cover on outside face.

- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
1. Mill-Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A641/A641M, Class 1 coating.
 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
 3. Stainless Steel Wire: ASTM A580/A580M, **[Type 304][Type 316]** .
 4. Galvanized-Steel Sheet: ASTM A653/A653M, Commercial Steel, **G60 (Z180)** zinc coating.
 5. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
 6. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666/A666M, **[Type 304][Type 316]** .
 7. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
 8. Stainless Steel Bars: ASTM A276 or ASTM A666/A666M, Type 304.
- C. Corrugated-Metal Ties: Metal strips not less than **7/8 inch (22 mm)** wide with corrugations having a wavelength of **0.3 to 0.5 inch (7.6 to 13 mm)** and an amplitude of **0.06 to 0.10 inch (1.5 to 2.5 mm)** made from **[0.0336-inch- (0.85-mm-) thick steel sheet, galvanized after fabrication][0.0635-inch- (1.61-mm-) thick steel sheet, galvanized after fabrication][0.0312-inch- (0.79-mm-) thick, stainless steel sheet][0.0625-inch- (1.59 mm-) thick, stainless steel sheet]** .
- D. Individual Wire Ties: Rectangular units with closed ends and not less than **4 inches (100 mm)** wide.
1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than **2 inches (51 mm)** long for masonry constructed from solid units.
 2. Where wythes **[do not align][are of different materials]** , use adjustable ties with pintle-and-eye connections having a maximum adjustment of **1-1/4 inches (32 mm)**.
 3. Wire: Fabricate from **[3/16-inch- (4.76-mm-)][1/4-inch- (6.4-mm-)]** diameter, **[hot-dip galvanized steel][stainless steel]** wire. **[Mill-galvanized wire ties may be used in interior walls unless otherwise indicated.]**
- E. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[3GEN Masonry Products, Inc.]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[3GEN Masonry Products, Inc.]**
 - b. **<Insert manufacturer's name>**
 3. Anchor Section for Welding to Steel Frame: Crimped **1/4-inch- (6.4-mm-)** diameter, **[hot-dip galvanized steel][stainless steel]** wire. **[Mill-galvanized wire may be used at interior walls unless otherwise indicated.]**
 4. Tie Section: Triangular-shaped wire tie made from **[0.187-inch- (4.76-mm-)][0.25-inch- (6.4-mm-)]**

)] diameter, **[hot-dip galvanized steel][stainless steel]** wire. **[Mill-galvanized wire may be used at interior walls unless otherwise indicated.]**

- F. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Connector Section: **[Dovetail][Channel]** tabs for inserting into **[dovetail][channel]** slots in concrete and attached to tie section; formed from **[0.060-inch- (1.52-mm-) thick steel sheet, galvanized after fabrication][0.105-inch- (2.66-mm-) thick steel sheet, galvanized after fabrication][0.062-inch- (1.59-mm-) thick, stainless steel sheet][0.109-inch- (2.78-mm-) thick, stainless steel sheet]** .
 - a. **[0.064-inch- (1.63-mm-)][0.108-inch- (2.74-mm-)]** thick, galvanized-steel sheet may be used at interior walls unless otherwise indicated.
 2. Tie Section: Triangular-shaped wire tie made from **[0.187-inch- (4.76-mm-)][0.25-inch- (6.4-mm-)]** diameter, **[hot-dip galvanized steel][stainless steel]** wire. **[Mill-galvanized wire may be used at interior walls unless otherwise indicated.]**
 3. Corrugated-Metal Ties: Metal strips not less than **7/8 inch (22 mm)** wide with corrugations having a wavelength of **0.3 to 0.5 inch (7.6 to 13 mm)** and an amplitude of **0.06 to 0.10 inch (1.5 to 2.5 mm)** made from **[0.0635-inch- (1.61-mm-) thick steel sheet, galvanized after fabrication][0.0785-inch- (1.99 mm-) thick steel sheet, galvanized after fabrication][0.1084-inch- (2.75-mm-) thick steel sheet, galvanized after fabrication][0.0625-inch- (1.59-mm-) thick, stainless steel sheet][0.0781-inch- (1.98-mm-) thick, stainless steel sheet][0.1094-inch- (2.78-mm-) thick, stainless steel sheet]** with **[dovetail][channel]** tabs for inserting into slots in concrete.
 - a. **[0.064-inch- (1.63-mm-)][0.079-inch- (2.01-mm-)][0.108-inch- (2.74-mm-)]** thick galvanized sheet may be used at interior walls unless otherwise indicated.
- G. Partition Top Anchors: **0.105-inch- (2.66-mm-) thick metal plate with a 3/8-inch- (10-mm-) diameter metal rod 6 inches (152 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from [steel, hot-dip galvanized after fabrication][stainless steel]** .
- H. Rigid Anchors: Fabricate from steel bars **[1-1/2 inches (38 mm) wide by 1/4 inch (6.4 mm) thick by 24 inches (610 mm) long, with ends turned up 2 inches (51 mm) or with cross pins unless otherwise indicated][bent to configuration indicated]** .
1. Corrosion Protection: **[Hot-dip galvanized to comply with ASTM A153/A153M][Epoxy coating 0.020 inch (0.51 mm) thick][Rust-inhibitive paint]** .
- I. Adjustable Masonry-Veneer Anchors:
1. General: Provide anchors that allow vertical adjustment but resist a **100 lbf (445 N)** load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of **1/16 inch (1.6 mm)**.
 2. Fabricate sheet metal anchor sections and other sheet metal parts from **[0.0785-inch- (1.99-mm-) thick steel sheet, galvanized after fabrication][0.1084-inch- (2.75-mm-) thick steel sheet, galvanized after fabrication][0.0781-inch- (1.98-mm-) thick, stainless steel sheet][0.1094-inch- (2.78-mm-) thick, stainless steel sheet]** .
 3. Fabricate wire ties from **[0.187-inch- (4.76-mm-)][0.25-inch- (6.4-mm-)]** diameter, **[hot-dip galvanized-steel][stainless steel]** wire unless otherwise indicated.
 4. Contractor's Option: Unless otherwise indicated, provide any of the adjustable masonry-veneer anchors specified.
 5. Masonry-Veneer Anchors; Vertical Slotted L-Plate: Rib-stiffened, sheet metal anchor section with

screw holes at top and bottom, projecting vertical leg with slotted hole for wire tie with seismic accessories [**and washer at face of insulation**] .

- a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - 1) [3GEN Masonry Products, Inc.]
 - 2) [FERO Corporation]
 - 3) [Hohmann & Barnard, Inc]
 - 4) [PROSOCO, Inc]
 - 5) [Wire-Bond]
 - 6) <Insert manufacturer's name>
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - 1) [3GEN Masonry Products, Inc.]
 - 2) [FERO Corporation]
 - 3) [Hohmann & Barnard, Inc]
 - 4) [PROSOCO, Inc]
 - 5) [Wire-Bond]
 - 6) <Insert manufacturer's name>
6. Masonry-Veneer Anchors; Double-Pintle Plate: Rib-stiffened, sheet metal anchor section with screw holes at top and bottom, projecting horizontal leg with slots for vertical legs of double pintle wire tie.
- a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - 1) [3GEN Masonry Products, Inc.]
 - 2) [Heckmann Building Products, Inc.]
 - 3) [Hohmann & Barnard, Inc]
 - 4) [Quality Steel and Wire LLC]
 - 5) [Wire-Bond]
 - 6) <Insert manufacturer's name>
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - 1) [3GEN Masonry Products, Inc.]
 - 2) [Heckmann Building Products, Inc.]
 - 3) [Hohmann & Barnard, Inc]
 - 4) [Quality Steel and Wire LLC]
 - 5) [Wire-Bond]
 - 6) <Insert manufacturer's name>
 - c. Seismic: Provide seismic tie, clip, and continuous wire in veneer.

7. Masonry-Veneer Anchors; Slotted Plate: Sheet metal anchor section, with screw holes at top and bottom; and raised rib-stiffened strap, stamped into center to provide a slot between strap and base for wire tie. [**Use self-adhering tape to seal penetration behind anchor plate.**]
- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
- 1) **[3GEN Masonry Products, Inc.]**
 - 2) **[Heckmann Building Products, Inc.]**
 - 3) **[Hohmann & Barnard, Inc]**
 - 4) **[Quality Steel and Wire LLC]**
 - 5) **[Wire-Bond]**
 - 6) **<Insert manufacturer's name>**
- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- 1) **[3GEN Masonry Products, Inc.]**
 - 2) **[Heckmann Building Products, Inc.]**
 - 3) **[Hohmann & Barnard, Inc]**
 - 4) **[Quality Steel and Wire LLC]**
 - 5) **[Wire-Bond]**
 - 6) **<Insert manufacturer's name>**
8. Masonry-Veneer Anchors; Slotted Plate with Prongs: Sheet metal anchor section, with screw holes at top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation; and raised rib-stiffened strap, stamped into center to provide a slot between strap and base for wire tie. [**Use self-adhering tape to seal penetration behind anchor plate.**]
- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
- 1) **[Hohmann & Barnard, Inc]**
 - 2) **[Wire-Bond]**
 - 3) **<Insert manufacturer's name>**
- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- 1) **[Hohmann & Barnard, Inc]**
 - 2) **[Wire-Bond]**
 - 3) **<Insert manufacturer's name>**
9. Masonry-Veneer Anchors; Single-Barrel Screw: Self-drilling, single-barrel screw designed to receive wire tie. Screw has a smooth barrel the same thickness as insulation.
- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

following] :

- 1) [3GEN Masonry Products, Inc.]
 - 2) [Heckmann Building Products, Inc.]
 - 3) [Hohmann & Barnard, Inc]
 - 4) [PROSOCO, Inc]
 - 5) [TruFast; a brand of Altenloh, Brinck & Co. US, Inc.]
 - 6) [Wire-Bond]
 - 7) <Insert manufacturer's name>
- b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- 1) [3GEN Masonry Products, Inc.]
 - 2) [Heckmann Building Products, Inc.]
 - 3) [Hohmann & Barnard, Inc]
 - 4) [PROSOCO, Inc]
 - 5) [TruFast; a brand of Altenloh, Brinck & Co. US, Inc.]
 - 6) [Wire-Bond]
 - 7) <Insert manufacturer's name>
- c. Factory Options: Provide factory-installed gasketed washer to seal at face of insulation and sheathing [**and a coating to reduce thermal conductivity**] .
- d. Seismic: Provide with seismic tie, clip, and continuous wire in veneer.
10. Masonry-Veneer Anchors; Single-Barrel Screw with Double-Pintle Wingnut: Self-drilling, single-barrel screw with wingnut or clip designed to receive double-pintle wire tie. Screw has a smooth barrel the same thickness as insulation.
- a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
- 1) [Heckmann Building Products, Inc.]
 - 2) [Hohmann & Barnard, Inc]
 - 3) <Insert manufacturer's name>
- b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- 1) [Heckmann Building Products, Inc.]
 - 2) [Hohmann & Barnard, Inc]
 - 3) <Insert manufacturer's name>
- c. Fastener Configuration: Single-barrel screw with [wingnut head][thermally resistant wingnut head][thermally resistant clip] .
- d. Factory Options: Provide factory-installed gasketed washer to seal at face of insulation and sheathing [**and a coating to reduce thermal conductivity**] .
- e. Seismic: Provide with seismic tie, clip, and continuous wire in veneer.
11. Masonry-Veneer Anchors; Seismic-Pintle Plate: Rib-stiffened, sheet metal anchor section with screw holes at top and bottom, projecting leg with slotted hole for vertical leg of seismic pintle tie.

Tie is rib-stiffened, sheet metal bent plate with down-turned leg to fit in anchor slot and with integral tabs to hold continuous wire in veneer.

- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - 1) **[Hohmann & Barnard, Inc]**
 - 2) **[Wire-Bond]**
 - 3) **<Insert manufacturer's name>**
- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[Hohmann & Barnard, Inc]**
 - 2) **[Wire-Bond]**
 - 3) **<Insert manufacturer's name>**
12. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, **No. 10 (4.83 mm)** diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours in accordance with ASTM B117.
13. Stainless Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, **No. 10 (4.83 mm)** diameter by length required to penetrate steel stud flange with not less than three exposed threads; either made from Type 410 stainless steel or made with a carbon-steel drill point and 300 Series stainless steel shank.

2.13 EMBEDDED FLASHING

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual."

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[3GEN Masonry Products, Inc.]**
 - b. **[Cheney Flashing Company]**
 - c. **[Hohmann & Barnard, Inc]**
 - d. **[Keystone Flashing Company, Inc]**
 - e. **[Wire-Bond]**
 - f. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[3GEN Masonry Products, Inc.]**
 - b. **[Cheney Flashing Company]**
 - c. **[Hohmann & Barnard, Inc]**
 - d. **[Keystone Flashing Company, Inc]**
 - e. **[Wire-Bond]**

f. <Insert manufacturer's name>

3. Stainless Steel: ASTM A240/A240M or ASTM A666/A666M, [Type 304][Type 316] , 0.016 inch (0.40 mm) thick.
4. Copper: [ASTM B370, Temper H00, cold-rolled copper sheet, 16 oz./sq. ft. (4.9 kg/sq. m) weight or 0.0216 inch (0.55 mm) thick][or][ASTM B370, Temper H01, high-yield copper sheet, 12 oz./sq. ft. (3.7 kg/sq. m) weight or 0.0162 inch (0.41 mm) thick] .
5. Fabricate continuous flashings in sections **96 inches (2438 mm)** long minimum, but not exceeding **12 ft. (3.7 m)**. Provide splice plates at joints of formed, smooth metal flashing.
6. Fabricate through-wall metal flashing embedded in masonry from [stainless steel][copper] , with sawtooth ribs at **3-inch (76-mm)** intervals along length of flashing to provide an integral mortar bond.
7. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
8. Fabricate through-wall flashing with drip edge [where][unless otherwise] indicated. Fabricate by extending flashing **1/2 inch (13 mm)** out from wall, with outer edge bent down 30 degrees [and hemmed] .
9. Fabricate through-wall flashing with sealant stop [where][unless otherwise] indicated. Fabricate by bending metal back on itself **3/4 inch (19 mm)** at exterior face of wall and down into joint **1/4 inch (6.4 mm)** to form a stop for retaining sealant backer rod.
10. Fabricate metal [drip edges][and][sealant stops] for sawtooth metal flashing from plain metal flashing of same metal as sawtooth flashing and extending at least **3 inches (76 mm)** into wall with hemmed inner edge to receive sawtooth flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam sheds water.
11. Fabricate metal drip edges from stainless steel. Extend at least **3 inches (76 mm)** into wall and **1/2 inch (13 mm)** out from wall, with outer edge bent down 30 degrees [and hemmed] .
12. Fabricate metal sealant stops from stainless steel. Extend at least **3 inches (76 mm)** into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for **3/4 inch (19 mm)** and down into joint **1/4 inch (6.4 mm)** to form a stop for retaining sealant backer rod.
13. Fabricate metal expansion-joint strips from [stainless steel][copper] to shapes indicated.
14. Solder metal items at corners.

B. Flexible Flashing: Where flashing is fully concealed in masonry, use one of the following unless otherwise indicated:

1. Copper-Fabric Flashing: Copper sheet bonded between two layers of glass-fiber cloth.
 - a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - 1) [Advanced Building Products Inc.]
 - 2) [Hohmann & Barnard, Inc]
 - 3) [STS Coatings, Inc.]
 - 4) [Wire-Bond]
 - 5) [York Manufacturing, Inc]
 - 6) <Insert manufacturer's name>
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - 1) [Advanced Building Products Inc.]
 - 2) [Hohmann & Barnard, Inc]

- 3) [STS Coatings, Inc.]
 - 4) [Wire-Bond]
 - 5) [York Manufacturing, Inc]
 - 6) <Insert manufacturer's name>
 - c. Sheet Weight: [3 oz./sq. ft. (0.9 kg/sq. m)][5 oz./sq. ft. (1.5 kg/sq. m)][7 oz./sq. ft. (2 kg/sq. m)] .
 - d. Sheet Type: [Non-adhesive][Self-adhesive] .
2. Asphalt-Coated Copper Flashing: Copper sheet coated with flexible asphalt.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - 1) [Hohmann & Barnard, Inc]
 - 2) [Wire-Bond]
 - 3) <Insert manufacturer's name>
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - 1) [Hohmann & Barnard, Inc]
 - 2) [Wire-Bond]
 - 3) <Insert manufacturer's name>
 - c. Sheet Weight: [5 oz./sq. ft. (1.5 kg/sq. m)][7 oz./sq. ft. (2 kg/sq. m)] .
3. Stainless Steel Fabric Flashing: Composite, flashing product consisting of minimum 2-mil- (0.05-mm-) thick stainless steel sheet, bonded to a layer of polymeric fabric.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - 1) [3GEN Masonry Products, Inc.]
 - 2) [Fiberweb, a brand of Clark/Hammerbeam Corp.]
 - 3) [Hohmann & Barnard, Inc]
 - 4) [PROSOCO, Inc]
 - 5) [STS Coatings, Inc.]
 - 6) [Wire-Bond]
 - 7) [York Manufacturing, Inc]
 - 8) <Insert manufacturer's name>
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - 1) [3GEN Masonry Products, Inc.]
 - 2) [Fiberweb, a brand of Clark/Hammerbeam Corp.]
 - 3) [Hohmann & Barnard, Inc]
 - 4) [PROSOCO, Inc]
 - 5) [STS Coatings, Inc.]

- 6) **[Wire-Bond]**
 - 7) **[York Manufacturing, Inc]**
 - 8) **<Insert manufacturer's name>**
- c. Grade: **[Type 304][Type 316]** .
 - d. Overall Thickness: Manufacturer's standard.
4. Self-Adhering, Stainless Steel Fabric Flashing: Composite, flashing product consisting of minimum **2-mil- (0.05-mm-)** thick stainless steel sheet, bonded to a layer of polymeric fabric.
- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - 1) **[3GEN Masonry Products, Inc.]**
 - 2) **[Hohmann & Barnard, Inc]**
 - 3) **[STS Coatings, Inc.]**
 - 4) **[VaproShield LLC]**
 - 5) **[Wire-Bond]**
 - 6) **[York Manufacturing, Inc]**
 - 7) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[3GEN Masonry Products, Inc.]**
 - 2) **[Hohmann & Barnard, Inc]**
 - 3) **[STS Coatings, Inc.]**
 - 4) **[VaproShield LLC]**
 - 5) **[Wire-Bond]**
 - 6) **[York Manufacturing, Inc]**
 - 7) **<Insert manufacturer's name>**
 - c. Grade: **[Type 304][Type 316]** .
 - d. Bonding Agent: **[Butyl][Permanent, clear]** adhesive.
 - e. Overall Thickness: Manufacturer's standard.
5. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film.
- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - 1) **[Advanced Building Products Inc.]**
 - 2) **[Carlisle Coatings & Waterproofing Inc]**
 - 3) **[Fiberweb, a brand of Clark/Hammerbeam Corp.]**
 - 4) **[GCP Applied Technologies Inc.]**
 - 5) **[Heckmann Building Products, Inc.]**
 - 6) **[Hohmann & Barnard, Inc]**
 - 7) **[Polyguard Products, Inc.]**
 - 8) **[W. R. Meadows, Inc]**

- 9) [Williams Products, Inc.]
 - 10) [Wire-Bond]
 - 11) [York Manufacturing, Inc]
 - 12) <Insert manufacturer's name>
- b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- 1) [Advanced Building Products Inc.]
 - 2) [Carlisle Coatings & Waterproofing Inc]
 - 3) [Fiberweb, a brand of Clark/Hammerbeam Corp.]
 - 4) [GCP Applied Technologies Inc.]
 - 5) [Heckmann Building Products, Inc.]
 - 6) [Hohmann & Barnard, Inc]
 - 7) [Polyguard Products, Inc.]
 - 8) [W. R. Meadows, Inc]
 - 9) [Williams Products, Inc.]
 - 10) [Wire-Bond]
 - 11) [York Manufacturing, Inc]
 - 12) <Insert manufacturer's name>
- c. Overall Thickness: Not less than [30 mils (0.76 mm)][40 mils (1.0 mm)][60 mils (1.5 mm)]
6. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin.
- a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
- 1) [DuPont de Nemours, Inc.]
 - 2) [GCP Applied Technologies Inc.]
 - 3) [Kingspan Insulation LLC]
 - 4) [Protecto Wrap Company]
 - 5) [Wire-Bond]
 - 6) [York Manufacturing, Inc]
 - 7) <Insert manufacturer's name>
- b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- 1) [DuPont de Nemours, Inc.]
 - 2) [GCP Applied Technologies Inc.]
 - 3) [Kingspan Insulation LLC]
 - 4) [Protecto Wrap Company]
 - 5) [Wire-Bond]
 - 6) [York Manufacturing, Inc]
 - 7) <Insert manufacturer's name>
- c. Overall Thickness: Not less than [35 mils (0.89 mm)][40 mils (1.0 mm)] .

7. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - 1) **[3GEN Masonry Products, Inc.]**
 - 2) **[Hohmann & Barnard, Inc]**
 - 3) **[Hyload; IKO Industries, Inc.]**
 - 4) **[Mortar Net Solutions]**
 - 5) **[Wire-Bond]**
 - 6) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[3GEN Masonry Products, Inc.]**
 - 2) **[Hohmann & Barnard, Inc]**
 - 3) **[Hyload; IKO Industries, Inc.]**
 - 4) **[Mortar Net Solutions]**
 - 5) **[Wire-Bond]**
 - 6) **<Insert manufacturer's name>**
 - c. Monolithic Sheet: Elastomeric thermoplastic flashing, **40 mils (1.0 mm)** thick.
 - d. Self-Adhesive Sheet: Elastomeric thermoplastic flashing, **25 mils (0.64 mm)** thick, with a **15-mil- (0.38-mm-)** thick coating of adhesive.
 - 1) Color: **[Gray][White][Tan/buff][Black]** .
8. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D4637/D4637M.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - 1) **[Carlisle Coatings & Waterproofing Inc]**
 - 2) **[Elevate; Amrize Building Envelope LLC]**
 - 3) **[Heckmann Building Products, Inc.]**
 - 4) **[Hohmann & Barnard, Inc]**
 - 5) **[Wire-Bond]**
 - 6) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[Carlisle Coatings & Waterproofing Inc]**
 - 2) **[Elevate; Amrize Building Envelope LLC]**
 - 3) **[Heckmann Building Products, Inc.]**
 - 4) **[Hohmann & Barnard, Inc]**

- 5) **[Wire-Bond]**
- 6) **<Insert manufacturer's name>**
- c. Thickness: **40 mils (1.0 mm)**.
- C. Drainage Plane Flashing: Provide flashing materials as follows:
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[3GEN Masonry Products, Inc.]**
 - b. **[Mortar Net Solutions]**
 - c. **[STS Coatings, Inc.]**
 - d. **[York Manufacturing, Inc]**
 - e. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[3GEN Masonry Products, Inc.]**
 - b. **[Mortar Net Solutions]**
 - c. **[STS Coatings, Inc.]**
 - d. **[York Manufacturing, Inc]**
 - e. **<Insert manufacturer's name>**
 - 3. Fabrication: **[Stainless steel][Copper][Rubberized asphalt][Elastomeric membrane]** and drainage membrane to shapes indicated [, **including weep tabs, termination bar, and drip edge]** .
 - a. Stainless Steel: ASTM A240/A240M or ASTM A666/A666M, **[Type 304][Type 316]** , **0.016 inch (0.40 mm)** thick.
 - b. Copper: **[3 oz./sq. ft. (0.9 kg/sq. m)][5 oz./sq. ft. (1.5 kg/sq. m)]** thick.
 - c. Rubberized Asphalt: **[40 mils (1.0 mm)][60 mils (1.5 mm)]** thick.
 - d. Elastomeric Membrane: **[EPDM complying with ASTM D4637/D4637M][PVC][PVC with Elvaloy Kee][TPO]** , **[40 mils (1.0 mm)][60 mils (1.5 mm)]** thick.
 - 4. Fabricate continuous flashings in sections **60 inches (1524 mm)** long, minimum.
- D. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from UV-resistant, high-density polyethylene. Cell flashing pans have integral weep spouts designed to be built into mortar bed joints and that extend into the cell to prevent clogging with mortar.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Mortar Net Solutions]**
 - b. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Mortar Net Solutions]**
- b. **<Insert manufacturer's name>**

- E. Preformed Corners, End Dams, and Seaming Shapes for Flashing: Flashing manufacturer's standard products or products recommended by flashing manufacturer for waterproofing openings.
- F. Solder and Sealants for Sheet Metal Flashings: [**As specified in Section 076200 "Sheet Metal Flashing and Trim."**]
 - 1. Solder for Stainless Steel: ASTM B32, **[Grade Sn60][Grade Sn96]** , with acid flux of type recommended by stainless steel sheet manufacturer.
 - 2. Solder for Copper: ASTM B32, **[Grade Sn50][with maximum lead content of 0.2 percent]** .
 - 3. Elastomeric Sealant: ASTM C920, chemically curing **[urethane][polysulfide][silicone]** sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.
- G. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
- H. Termination Bars for Flexible Flashing:
 - 1. Material: **[Aluminum][Stainless steel][Rigid PVC]**
 - 2. Size: **[0.075 by 1 inch (1.90 by 25 mm)][1/8 by 1 inch (3.2 by 25 mm)][1/8 by 1-1/8 inch (3.2 by 29 mm)]** .
- I. Termination Bars for Flexible Flashing, Flanged:
 - 1. Material: **[Stainless steel sheet 0.019 by 1-1/2 inches (0.48 by 38 mm)][Aluminum sheet 0.064 by 1-1/2 inches (1.63 by 38 mm)]** .
 - 2. Fabricate with a **3/8-inch (10-mm)** flange at top [**and bottom**] .

2.14 ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from **[neoprene][urethane][or][PVC]** .
- B. Preformed Control-Joint Gaskets: Made from **[styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805][or][PVC, complying with ASTM D2287, Type PVC-65406]** and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).
- D. Weep/Cavity Vents: Use one of the following unless otherwise indicated:
 - 1. Wicking Material: Absorbent rope, made from cotton, **1/4 to 3/8 inch (6.4 to 10 mm)** in diameter, in length required to produce **2-inch (51-mm)** exposure on exterior and **18 inches (457 mm)** in cavity. Use only for weeps.
 - 2. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, **3/8-inch (10-mm)** OD by **4 inches (102 mm)** long.
 - 3. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, **3/8 by 1-1/2 by 3-1/2 inches (10 by 38 by 89 mm)** long.

4. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth **1/8 inch (3.2 mm)** less than depth of outer wythe, in color selected from manufacturer's standard.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - 1) **[3GEN Masonry Products, Inc.]**
 - 2) **[Advanced Building Products Inc.]**
 - 3) **[Heckmann Building Products, Inc.]**
 - 4) **[Hohmann & Barnard, Inc]**
 - 5) **[Mortar Net Solutions]**
 - 6) **[Wire-Bond]**
 - 7) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[3GEN Masonry Products, Inc.]**
 - 2) **[Advanced Building Products Inc.]**
 - 3) **[Heckmann Building Products, Inc.]**
 - 4) **[Hohmann & Barnard, Inc]**
 - 5) **[Mortar Net Solutions]**
 - 6) **[Wire-Bond]**
 - 7) **<Insert manufacturer's name>**
5. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth **1/8 inch (3.2 mm)** less than depth of outer wythe; in color selected from manufacturer's standard.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - 1) **[CavClear; a division of Archovations, Inc.]**
 - 2) **[Hohmann & Barnard, Inc]**
 - 3) **[Keene Building Products]**
 - 4) **[Mortar Net Solutions]**
 - 5) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[CavClear; a division of Archovations, Inc.]**
 - 2) **[Hohmann & Barnard, Inc]**
 - 3) **[Keene Building Products]**
 - 4) **[Mortar Net Solutions]**
 - 5) **<Insert manufacturer's name>**
6. Vinyl Weep Hole/Vent: Units made from flexible PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a

top flap to keep mortar out of the head joint; in color selected by Architect.

- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- 1) **[Hohmann & Barnard, Inc]**
- 2) **[Williams Products, Inc.]**
- 3) **[Wire-Bond]**
- 4) **<Insert manufacturer's name>**

- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- 1) **[Hohmann & Barnard, Inc]**
- 2) **[Williams Products, Inc.]**
- 3) **[Wire-Bond]**
- 4) **<Insert manufacturer's name>**

- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Mortar Deflector:

- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- 1) **[Advanced Building Products Inc.]**
- 2) **[Hohmann & Barnard, Inc]**
- 3) **[Keene Building Products]**
- 4) **[Mortar Net Solutions]**
- 5) **[Wire-Bond]**
- 6) **[York Manufacturing, Inc]**
- 7) **<Insert manufacturer's name>**

- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- 1) **[Advanced Building Products Inc.]**
- 2) **[Hohmann & Barnard, Inc]**
- 3) **[Keene Building Products]**
- 4) **[Mortar Net Solutions]**
- 5) **[Wire-Bond]**
- 6) **[York Manufacturing, Inc]**
- 7) **<Insert manufacturer's name>**

- c. Size: Strips **[full depth of cavity][3/4 inch (19 mm) thick][1 inch (25 mm)][1-1/2 inches (38 mm) thick][2 inches (51 mm)]<Insert thickness>** and **[10 inches (254 mm)][16 inches (406 mm)]<Insert thickness>** high.
- d. Surface Drainage: **[Dovetail-shaped notches][Dimpled surface]** that prevents clogging

with mortar droppings.

2. Rainscreen Drainage Mat:

- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- 1) **[Advanced Building Products Inc.]**
- 2) **[CavClear; a division of Archovations, Inc.]**
- 3) **[Keene Building Products]**
- 4) **[Maxxon Corporation]**
- 5) **[Mortar Net Solutions]**
- 6) **[Wire-Bond]**
- 7) **<Insert manufacturer's name>**

- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- 1) **[Advanced Building Products Inc.]**
- 2) **[CavClear; a division of Archovations, Inc.]**
- 3) **[Keene Building Products]**
- 4) **[Maxxon Corporation]**
- 5) **[Mortar Net Solutions]**
- 6) **[Wire-Bond]**
- 7) **<Insert manufacturer's name>**

- c. Size: Sheets or strips not less than **[full depth of cavity][3/4 inch (19 mm)][1 inch (25 mm)][1-1/2 inches (38 mm) thick][2 inches (51 mm)]<Insert thickness>** thick and installed to full height of cavity.
- d. Surface Drainage: Provide additional strips **4 inches (102 mm)** high at weep holes and thick enough to fill entire depth of cavity to prevent weep holes from clogging with mortar.

- F. Masonry Cell Fill: **[Loose-Fill Insulation: Perlite complying with ASTM C549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation)][Lightweight-Aggregate Fill: ASTM C331/C331M][Foamed-in-place masonry cell fill]** .

- G. Proprietary Acidic Masonry Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- a. **[Diedrich Technologies, Inc.; a Hohmann & Barnard company]**
- b. **[EaCo Chem, Inc.]**
- c. **[PROSOCO, Inc]**
- d. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert**

manufacturer's name; product name or designation> or comparable product by one of the following:

- a. **[Diedrich Technologies, Inc.; a Hohmann & Barnard company]**
- b. **[EaCo Chem, Inc.]**
- c. **[PROSOCO, Inc]**
- d. **<Insert manufacturer's name>**

2.15 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use **[portland cement-lime][masonry cement][or][mortar cement]** mortar unless otherwise indicated.
 - 3. For exterior masonry, use **[portland cement-lime][masonry cement][or][mortar cement]** mortar.
 - 4. For reinforced masonry, use **[portland cement-lime][masonry cement][or][mortar cement]** mortar.
 - 5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C270, **[Proportion][Property]** Specification. Provide the following types of mortar for applications stated unless another type is indicated **[or needed to provide required compressive strength of masonry]** .
 - 1. For masonry below grade or in contact with earth, use Type M.
 - 2. For reinforced masonry, use **[Type M][Type S][Type N]** .
 - 3. For mortar parge coats, use **[Type S][or][Type N]** .
 - 4. For exterior, above-grade, load-bearing, nonload-bearing walls, and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
 - 5. For interior nonload-bearing partitions, Type O may be used instead of Type N.
- D. Pigmented Mortar: Use colored cement product **[or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored mortar cement]** .
 - 1. Pigments do not exceed 10 percent of portland cement by weight.
 - 2. Pigments do not exceed 5 percent of **[masonry cement][or][mortar cement]** by weight.
 - 3. Mix to match Architect's sample.
 - 4. Application: Use pigmented mortar for exposed mortar joints with the following units: **<Insert masonry unit types>** .
- E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 - 1. Mix to match Architect's sample.
 - 2. Application: Use colored-aggregate mortar for exposed mortar joints with the following units: **<Insert masonry unit types>** .

- F. Grout for Unit Masonry: Comply with ASTM C476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 402/602 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C476, **[Table 1][or][paragraph 4.2.1.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa)]**.
 3. Provide grout with a slump of **[8 to 11 inches (203 to 279 mm)][10 to 11 inches (254 to 279 mm)]** as measured in accordance with ASTM C143/C143M.
- G. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.
1. Application: Use epoxy pointing mortar for exposed mortar joints with the following units: **<Insert masonry unit types>**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
 4. Verify that substrates are free of substances that impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

- G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds **30 g/30 sq. in. (30 g/194 sq. cm)** per minute when tested in accordance with ASTM C67/C67M. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than **1/2 inch (13 mm)** or minus **1/4 inch (6.4 mm)**.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus **1/2 inch (13 mm)**.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus **1/4 inch (6.4 mm)** in a story height or **1/2 inch (13 mm)** total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than **1/4 inch in 10 ft. (6.4 mm in 3 m)**, or **1/2-inch (13-mm)** maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than **1/8 inch in 10 ft. (3.2 mm in 3 m)**, **1/4 inch in 20 ft. (6.4 mm in 6 m)**, or **1/2-inch (13-mm)** maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than **1/4 inch in 10 ft. (6.4 mm in 3 m)**, **3/8 inch in 20 ft. (10 mm in 6 m)**, or **1/2-inch (13-mm)** maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than **1/8 inch in 10 ft. (3.2 mm in 3 m)**, **1/4 inch in 20 ft. (6.4 mm in 6 m)**, or **1/2-inch (13-mm)** maximum.
5. For lines and surfaces, do not vary from straight by more than **1/4 inch in 10 ft. (6.4 mm in 3 m)**, **3/8 inch in 20 ft. (10 mm in 6 m)**, or **1/2-inch (13-mm)** maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than **1/4 inch in 10 ft. (6.4 mm in 3 m)**, or **1/2-inch (13-mm)** maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than **1/16 inch (1.6 mm)** except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus **1/8 inch (3.2 mm)**, with a maximum thickness limited to **1/2 inch (13 mm)**.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than **1/8 inch (3.2 mm)**.
3. For head and collar joints, do not vary from thickness indicated by more than plus **3/8 inch (10 mm)** or minus **1/4 inch (6.4 mm)**.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus **1/8 inch (3.2 mm)**. [**Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3.2 mm).**]
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than **1/16 inch (1.6 mm)** from one masonry unit to the next.

3.4 INSTALLATION OF MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-

half-size units, particularly at corners, jambs, and, where possible, at other locations.

- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in **[running bond][stack bond][one-third running bond][Flemish bond][English bond][bond pattern indicated on Drawings]** ; do not use units with less-than-nominal **4-inch (102-mm)** horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than **[2 inches (51 mm)][4 inches (102 mm)]** . Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal **4-inch (102-mm)** horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-In Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout **24 inches (610 mm)** under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Rigid, Cellular Thermal Insulation, CMUs: Install molded-polystyrene insulation units into masonry unit cells before laying units.
- J. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of hollow CMUs solidly around plastic tubes of anchors, and push tubes down into grout to provide **1/2-inch (13-mm)** clearance between end of anchor rod and end of tube. Space anchors **[48 inches (1219 mm)]<Insert spacing>** o.c. unless otherwise indicated.
 - 3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."

3.5 INSTALLATION OF MORTAR BEDDING AND JOINTING

- A. General: Lay masonry units as follows:
 - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
 - 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- B. Hollow Clay Facing Brick: Lay units with completely filled bed and head joints; butter ends with sufficient

mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

- C. Solid Masonry Units: Lay units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- D. Structural Clay Facing Tiles: Lay units as follows:
 - 1. Lay vertical-cell units with full head joints unless otherwise indicated. Provide bed joints with full mortar coverage on face shells and webs.
 - 2. Lay horizontal-cell units with full bed joints unless otherwise indicated. Keep drainage channels, if any, free of mortar. Form head joints with sufficient mortar so excess will be squeezed out as units are placed in position. Butter both sides of units to be placed, or butter one side of unit already in place and one side of unit to be placed.
 - 3. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with **1/4- to 3/8-inch- (6.4- to 10-mm-)** thick joints.
- E. Firebox Brick: Set units in full bed of refractory mortar with full head joints. Form joints by buttering both surfaces of adjoining brick and sliding it into place. Make joints just wide enough to accommodate variations in size of brick, approximately **1/8 inch (3.2 mm)**. Tool joints smooth on surfaces exposed to fire or smoke.
- F. Clay Flue Lining Units: Install units to comply with ASTM C1283. Install flue liners ahead of surrounding masonry. Set clay flue liners in full bed of refractory mortar **1/16 to 1/8 inch (1.6 to 3.2 mm)** thick. Strike joints flush on inside of flue to provide smooth surface. Maintain expansion space between flue liner and surrounding masonry except where surrounding masonry is required to provide lateral support for flue liners.
- G. Trim Units: Set **[stone][cast-stone]** trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
 - 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 - 2. Allow cleaned surfaces to dry before setting.
 - 3. Wet joint surfaces thoroughly before applying mortar.
 - 4. Rake out mortar joints for pointing with sealant.
- H. Rake out mortar joints at **[prefaced CMUs][glazed brick][and][glazed structural clay facing tile]** to a uniform depth of **1/4 inch (6.4 mm)** and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.
- I. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
 - 1. For glazed masonry units, use a nonmetallic jointer **3/4 inch (19 mm)** or more in width.
- J. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- K. Cut joints flush where indicated to receive **[waterproofing][cavity wall insulation][air barriers]** unless otherwise indicated.

3.6 INSTALLATION OF COMPOSITE MASONRY

- A. Bond wythes of composite masonry together **[using one of the following methods][as follows]** :

1. Individual Wire Ties: Provide ties as indicated installed in horizontal joints, but not less than one metal tie for [4.5 sq. ft. (0.42 sq. m)][2.67 sq. ft. (0.25 sq. m)][1.77 sq. ft. (0.16 sq. m)] of wall area spaced not to exceed [36 inches (914 mm)][24 inches (610 mm)][16 inches (406 mm)] o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (914 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
 - a. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) ties.
 2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use [ladder-type reinforcement extending across both wythes][tab-type reinforcement] .
 - b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement [with continuous horizontal wire in facing wythe attached to ties] .
 3. Header Bonding: Provide masonry unit headers extending not less than 3 inches (76 mm) into each wythe. Space headers not more than [8 inches (200 mm)][12 inches (300 mm)] clear horizontally and 16 inches (400 mm) clear vertically.
- B. Bond wythes of composite masonry together using bonding system indicated on Drawings.
- C. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.
1. Structural Clay Facing Tile: After each course is laid, fill the vertical, longitudinal joint between wythes solidly with mortar at [exterior walls, except cavity walls][, and][interior walls and partitions] .
- D. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.
1. Provide continuity with masonry-joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.
- E. Intersecting and Abutting Walls: Unless vertical expansion or control joints are indicated at juncture, bond walls together as follows:
1. Provide individual wire ties not more than [8 inches (203 mm)][16 inches (406 mm)] o.c.
 2. Provide continuity with masonry-joint reinforcement by using prefabricated T-shaped units.
 3. Provide rigid metal anchors not more than [24 inches (610 mm)][48 inches (1219 mm)] o.c. If used with hollow masonry units, embed ends in mortar-filled cores.
- 3.7 INSTALLATION OF CAVITY WALLS
- A. Bond wythes of cavity walls together as follows:
1. Individual Wire Ties: Provide ties as indicated installed in horizontal joints, but not less than one metal tie for [4.5 sq. ft. (0.42 sq. m)][2.67 sq. ft. (0.25 sq. m)][1.77 sq. ft. (0.16 sq. m)] of wall area spaced not to exceed [36 inches (914 mm)][24 inches (610 mm)][16 inches (406 mm)] o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (914 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.

- a. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) ties.
 - b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) ties to allow for differential movement regardless of whether bed joints align.
2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use **[ladder-type reinforcement extending across both wythes][tab-type reinforcement]** .
 - b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement **[with continuous horizontal wire in facing wythe attached to ties]** .
 - c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) reinforcement **[with continuous horizontal wire in facing wythe attached to ties]** to allow for differential movement regardless of whether bed joints align.
 3. Header Bonding: Provide masonry unit headers extending not less than **3 inches (76 mm)** into each wythe. Space headers not more than **[8 inches (203 mm)][12 inches (305 mm)]** clear horizontally and **16 inches (406 mm)** clear vertically.
 4. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Bond wythes of cavity walls together using bonding system indicated on Drawings.
 - C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
 - D. Parge cavity face of backup wythe in a single coat approximately **3/8 inch (10 mm)** thick. Trowel face of parge coat smooth.
 - E. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately **12 inches (305 mm)** o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as indicated.
 1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.8 INSTALLATION OF ANCHORED MASONRY VENEERS

- A. Masonry-veneer anchors to comply with the following requirements:
 1. Fasten **[screw-attached][and][seismic]** anchors **[through sheathing to wall framing][and][to concrete and masonry backup]** with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 2. Embed **[tie sections][connector sections and continuous wire]** in masonry joints.
 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 4. Space anchors as indicated, but not more than **18 inches (457 mm)** o.c. vertically and **24 inches (610 mm)** o.c. horizontally, with not less than one anchor for each **2 sq. ft. (0.2 sq. m)** of wall area. Install additional anchors within **12 inches (305 mm)** of openings and at intervals, not exceeding **8 inches (203 mm)**, around perimeter.
 5. Space anchors as indicated, but not more than **16 inches (406 mm)** o.c. vertically and **25 inches (635 mm)** o.c. horizontally, with not less than one anchor for each **[2.67 sq. ft. (0.25 sq. m)][3.5 sq. ft. (0.33 sq. m)]** of wall area. Install additional anchors within **12 inches (305 mm)** of openings and at intervals, not exceeding **36 inches (914 mm)**, around perimeter.

6. Space anchors as indicated, but not more than **18 inches (457 mm)** o.c. vertically and horizontally. Install additional anchors within **12 inches (305 mm)** of openings and at intervals, not exceeding **24 inches (610 mm)**, around perimeter.
- B. Provide not less than **[2 inches (51 mm)][1 inch (25 mm)]<Insert distance>** of airspace between back of masonry veneer and face of **[sheathing][insulation]** .
 1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.9 INSTALLATION OF MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of **5/8 inch (16 mm)** on exterior side of walls, **1/2 inch (13 mm)** elsewhere. Lap reinforcement a minimum of **6 inches (152 mm)**.
 1. Space reinforcement not more than **16 inches (406 mm)** o.c.
 2. Space reinforcement not more than **8 inches (203 mm)** o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than **8 inches (203 mm)** above and below wall openings and extending **12 inches (305 mm)** beyond openings **[in addition to continuous reinforcement]** .
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at **[corners,]** returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.10 INSTALLATION OF ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
 1. Provide an open space not less than **[1/2 inch (13 mm)][1 inch (25 mm)][2 inches (51 mm)]** wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 3. Space anchors as indicated, but not more than **24 inches (610 mm)** o.c. vertically and **36 inches (914 mm)** o.c. horizontally.

3.11 INSTALLATION OF CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Indicate locations of joints on Drawings. Form control joints in concrete masonry as follows:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint **4 inches (102 mm)** in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
2. Build flanges of factory-fabricated, expansion-joint units into masonry.
3. Build in compressible joint fillers where indicated.
4. Form open joint full depth of brick wythe and of width indicated, but not less than **[3/8 inch (10 mm)][1/2 inch (13 mm)]<Insert minimum width>** for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

D. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than **[3/8 inch (10 mm)]<Insert minimum width>**.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.12 INSTALLATION OF LINTELS

- A. Provide lintel types where indicated on Drawings and where openings of more than **12 inches (305 mm)** for brick-size units and **24 inches (610 mm)** for block-size units are indicated without structural steel or other supporting lintels.
- B. Provide minimum bearing of **8 inches (203 mm)** at each jamb unless otherwise indicated.

3.13 INSTALLATION OF EMBEDDED FLASHING

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. **[Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.]**
- B. Install flashing as follows unless otherwise indicated:
 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape **[as recommended by flashing manufacturer]**.
 2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of **[4 inches (102 mm)][8 inches (203 mm)]**, and through inner wythe to within **1/2 inch (13 mm)** of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately **2 inches (51 mm)** on interior face.
 3. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of **[4 inches (102 mm)][8 inches (203 mm)]**, and **1-1/2 inches (38 mm)** into the inner wythe. **[Form 1/4-inch (6.4-mm) hook in edge of flashing embedded in inner wythe.]**

4. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least **8 inches (203 mm)**; with upper edge tucked under **[water-resistive barrier][air barrier]**, lapping at least **4 inches (102 mm)**. **[Fasten upper edge of flexible flashing to sheathing through termination bar.]**
 5. At lintels and shelf angles, extend flashing **6 inches (152 mm)** minimum **[, to edge of next full unit]** at each end. At heads and sills, extend flashing **6 inches (152 mm)** minimum **[, to edge of next full unit]** and turn ends up not less than **2 inches (51 mm)** to form end dams.
 6. Interlock end joints of sawtooth sheet metal flashing by overlapping ribs not less than **1-1/2 inches (38 mm)** or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 7. Install metal **[drip edges][and][sealant stops]** with sawtooth sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 8. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing **1/2 inch (13 mm)** back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
 9. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing **1/2 inch (13 mm)** back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
 10. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Single-Wythe CMU Flashing System: Install in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.
- D. Install reglets and nailers for flashing and other related construction where they are indicated to be built into masonry.

3.14 INSTALLATION OF WEEP/CAVITY VENTS

- A. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.
1. Use **[specified weep/cavity vents][or][open-head joints]** to form weep holes.
 2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
 3. Space weep holes **24 inches (610 mm)** o.c. unless otherwise indicated.
 4. Space weep holes formed from **[plastic tubing][or][wicking material]** **16 inches (406 mm)** o.c.
 5. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
 6. Trim wicking material flush with outside face of wall after mortar has set.
- B. Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than **2 inches (51 mm)**, to maintain drainage.
1. Fill cavities full height by placing pea gravel in cavities as masonry is laid, so that at any point, masonry does not extend more than **24 inches (610 mm)** above top of pea gravel.
- C. Cavity Drainage Material: Place in **[cavities][airspace behind veneers]** to comply with configuration requirements for cavity drainage material in "Accessories" Article.
- D. Install cavity vents in head joints in exterior wythes at spacing indicated. Use **[specified weep/cavity vent][or][open-head joints]** to form cavity vents.

1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.15 INSTALLATION OF REINFORCED UNIT MASONRY

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 402/602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 1. Comply with requirements in TMS 402/602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than **[60 inches (1524 mm)]****[12.67 ft. (3.86 m)]****<Insert height>** .

3.16 INSTALLATION OF MASONRY CELL FILL

- A. Loose-Fill Insulation: Pour into cavities to fill void spaces. Maintain inspection ports to show presence of fill at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of fill to one story high, but not more than **20 ft. (6 m)**.
- B. Lightweight-Aggregate Fill: Pour into cavities to fill void spaces. Maintain inspection ports to show presence of fill at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of fill to one story high, but not more than **20 ft. (6 m)**.
- C. Foamed-in-Place Masonry Cell Fill: Drill holes in mortar bed joints at spacing as indicated in writing by foamed-in-place masonry fill manufacturer, and inject foam to fill masonry cell voids.

3.17 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage]****[Engage]** a qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements will be at Contractor's expense.
- B. Inspections: Special inspections in accordance with **[Level 2]****[Level 3]** in TMS 402/602.
 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 3. Place grout only after inspectors have verified proportions of site-prepared grout.

- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each **5000 sq. ft. (464 sq. m)** of wall area or portion thereof.
- E. Concrete Masonry Units: Test each type of unit provided, in accordance with ASTM C140/C140M for compressive strength.
- F. Clay Masonry Units: Test each type of unit provided, in accordance with ASTM C67/C67M for compressive strength.
- G. Mortar Aggregates: Ratio test (Proportion Specification) for each mix provided, in accordance with ASTM C780.
- H. Mortar: Test each mix provided in accordance with ASTM C780. Test mortar for **[mortar air content][and][compressive strength]** .
- I. Grout: Test each mix provided in accordance with ASTM C1019.
- J. Prism Test: For each type of construction provided, in accordance with ASTM C1314 at **[7 days and at]** 28 days.

3.18 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of **3/4 inch (19 mm)**. Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of **1/8 inch per foot (3.2 mm per 305 mm)**. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.19 REPAIRING AND POINTING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

3.20 CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison

purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.

3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean concrete masonry by applicable cleaning methods indicated in TEK 08-04A.
7. Clean masonry with a proprietary acidic masonry cleaner applied in accordance with manufacturer's written instructions.

3.21 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 1. Crush masonry waste to less than **4 inches (102 mm)** in each dimension.
 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
 3. Do not dispose of masonry waste as fill within **18 inches (457 mm)** of finished grade.
- C. Masonry Waste Recycling: Return broken masonry units not used as fill to manufacturer for recycling.
- D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 20 00 00

SECTION 04 20 00 00A - MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Clay masonry units.
2. Concrete masonry units.
3. Mortar materials.
4. Ties and anchors.
5. Embedded flashing.
6. Accessories.
7. Mortar mixes.

B. Products Installed, but Not Furnished, under This Section:

1. Cast-stone trim in masonry veneer.
2. Stone trim units in masonry veneer.
3. Steel lintels in masonry veneer.
4. Steel shelf angles for supporting masonry veneer.

C. Related Requirements:

1. Section 014339 "Mockups" for integrated exterior mockup requirements.
2. Section 019119.43 "Exterior Enclosure Commissioning."
3. Section 033000 "Cast-in-Place Concrete" for [**installing**] dovetail slots or channel slots for masonry-veneer anchors.
4. Section 034100 "Precast Structural Concrete" for thin brick veneer.
5. Section 034500 "Precast Architectural Concrete" for thin brick veneer.
6. Section 042000 "Unit Masonry" for multi-wythe masonry veneer assemblies.
7. Section 042200 "Concrete Unit Masonry" for full-size, single-wythe CMU assemblies.
8. Section 044200 "Exterior Stone Cladding" for stone trim secured with stone anchors.
9. Section 044313.13 "Anchored Stone Masonry Veneer" for thin stone trim set as anchored veneer.
10. Section 044313.16 "Adhered Stone Masonry Veneer" for thin stone trim set as adhered veneer.
11. Section 047200 "Cast Stone Masonry" for cast-stone trim units.
12. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural-steel frame.
13. Section 071900 "Water Repellents" for water repellents applied to masonry veneer assemblies.
14. Section 072500 "Weather Barriers" for weather barriers part of masonry veneer assemblies.
15. Section 076200 "Sheet Metal Flashing and Trim" for [**exposed**] sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.
16. Section 092900 "Gypsum Board" for exterior backer board part of masonry veneer assemblies.

1.2 ALLOWANCES

- A. See Section 012100 "Allowances" for description of allowances affecting items specified in this Section.

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Exposed: Weather-exposed side of a constructed wall.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference [at **Project site**][by web conference]<Insert **location**> .

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Indicate sizes, profiles, coursing, and locations of special shapes.
 - 2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Initial Selection:
 - 1. Hollow Clay Facing Brick: [**Small-scale units**][**Full-size units, minimum of five**] .
 - 2. Solid Clay Facing Brick: [**Small-scale units**][**Full-size units, minimum of five**] .
 - 3. Thin Brick: [**Small-scale units**][**Full-size units, minimum of five**] .
 - 4. Glazed Brick: [**Small-scale units**][**Full-size units, minimum of five**] .
 - 5. Architectural CMUs: [**Small-scale units**][**Full-size units, minimum of five**] .
 - 6. Thin CMUs: [**Small-scale units**][**Full-size units, minimum of five**] .
 - 7. Concrete Facing Brick: [**Small-scale units**][**Full-size units, minimum of five**] .
 - 8. Colored Mortar: Full range of manufacturer's standard colors.
 - 9. Aggregate for Mortar: Range of aggregate colors for colored-aggregate mortar.
 - 10. Weep/cavity vents.
- D. Samples for Verification: For each type and color of the following:
 - 1. Hollow Clay Facing Brick: [**Small-scale units**][**Full-size units, minimum of five**] .
 - 2. Thin Brick: [**Small-scale units**][**Full-size units, minimum of five**] .
 - 3. Solid Clay Facing Brick: [**Small-scale units**][**Full-size units, minimum of five**] .
 - 4. Glazed Brick: [**Small-scale units**][**Full-size units, minimum of five**] .
 - 5. Architectural CMUs: [**Small-scale units**][**Full-size units, minimum of five**] .
 - 6. Thin CMUs: [**Small-scale units**][**Full-size units, minimum of five**] .
 - 7. Concrete Facing Brick: [**Small-scale units**][**Full-size units, minimum of five**] .
 - 8. Special Masonry Shapes: One of each unique shape.
 - 9. Colored Mortar: Full range of manufacturer's standard colors.
 - 10. Pigmented Mortar: Make Samples using same sand and mortar ingredients to be used on Project.
 - 11. Colored-Aggregate Mortar: Make Samples using same sand and mortar ingredients to be used on Project.
 - 12. Weep/cavity vents.
 - 13. Cavity drainage material.
 - 14. Accessories embedded in masonry.
- E. Sustainable Design Submittals:

1. Environmental Product Declaration (EPD): For each product.
2. Health Product Declaration (HPD): For each product.
3. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
4. Environmental Product Declaration (EPD): For each product.
5. Health Product Declaration (HPD): For each product.
6. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
7. Environmental Product Declaration (EPD): For each product.
8. Environmental Product Declaration (EPD): For each product.
9. Environmental Product Declaration (EPD): For each product.
10. Third-Party Certifications: For each product.
11. Third-Party-Certified Life-Cycle Assessment: For each product.
12. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.

1.6 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and include source of aggregates.
 1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to attention of Architect and approved in writing.
- B. Material Certificates: For each type and size of the following:
 1. Masonry units.
 - a. Include **[data on material properties][material test reports substantiating compliance with requirements]** .
 - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include test report for efflorescence in accordance with ASTM C67/C67M.
 - d. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing in accordance with ASTM C67/C67M **[or a list of addresses of buildings in Project's area where proposed brick has been used successfully and with a history of durability]** .
 2. Integral water repellent used in decorative CMUs.
 3. Cementitious Materials: Include name of manufacturer, brand name, and type.
 4. Mortar admixtures.
 5. Preblended, Dry Mortar Mixes: Include description of type and proportions of ingredients.
 6. Anchors, ties, and metal accessories.
- C. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.
 1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
- D. Qualification Statements: For testing agency.

- E. Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements for [cold][and][hot] weather.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: All masonry flashing installers must complete the International Masonry Institute Flashing Upgrade training course.
- B. Testing Agency Qualifications: Qualified in accordance with ASTM C1093 for testing indicated.

1.8 MOCKUPS

- A. Sample Panel Mockups: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
 - 1. Build sample panels for [each type of exposed masonry veneer construction][typical exterior wall][typical interior wall][typical exterior and interior walls] in sizes approximately [48 inches (1219 mm)][60 inches (1524 mm)]<Insert dimension> long by [36 inches (914 mm)][48 inches (1219 mm)]<Insert dimension> high [by full thickness] .
 - 2. Build sample panels facing south.
 - 3. Where masonry is to match existing, build panels adjacent and parallel to existing surface.
 - 4. Clean [one-half of] exposed faces of panels with masonry cleaner indicated.
 - 5. Protect approved sample panels from the elements with weather-resistant membrane.
 - 6. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless Owner specifically approves such deviations by Change Order.
- B. Wall Mockups: Build mockups [to verify selections made under Sample submittals][to demonstrate aesthetic effects][to set quality standards for materials and execution][and][to set quality standards for installation] . [See Section 014339 "Mockups" for additional construction requirements for integrated exterior mockups.]
 - 1. Build mockup [as indicated on Drawings]<Insert mockup requirements> .
 - 2. Build mockups for [each type of exposed masonry veneer construction][typical exterior wall] in sizes approximately [48 inches (1219 mm)][60 inches (1524 mm)][72 inches (1829 mm)][96 inches (2438 mm)]<Insert dimension> long by [36 inches (914 mm)][48 inches (1219 mm)][60 inches (1524 mm)][72 inches (1829 mm)]<Insert dimension> high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches (406 mm) long in [each] mockup.
 - b. Include lower corner of window opening [, framed with stone trim,] at upper corner of exterior wall mockup. Make opening approximately 12 inches (305 mm) wide by 16 inches (406 mm) high.
 - c. Include through-wall flashing installed for a 24-inch (610-mm) length in corner of exterior wall mockup approximately 16 inches (406 mm) down from top of mockup, with a 12-inch (305-mm) length of flashing left exposed to view (omit masonry above half of flashing).
 - d. Include wall substrate and cavity materials, veneer anchors, flashing [, cavity drainage

material] , and weep holes in exterior masonry-veneer wall mockup.

3. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
4. Clean [**one-half of**] exposed faces of mockups with masonry cleaner as indicated.
5. Protect accepted mockups from the elements with weather-resistant membrane.
6. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
7. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If the units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of veneer, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 1. Extend cover a minimum of **24 inches (610 mm)** down face of veneer, and hold cover securely in place.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry. Immediately remove grout, mortar, and soil that come in contact with masonry.
 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace masonry veneer damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 402/602.
 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is **40 deg F (4 deg C)** and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 402/602.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain **[exposed masonry units][cementitious mortar components][and][mortar aggregate]** from single **[source][producer][or][manufacturer]** .
- B. For **[exposed masonry units][and][cementitious mortar components]** , obtain each color and grade from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 MASONRY VENEER, GENERAL

- A. Masonry Standard: Comply with TMS 402/602, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work **[and will be within 20 ft. (6 m) vertically and horizontally of a walking surface]** .
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
1. Where fire-resistance-rated construction is indicated, units are listed by UL or a qualified testing agency acceptable to authorities having jurisdiction.

2.3 CLAY MASONRY UNITS

- A. Regional Materials: Verify brick is manufactured within 100 miles (160 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles (160 km) of Project site.
- B. Regional Materials: Verify brick is manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site. If materials are transported by rail or water, multiply the distance by 0.25 to determine the distance to Project site.
- C. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.
1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications **[where stretcher units cannot accommodate special conditions, including corners, movement joints, bond beams, sashes, and lintels][requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing][where shapes produced by sawing would result in sawed surfaces]**

being exposed to view] .

- D. Hollow Clay Facing Brick: ASTM C652, Grade [SW][MW] , Type [HBX][HBS][HBA] , Class H40V.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [Acme Brick Company]
 - b. [Belden Brick Company (The)]
 - c. [Bilco Brick Company]
 - d. [Echelon Masonry, an Oldcastle APG brand]
 - e. [Endicott Clay Products Co]
 - f. [General Shale, Inc.]
 - g. [Glen-Gery Corporation]
 - h. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Acme Brick Company]
 - b. [Belden Brick Company (The)]
 - c. [Bilco Brick Company]
 - d. [Echelon Masonry, an Oldcastle APG brand]
 - e. [Endicott Clay Products Co]
 - f. [General Shale, Inc.]
 - g. [Glen-Gery Corporation]
 - h. <Insert manufacturer's name>
 3. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested in accordance with ASTM C67/C67M.
 4. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."
 5. Surface Coating: Brick with colors or textures produced by application of coatings withstand 50 cycles of freezing and thawing in accordance with ASTM C67/C67M with no observable difference in the applied finish when viewed from 10 ft. (3 m)[or have a history of successful use in Project's area] .
 6. Size (Actual Dimensions): [2-3/4 inches (70 mm)][3 inches (76 mm)][3-1/2 inches (89 mm)][3-5/8 inches (92 mm)]<Insert dimension> wide by [2-1/4 inches (57 mm)][2-3/4 inches (70 mm)][2-5/8 inches (67 mm)][2-13/16 inches (71 mm)][3-1/2 inches (89 mm)][3-5/8 inches (92 mm)][7-1/2 inches (190 mm)][7-5/8 inches (194 mm)]<Insert dimension> high by [7-1/2 inches (190 mm)][7-5/8 inches (194 mm)][8 inches (203 mm)][9-5/8 inches (244 mm)][11-1/2 inches (292 mm)][11-5/8 inches (295 mm)]<Insert dimension> long.
 7. Application: Use for exposed brick unless otherwise indicated.
 8. [Where indicated to "match existing,"] provide facing brick matching color range, texture, and size of existing adjacent brickwork.
 9. Color and Texture: [Medium brown, wire cut][Full-range red, sand molded][Buff, velour][Match Architect's samples][As selected by Architect] .
- E. Solid Clay Facing Brick: ASTM C216, Grade [SW][MW] , Type [FBX][FBS][FBA] .
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the

following] :

- a. [Acme Brick Company]
- b. [Belden Brick Company (The)]
- c. [Bilco Brick Company]
- d. [Boral Bricks, Inc; Boral Limited]
- e. [Echelon Masonry, an Oldcastle APG brand]
- f. [Endicott Clay Products Co]
- g. [General Shale, Inc.]
- h. [Glen-Gery Corporation]
- i. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Acme Brick Company]
- b. [Belden Brick Company (The)]
- c. [Bilco Brick Company]
- d. [Boral Bricks, Inc; Boral Limited]
- e. [Echelon Masonry, an Oldcastle APG brand]
- f. [Endicott Clay Products Co]
- g. [General Shale, Inc.]
- h. [Glen-Gery Corporation]
- i. <Insert manufacturer's name>

- 3. Initial Rate of Absorption: Less than **30 g/30 sq. in. (30 g/194 sq. cm)** per minute when tested in accordance with ASTM C67/C67M.
- 4. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."
- 5. Surface Coating: Brick with colors or textures produced by application of coatings withstand 50 cycles of freezing and thawing in accordance with ASTM C67/C67M with no observable difference in the applied finish when viewed from **10 ft. (3 m)** [or have a history of successful use in Project's area] .
- 6. Size (Actual Dimensions): [**2-3/4 inches (70 mm)**][**3 inches (76 mm)**][**3-1/2 inches (89 mm)**][**3-5/8 inches (92 mm)**]<Insert dimension> wide by [**2-1/4 inches (57 mm)**][**2-3/4 inches (70 mm)**][**2-5/8 inches (67 mm)**][**2-13/16 inches (71 mm)**][**3-1/2 inches (89 mm)**][**3-5/8 inches (92 mm)**][**7-1/2 inches (190 mm)**][**7-5/8 inches (194 mm)**]<Insert dimension> high by [**7-1/2 inches (190 mm)**][**7-5/8 inches (194 mm)**][**8 inches (203 mm)**][**9-5/8 inches (244 mm)**][**11-1/2 inches (292 mm)**][**11-5/8 inches (295 mm)**]<Insert dimension> long.
- 7. Application: Use for exposed brick unless otherwise indicated.
- 8. [Where indicated to "match existing,"] provide facing brick matching color range, texture, and size of existing adjacent brickwork.
- 9. Color and Texture: [**Medium brown, wire cut**][**Full-range red, sand molded**][**Buff, velour**][**Match Architect's samples**][**As selected by Architect**] .
- 10. Solid Building Brick: ASTM C62, Grade [**SW**][**MW**][**NW**] .

- F. Glazed Brick: ASTM C126, Grade [**S**][**SS**] .

- 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [Belden Brick Company (The)]

- b. **[Elgin Butler Company]**
 - c. **[Glen-Gery Corporation]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Belden Brick Company (The)]**
 - b. **[Elgin Butler Company]**
 - c. **[Glen-Gery Corporation]**
 - d. **<Insert manufacturer's name>**
 3. Size (Actual Dimensions): **3-5/8 inches (92 mm)** wide by **[2-1/4 inches (57 mm)][2-3/4 inches (70 mm)][3-5/8 inches (92 mm)][7-5/8 inches (194 mm)]** high by **[7-5/8 inches (194 mm)][8 inches (203 mm)][11-5/8 inches (295 mm)]** long.
 4. Provide Type I (single-faced units) where only one finished face is exposed when units are installed, and Type II (double-faced units) where two opposite finished faces are exposed when units are installed.
 5. Application: Use where **[brick is exposed unless otherwise indicated][indicated]** .
 6. Colors: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]** .
 7. **[Where indicated to "match existing,"]** provide glazed brick matching color range, texture, and size of existing adjacent brickwork.
- G. Thin Brick: ASTM C1088, Grade **[Exterior][Interior]** , Type **[TBA][TBS][TBX]** .
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Acme Brick Company]**
 - b. **[Elgin Butler Company]**
 - c. **[General Shale, Inc.]**
 - d. **[Glen-Gery Corporation]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Acme Brick Company]**
 - b. **[Elgin Butler Company]**
 - c. **[General Shale, Inc.]**
 - d. **[Glen-Gery Corporation]**
 - e. **<Insert manufacturer's name>**
 3. Initial Rate of Absorption: Less than **30 g/30 sq. in. (30 g/194 sq. cm)** per minute when tested in accordance with ASTM C67/C67M.
 4. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."
 5. Surface Coating: Thin brick with colors or textures applied as coatings to withstand 50 cycles of freezing and thawing; ASTM C67/C67M, with no observable difference in applied finish when viewed from **10 ft. (3 m)**.
 6. Size (Actual Dimensions): **[3/8 inches (10 mm)][1/2 inches (13 mm)][9/16 inches (14 mm)][5/8**

inches (16 mm)][3/4 inches (19 mm)][1 inches (25 mm)][1-5/8 inches (41 mm)]<Insert dimension> wide by [2-1/4 inches (57 mm)][2-3/4 inches (70 mm)][2-3/16 inches (71 mm)][3-5/8 inches (92 mm)][7-1/2 inches (190 mm)][7-5/8 inches (194 mm)]<Insert dimension> high by [7-5/8 inches (194 mm)][8 inches (203 mm)][8-1/2 inches (216 mm)][9-1/2 inches (241 mm)][9-5/8 inches (244 mm)][11-5/8 inches (295 mm)][15-5/8 inches (397 mm)][19-1/4 inches (489 mm)]<Insert dimension> long.

7. Installation Method: [Thinset][Thickset][Modular panels systems] .
8. [Where indicated to "match existing,"] provide facing brick matching color range, texture, and size of existing adjacent brickwork.
9. Color and Texture: [Match Architect's samples][As selected by Architect]<Insert color and texture> .

2.4 CONCRETE MASONRY UNITS

- A. Regional Materials: Verify CMUs are manufactured within **100 miles (160 km)** of Project site from aggregates [**and cement**] that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- B. Regional Materials: Verify CMUs are manufactured within **500 miles (800 km)** of Project site from aggregates [**and cement**] that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, multiply the distance by 0.25 to determine the distance to Project site.
- C. General: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
- D. Architectural CMUs: ASTM C90. [normal weight][medium weight][lightweight] architectural veneer units.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [Angelus Block Co., Inc.]
 - b. [Echelon Masonry, an Oldcastle APG brand]
 - c. [York Building Products]
 - d. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Angelus Block Co., Inc.]
 - b. [Echelon Masonry, an Oldcastle APG brand]
 - c. [York Building Products]
 - d. <Insert manufacturer's name>
 3. Size (Actual Dimensions): [3-5/8 inches (92 mm) wide by 3-5/8 inches (92 mm) high by 15-5/8 inches (397 mm) long]<Insert dimensions> .
 4. Pattern and Texture: [Standard pattern, ground-face finish][Standard pattern, split-face

- finish][Standard pattern, split-ribbed finish][Scored vertically to appear square in stacked bond, standard finish][Triple scored vertically to appear as soldier courses in stacked bond, standard finish][Match Architect's samples]<Insert pattern> .
5. Colors: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range] .
 6. Special Aggregate: Provide units made with aggregate matching aggregate in Architect's sample.
- E. Thin CMUs: ASTM C1877 and TMS 402/602 Ch. 13.3.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [Angelus Block Co., Inc.]
 - b. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Angelus Block Co., Inc.]
 - b. <Insert manufacturer's name>
 3. Size (Actual Dimensions): 1-5/8 inches (41 mm) wide by [3-5/8 inches (92 mm)][7-5/8 inches (193 mm)] high by [15-5/8 inches (397 mm) long]<Insert dimensions> .
 4. Pattern and Texture: [Standard pattern, smooth finish][Match Architect's samples]<Insert pattern> .
 5. Colors: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range] .
 6. Special Aggregate: Provide units made with aggregate matching aggregate in Architect's sample.
- F. Concrete Facing Brick: ASTM C1634, [normal weight][medium weight][lightweight] solid units.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [Acme Brick Company]
 - b. [Belden Brick Company (The)]
 - c. [Bilco Brick Company]
 - d. [Echelon Masonry, an Oldcastle APG brand]
 - e. [Westbrook Concrete Block Co., Inc.]
 - f. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Acme Brick Company]
 - b. [Belden Brick Company (The)]
 - c. [Bilco Brick Company]
 - d. [Echelon Masonry, an Oldcastle APG brand]
 - e. [Westbrook Concrete Block Co., Inc.]
 - f. <Insert manufacturer's name>

3. Size (Actual Dimensions): **3-5/8 inches (92 mm)** wide by **[2-1/4 inches (57 mm)][2-3/4 inches (70 mm)][3-5/8 inches (92 mm)]** high by **[7-5/8 inches (194 mm)][11-5/8 inches (295 mm)][15-5/8 inches (397 mm)]** long.
4. Texture: **[Smooth-face][Split-face][Ground-face]<Insert description> finish. [Match Architect's samples.]**
5. Colors: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range] .**
6. Special Aggregate: Provide units made with aggregate matching aggregate in Architect's sample.

G. Concrete Masonry Unit Admixtures:

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested in accordance with ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, will show no visible water or leaks on the back of test specimen.

a. Location: **[For exposed units][and][where indicated on Drawings] .**

2.5 MORTAR MATERIALS

- A. Regional Materials: Verify aggregate for mortar and grout **[, cement, and lime]** is manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- B. Regional Materials: Verify aggregate for mortar and grout **[, cement, and lime]** is manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, multiply the distance by 0.25 to determine the distance to Project site.
- C. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.
- D. Hydrated Lime: ASTM C207, Type S.
- E. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- F. Masonry Cement: ASTM C91/C91M.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :**
 - a. **[Argos USA LLC]**
 - b. **[Cemex S.A.B. de C.V.]**
 - c. **[Fairborn Cement Company]**
 - d. **[Federal White Cement, Ltd.]**
 - e. **[Heidelberg Materials]**
 - f. **[Holcim (US) Inc]**
 - g. **[Lafarge North America Inc.]**

- h. [Lehigh White Cement Company]
 - i. [Quikrete; The QUIKRETE Companies, LLC]
 - j. [Sakrete; CRH Americas, Oldcastle APG]
 - k. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Argos USA LLC]
 - b. [Cemex S.A.B. de C.V.]
 - c. [Fairborn Cement Company]
 - d. [Federal White Cement, Ltd.]
 - e. [Heidelberg Materials]
 - f. [Holcim (US) Inc]
 - g. [Lafarge North America Inc.]
 - h. [Lehigh White Cement Company]
 - i. [Quikrete; The QUIKRETE Companies, LLC]
 - j. [Sakrete; CRH Americas, Oldcastle APG]
 - k. <Insert manufacturer's name>
- G. Mortar Cement: ASTM C1329/C1329M.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [Lafarge North America Inc.]
 - b. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Lafarge North America Inc.]
 - b. <Insert manufacturer's name>
- H. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [Davis Colors]
 - b. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - c. [Lanxess Corporation]
 - d. [Solomon Colors Inc.]
 - e. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. **[Davis Colors]**
 - b. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - c. **[Lanxess Corporation]**
 - d. **[Solomon Colors Inc.]**
 - e. **<Insert manufacturer's name>**
- I. Colored Mortar: Packaged blend made from **[portland cement-lime mix][or][masonry cement]** and mortar pigments, all complying with specified requirements, and containing no other ingredients.
1. Colored Portland Cement-Lime Mix:
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - 1) **[Argos USA LLC]**
 - 2) **[Heidelberg Materials]**
 - 3) **[Holcim (US) Inc]**
 - 4) **[Lafarge North America Inc.]**
 - 5) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[Argos USA LLC]**
 - 2) **[Heidelberg Materials]**
 - 3) **[Holcim (US) Inc]**
 - 4) **[Lafarge North America Inc.]**
 - 5) **<Insert manufacturer's name>**
 2. Colored Masonry Cement:
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - 1) **[Argos USA LLC]**
 - 2) **[Cemex S.A.B. de C.V.]**
 - 3) **[Fairborn Cement Company]**
 - 4) **[Heidelberg Materials]**
 - 5) **[Holcim (US) Inc]**
 - 6) **[Lafarge North America Inc.]**
 - 7) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[Argos USA LLC]**
 - 2) **[Cemex S.A.B. de C.V.]**
 - 3) **[Fairborn Cement Company]**
 - 4) **[Heidelberg Materials]**

- 5) [Holcim (US) Inc]
 - 6) [Lafarge North America Inc.]
 - 7) <Insert manufacturer's name>
3. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
 4. Pigments do not exceed 10 percent of portland cement by weight.
 5. Pigments do not exceed 5 percent of [masonry cement][or][mortar cement] by weight.
- J. Preblended Dry Mortar Mix: Packaged blend complying with ASTM C1714/C1714M.
1. Preblended Dry Portland Cement Mortar Mix:
 - a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - 1) [Amerimix is a trademark of Bonsal American, an Oldcastle company]
 - 2) [Quikrete; The QUIKRETE Companies, LLC]
 - 3) [Sakrete; CRH Americas, Oldcastle APG]
 - 4) [SPEC MIX, LLC]
 - 5) <Insert manufacturer's name>
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - 1) [Amerimix is a trademark of Bonsal American, an Oldcastle company]
 - 2) [Quikrete; The QUIKRETE Companies, LLC]
 - 3) [Sakrete; CRH Americas, Oldcastle APG]
 - 4) [SPEC MIX, LLC]
 - 5) <Insert manufacturer's name>
 - c. Dry Mortar Mix Materials: Made from [portland cement-lime mix][masonry cement][or][mortar cement] sand, [mortar pigments][water repellent admixture] and <Insert admixture> .
 2. Preblended Dry Masonry Cement Mortar Mix:
 - a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - 1) [Amerimix is a trademark of Bonsal American, an Oldcastle company]
 - 2) [SPEC MIX, LLC]
 - 3) <Insert manufacturer's name>
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - 1) [Amerimix is a trademark of Bonsal American, an Oldcastle company]
 - 2) [SPEC MIX, LLC]
 - 3) <Insert manufacturer's name>

- K. Aggregate for Mortar: ASTM C144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. For joints less than **1/4 inch (6.4 mm)** thick, use aggregate graded with 100 percent passing the **No. 16 (1.18-mm)** sieve.
 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- L. Latex Additive: Manufacturer's standard emulsion, serving as replacement for part or all of gauging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement mortar bed, and not containing a retarder.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[BASF]**
 - b. **[Custom Building Products]**
 - c. **[Euclid Chemical]**
 - d. **[H.B. Fuller Construction Products Inc. / TEC]**
 - e. **[Laticrete International, Inc.]**
 - f. **[MAPEI Corporation]**
 - g. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[BASF]**
 - b. **[Custom Building Products]**
 - c. **[Euclid Chemical]**
 - d. **[H.B. Fuller Construction Products Inc. / TEC]**
 - e. **[Laticrete International, Inc.]**
 - f. **[MAPEI Corporation]**
 - g. **<Insert manufacturer's name>**
- M. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture, complying with **[ASTM C494/C494M, Type C][ASTM C1384]** , and recommended by manufacturer for use in masonry mortar of composition indicated.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - b. **[GCP Applied Technologies Inc.]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - b. **[GCP Applied Technologies Inc.]**
 - c. **<Insert manufacturer's name>**

 - N. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[ACM Chemistries]**
 - b. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - c. **[GCP Applied Technologies Inc.]**
 - d. **[Master Builders Solutions]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ACM Chemistries]**
 - b. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - c. **[GCP Applied Technologies Inc.]**
 - d. **[Master Builders Solutions]**
 - e. **<Insert manufacturer's name>**

 - O. Water: Potable.
- 2.6 TIES AND ANCHORS**
- A. General: Ties and anchors extend at least **1-1/2 inches (38 mm)** into veneer but with at least a **5/8-inch (16-mm)** cover on outside face.
 - B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 1. Mill-Galvanized, Carbon Steel Wire: ASTM A1064/A1064M, with ASTM A641/A641M, Class 1 coating.
 2. Hot-Dip Galvanized, Carbon Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
 3. Stainless Steel Wire: ASTM A580/A580M, **[Type 304][Type 316]** .
 4. Galvanized-Steel Sheet: ASTM A653/A653M, Commercial Steel, **G60 (Z180)** zinc coating.
 5. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
 6. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, **[Type 304][Type 316]** .
 - C. Corrugated-Metal Ties: Metal strips not less than **7/8 inch (22 mm)** wide with corrugations having a wavelength of **0.3 to 0.5 inch (7.6 to 13 mm)** and an amplitude of **0.06 to 0.10 inch (1.5 to 2.5 mm)** made from **[0.0336-inch- (0.85-mm-) thick, steel sheet, galvanized after fabrication][0.0635-inch- (1.61-mm-) thick, steel sheet, galvanized after fabrication][0.0312-inch- (0.79-mm-) thick, stainless steel sheet][0.0625-inch- (1.59-mm-) thick, stainless steel sheet]** .
 - D. Adjustable Anchors for Connecting to Structural-Steel Framing: Provide anchors that allow vertical or

horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped **1/4-inch- (6.4-mm-)** diameter, **[hot-dip galvanized steel][stainless steel]** wire. **[Mill-galvanized wire may be used at interior walls unless otherwise indicated.]**
2. Tie Section: Triangular-shaped wire tie made from **[0.187-inch- (4.76-mm-)][0.25-inch- (6.4-mm-)]** diameter, **[hot-dip galvanized steel][stainless steel]** wire. **[Mill-galvanized wire may be used at interior walls unless otherwise indicated.]**

E. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Connector Section: **[Dovetail][Channel]** tabs for inserting into **[dovetail][channel]** slots in concrete and attached to tie section; formed from **[0.060-inch- (1.52-mm-)** thick, **steel sheet, galvanized after fabrication][0.105-inch- (2.66-mm-)** thick, **steel sheet, galvanized after fabrication][0.062-inch- (1.59-mm-)** thick, **stainless steel sheet][0.109-inch- (2.78-mm-)** thick, **stainless steel sheet]** .
 - a. **[0.064-inch- (1.63-mm-)][0.108-inch- (2.74-mm-)]** thick, galvanized-steel sheet may be used at interior walls unless otherwise indicated.
2. Tie Section: Triangular-shaped wire tie made from **[0.187-inch- (4.76-mm-)][0.25-inch- (6.4-mm-)]** diameter, **[hot-dip galvanized steel][stainless steel]** wire. **[Mill-galvanized wire may be used at interior walls unless otherwise indicated.]**
3. Corrugated-Metal Ties: Metal strips not less than **7/8 inch (22 mm)** wide with corrugations having a wavelength of **0.3 to 0.5 inch (7.6 to 13 mm)** and an amplitude of **0.06 to 0.10 inch (1.5 to 2.5 mm)** made from **[0.0635-inch- (1.61-mm-)** thick **steel sheet, galvanized after fabrication][0.0785-inch- (1.99-mm-)** thick **steel sheet, galvanized after fabrication][0.1084-inch- (2.75-mm-)** thick **steel sheet, galvanized after fabrication][0.0625-inch- (1.59-mm-)** thick, **stainless steel sheet][0.0781-inch- (1.98-mm-)** thick, **stainless steel sheet][0.1094-inch- (2.78-mm-)** thick, **stainless steel sheet]** with **[dovetail][channel]** tabs for inserting into dovetail slots in concrete.
 - a. **[0.064-inch- (1.63-mm-)][0.079-inch- (2.01-mm-)][0.108-inch- (2.74-mm-)]** thick, galvanized sheet may be used at interior walls unless otherwise indicated.

F. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a **100 lbf (445 N)** load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of **1/16 inch (1.6 mm)**.
2. Fabricate sheet metal anchor sections and other sheet metal parts from **[0.0785-inch- (1.99-mm-)** thick **steel sheet, galvanized after fabrication][0.1084-inch- (2.75-mm-)** thick **steel sheet, galvanized after fabrication][0.0781-inch- (1.98-mm-)** thick, **stainless steel sheet][0.1094-inch- (2.78-mm-)** thick, **stainless steel sheet]** .
3. Fabricate wire ties from **[0.187-inch- (4.76-mm-)][0.25-inch- (6.4-mm-)]** diameter, **[hot-dip galvanized steel][stainless steel]** wire unless otherwise indicated.
4. Contractor's Option: Unless otherwise indicated, provide any of the adjustable masonry-veneer anchors specified.
5. Masonry-Veneer Anchors; Vertical Slotted L-Plate: Rib-stiffened, sheet metal anchor section with screw holes at top and bottom, projecting vertical leg with slotted hole for wire tie **[and washer at face of insulation]** .
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering**

products that may be incorporated into the Work include, but are not limited to, the following] :

- 1) [FERO Corporation]
- 2) [Hohmann & Barnard, Inc]
- 3) [PROSOCO, Inc]
- 4) [Wire-Bond]
- 5) <Insert manufacturer's name>

- b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- 1) [FERO Corporation]
- 2) [Hohmann & Barnard, Inc]
- 3) [PROSOCO, Inc]
- 4) [Wire-Bond]
- 5) <Insert manufacturer's name>

6. Masonry-Veneer Anchors; Double-Pintle Plate: Rib-stiffened, sheet metal anchor section with screw holes at top and bottom, projecting horizontal leg with slots for vertical legs of double pintle wire tie.

- a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :

- 1) [Heckmann Building Products, Inc.]
- 2) [Hohmann & Barnard, Inc]
- 3) [Quality Steel and Wire LLC]
- 4) [Wire-Bond]
- 5) <Insert manufacturer's name>

- b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- 1) [Heckmann Building Products, Inc.]
- 2) [Hohmann & Barnard, Inc]
- 3) [Quality Steel and Wire LLC]
- 4) [Wire-Bond]
- 5) <Insert manufacturer's name>

- c. Seismic: Provide seismic tie, clip, and continuous wire in veneer.

7. Masonry-Veneer Anchors; Slotted Plate: Sheet metal anchor section, with screw holes at top and bottom; and raised rib-stiffened strap, stamped into center to provide a slot between strap and base for wire tie. [Use self-adhering tape to seal penetration behind anchor plate.]

- a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :

- 1) [Heckmann Building Products, Inc.]

- 2) [Hohmann & Barnard, Inc]
 - 3) [Quality Steel and Wire LLC]
 - 4) [Wire-Bond]
 - 5) <Insert manufacturer's name>
- b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- 1) [Heckmann Building Products, Inc.]
 - 2) [Hohmann & Barnard, Inc]
 - 3) [Quality Steel and Wire LLC]
 - 4) [Wire-Bond]
 - 5) <Insert manufacturer's name>
8. Masonry-Veneer Anchors; Slotted Plate with Prongs: Sheet metal anchor section, with screw holes at top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation; and raised rib-stiffened strap, stamped into center to provide a slot between strap and base for wire tie. [**Use self-adhering tape to seal penetration behind anchor plate.**]
- a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
- 1) [Hohmann & Barnard, Inc]
 - 2) [Wire-Bond]
 - 3) <Insert manufacturer's name>
- b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- 1) [Hohmann & Barnard, Inc]
 - 2) [Wire-Bond]
 - 3) <Insert manufacturer's name>
9. Masonry-Veneer Anchors; Single-Barrel Screw: Self-drilling, single-barrel screw designed to receive wire tie. Screw has a smooth barrel the same thickness as insulation.
- a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
- 1) [Heckmann Building Products, Inc.]
 - 2) [Hohmann & Barnard, Inc]
 - 3) [PROSOCO, Inc]
 - 4) [TRUFast Walls]
 - 5) [Wire-Bond]
 - 6) <Insert manufacturer's name>
- b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of

the following:

- 1) [Heckmann Building Products, Inc.]
 - 2) [Hohmann & Barnard, Inc]
 - 3) [PROSOCO, Inc]
 - 4) [TRUFast Walls]
 - 5) [Wire-Bond]
 - 6) <Insert manufacturer's name>
- c. Factory Options: Provide factory-installed gasketed washer to seal at face of insulation and sheathing [**and a coating to reduce thermal conductivity**] .
- d. Seismic: Provide with seismic tie, clip, and continuous wire in veneer.
10. Masonry-Veneer Anchors; Single-Barrel Screw with Double-Pintle Wingnut: Self-drilling, single-barrel screw with wingnut or clip designed to receive double-pintle wire tie. Screw has a smooth barrel the same thickness as insulation.
- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
- 1) [Heckmann Building Products, Inc.]
 - 2) [Hohmann & Barnard, Inc]
 - 3) <Insert manufacturer's name>
- b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert **manufacturer's name; product name or designation**> or comparable product by one of the following:
- 1) [Heckmann Building Products, Inc.]
 - 2) [Hohmann & Barnard, Inc]
 - 3) <Insert manufacturer's name>
- c. Fastener Configuration: Single-barrel screw with [wingnut head][thermally resistant wingnut head][thermally resistant clip] .
- d. Factory Options: Provide factory-installed gasketed washer to seal at face of insulation and sheathing [**and a coating to reduce thermal conductivity**] .
- e. Seismic: Provide with seismic tie, clip, and continuous wire in veneer.
11. Masonry-Veneer Anchors; Seismic-Pintle Plate: Rib-stiffened, sheet metal anchor section with screw holes at top and bottom, projecting leg with slotted hole for vertical leg of seismic pintle tie. Tie is rib-stiffened, sheet metal bent plate with down-turned leg to fit in anchor slot and with integral tabs to hold continuous wire in veneer.
- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
- 1) [Hohmann & Barnard, Inc]
 - 2) [Wire-Bond]
 - 3) <Insert manufacturer's name>
- b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert **manufacturer's name; product name or designation**> or comparable product by one of

the following:

- 1) **[Hohmann & Barnard, Inc]**
 - 2) **[Wire-Bond]**
 - 3) **<Insert manufacturer's name>**
12. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, **No. 10 (4.83 mm)** diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours in accordance with ASTM B117.
 13. Stainless Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, **No. 10 (4.83 mm)** diameter by length required to penetrate steel stud flange with not less than three exposed threads; either made from Type 410 stainless steel or made with a carbon steel drill point and 300 Series stainless steel shank.

2.7 EMBEDDED FLASHING

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual."

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Cheney Flashing Company]**
 - b. **[Hohmann & Barnard, Inc]**
 - c. **[Keystone Flashing Company, Inc]**
 - d. **[Wire-Bond]**
 - e. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Cheney Flashing Company]**
 - b. **[Hohmann & Barnard, Inc]**
 - c. **[Keystone Flashing Company, Inc]**
 - d. **[Wire-Bond]**
 - e. **<Insert manufacturer's name>**
3. Stainless Steel: ASTM A240/A240M or ASTM A666, **[Type 304][Type 316]** , **0.016 inch (0.40 mm)** thick.
4. Copper: **[ASTM B370, Temper H00, cold-rolled copper sheet, 16 oz./sq. ft. (4.9 kg/sq. m) weight or 0.0216 inch (0.55 mm) thick][or][ASTM B370, Temper H01, high-yield copper sheet, 12 oz./sq. ft. (3.7 kg/sq. m) weight or 0.0162 inch (0.41 mm) thick]** .
5. Fabricate continuous flashings in sections **96 inches (2438 mm)** long minimum, but not exceeding **12 ft. (3.7 m)**. Provide splice plates at joints of formed, smooth metal flashing.
6. Fabricate through-wall metal flashing embedded in masonry from **[stainless steel][copper]** , with ribs at **3-inch (76-mm)** intervals along length of flashing to provide an integral mortar bond.
7. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
8. Fabricate through-wall flashing with drip edge **[where][unless otherwise]** indicated. Fabricate by extending flashing **1/2 inch (13 mm)** out from wall, with outer edge bent down 30 degrees **[and**

- hemmed]** .
9. Fabricate through-wall flashing with sealant stop **[where][unless otherwise]** indicated. Fabricate by bending metal back on itself **3/4 inch (19 mm)** at exterior face of wall and down into joint **1/4 inch (6.4 mm)** to form a stop for retaining sealant backer rod.
 10. Fabricate metal **[drip edges][and][sealant stops]** for sawtooth metal flashing from plain metal flashing of same metal as sawtooth flashing and extending at least **3 inches (76 mm)** into wall with hemmed inner edge to receive sawtooth flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam sheds water.
 11. Fabricate metal drip edges from stainless steel. Extend at least **3 inches (76 mm)** into wall and **1/2 inch (13 mm)** out from wall, with outer edge bent down 30 degrees **[and hemmed]** .
 12. Fabricate metal sealant stops from stainless steel. Extend at least **3 inches (76 mm)** into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for **3/4 inch (19 mm)** and down into joint **1/4 inch (6.4 mm)** to form a stop for retaining sealant backer rod.
 13. Fabricate metal expansion-joint strips from **[stainless steel][copper]** to shapes indicated.
 14. Solder metal items at corners.
- B. Flexible Flashing: Where flashing is fully concealed in masonry, use one of the following unless otherwise indicated:
1. Copper Fabric Flashing: Copper sheet bonded between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - 1) **[Advanced Building Products Inc.]**
 - 2) **[Hohmann & Barnard, Inc]**
 - 3) **[STS Coatings, Inc.]**
 - 4) **[Wire-Bond]**
 - 5) **[York Manufacturing, Inc]**
 - 6) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[Advanced Building Products Inc.]**
 - 2) **[Hohmann & Barnard, Inc]**
 - 3) **[STS Coatings, Inc.]**
 - 4) **[Wire-Bond]**
 - 5) **[York Manufacturing, Inc]**
 - 6) **<Insert manufacturer's name>**
 - c. Sheet Weight: **[3 oz./sq. ft. (0.9 kg/sq. m)][5 oz./sq. ft. (1.5 kg/sq. m)][7 oz./sq. ft. (2 kg/sq. m)]** .
 - d. Sheet Type: **[Non-adhesive][Self-adhesive]** .
 2. Stainless Steel Fabric Flashing: Composite, flashing product consisting of minimum **2-mil (0.05-mm)** thick stainless steel sheet, bonded to a layer of polymeric fabric.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- 1) [Fiberweb, a brand of Clark/Hammerbeam Corp.]
 - 2) [Hohmann & Barnard, Inc]
 - 3) [PROSOCO, Inc]
 - 4) [STS Coatings, Inc.]
 - 5) [Wire-Bond]
 - 6) [York Manufacturing, Inc]
 - 7) <Insert manufacturer's name>
- b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- 1) [Fiberweb, a brand of Clark/Hammerbeam Corp.]
 - 2) [Hohmann & Barnard, Inc]
 - 3) [PROSOCO, Inc]
 - 4) [STS Coatings, Inc.]
 - 5) [Wire-Bond]
 - 6) [York Manufacturing, Inc]
 - 7) <Insert manufacturer's name>
- c. Grade: [Type 304][Type 316] .
- d. Overall Thickness: Manufacturer's standard.
3. Self-Adhering, Stainless Steel Fabric Flashing: Composite, flashing product consisting of minimum **2-mil (0.05-mm)** thick stainless steel sheet, bonded to a layer of polymeric fabric.
- a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
- 1) [Hohmann & Barnard, Inc]
 - 2) [STS Coatings, Inc.]
 - 3) [VaproShield LLC]
 - 4) [Wire-Bond]
 - 5) [York Manufacturing, Inc]
 - 6) <Insert manufacturer's name>
- b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- 1) [Hohmann & Barnard, Inc]
 - 2) [STS Coatings, Inc.]
 - 3) [VaproShield LLC]
 - 4) [Wire-Bond]
 - 5) [York Manufacturing, Inc]
 - 6) <Insert manufacturer's name>
- c. Grade: [Type 304][Type 316] .
- d. Bonding Agent: [Butyl][Permanent, clear] adhesive.
- e. Overall Thickness: Manufacturer's standard.
4. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene.

- a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
- 1) [Advanced Building Products Inc.]
 - 2) [Carlisle Coatings & Waterproofing Inc]
 - 3) [Fiberweb, a brand of Clark/Hammerbeam Corp.]
 - 4) [GCP Applied Technologies Inc.]
 - 5) [Heckmann Building Products, Inc.]
 - 6) [Hohmann & Barnard, Inc]
 - 7) [Polyguard Products, Inc.]
 - 8) [W. R. Meadows, Inc]
 - 9) [Williams Products, Inc.]
 - 10) [Wire-Bond]
 - 11) [York Manufacturing, Inc]
 - 12) <Insert manufacturer's name>
- b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- 1) [Advanced Building Products Inc.]
 - 2) [Carlisle Coatings & Waterproofing Inc]
 - 3) [Fiberweb, a brand of Clark/Hammerbeam Corp.]
 - 4) [GCP Applied Technologies Inc.]
 - 5) [Heckmann Building Products, Inc.]
 - 6) [Hohmann & Barnard, Inc]
 - 7) [Polyguard Products, Inc.]
 - 8) [W. R. Meadows, Inc]
 - 9) [Williams Products, Inc.]
 - 10) [Wire-Bond]
 - 11) [York Manufacturing, Inc]
 - 12) <Insert manufacturer's name>
- c. Overall Thickness: Not less than [30 mils (0.76 mm)][40 mils (1.0 mm)][60 mils (1.5 mm)]
5. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin.
- a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
- 1) [DuPont de Nemours, Inc.]
 - 2) [GCP Applied Technologies Inc.]
 - 3) [Kingspan Insulation LLC]
 - 4) [Protecto Wrap Company]
 - 5) [Viaflex]
 - 6) [Wire-Bond]
 - 7) <Insert manufacturer's name>
- b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert

manufacturer's name; product name or designation> or comparable product by one of the following:

- 1) [DuPont de Nemours, Inc.]
- 2) [GCP Applied Technologies Inc.]
- 3) [Kingspan Insulation LLC]
- 4) [Protecto Wrap Company]
- 5) [Viaflex]
- 6) [Wire-Bond]
- 7) <Insert manufacturer's name>

c. Overall Thickness: Not less than **[35 mils (0.89 mm)][40 mils (1.0 mm)]** .

6. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.

a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- 1) [Hohmann & Barnard, Inc]
- 2) [Hyload; IKO Industries, Inc.]
- 3) [Mortar Net Solutions]
- 4) [Wire-Bond]
- 5) <Insert manufacturer's name>

b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- 1) [Hohmann & Barnard, Inc]
- 2) [Hyload; IKO Industries, Inc.]
- 3) [Mortar Net Solutions]
- 4) [Wire-Bond]
- 5) <Insert manufacturer's name>

c. Monolithic Sheet: Elastomeric thermoplastic flashing, **40 mils (1.0 mm)** thick.

d. Self-Adhesive Sheet: Elastomeric thermoplastic flashing, **25 mils (0.64 mm)** thick, with a **15-mil- (0.38-mm-)** thick coating of adhesive.

- 1) Color: **[Gray][White][Tan/buff][Black]** .

7. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D4637/D4637M.

a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- 1) [Carlisle Coatings & Waterproofing Inc]
- 2) [Elevate; Amrize Building Envelope LLC]
- 3) [Heckmann Building Products, Inc.]
- 4) [Hohmann & Barnard, Inc]

- 5) **[Wire-Bond]**
 - 6) **<Insert manufacturer's name>**
- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- 1) **[Carlisle Coatings & Waterproofing Inc]**
 - 2) **[Elevate; Amrize Building Envelope LLC]**
 - 3) **[Heckmann Building Products, Inc.]**
 - 4) **[Hohmann & Barnard, Inc]**
 - 5) **[Wire-Bond]**
 - 6) **<Insert manufacturer's name>**
- c. Thickness: **40 mils (1.0 mm)**.
- C. Drainage Plane Flashing: Provide flashing materials as follows:
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Mortar Net Solutions]**
 - b. **[STS Coatings, Inc.]**
 - c. **[York Manufacturing, Inc]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Mortar Net Solutions]**
 - b. **[STS Coatings, Inc.]**
 - c. **[York Manufacturing, Inc]**
 - d. **<Insert manufacturer's name>**
 3. Fabrication: **[Stainless steel][Copper][Rubberized asphalt][Elastomeric membrane]** and drainage membrane to shapes indicated [, **including weep tabs, termination bar, and drip edge**] .
 - a. Stainless Steel: ASTM A240/A240M or ASTM A666, **[Type 304][Type 316]** , **0.016 inch (0.40 mm)** thick.
 - b. Copper: **[3 oz./sq. ft. (0.9 kg/sq. m)][5 oz./sq. ft. (1.5 kg/sq. m)]** thick.
 - c. Rubberized Asphalt: **[40 mils (1.0 mm)][60 mils (1.5 mm)]** thick.
 - d. Elastomeric Membrane: **[EPDM, complying with ASTM D4637/D4637M][PVC][PVC with Elvaloy Kee][TPO]** , **[40 mils (1.0 mm)][60 mils (1.5 mm)]** thick.
 4. Fabricate continuous flashings in sections **60 inches (1524 mm)** long, minimum.
 5. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
- D. Preformed Corners, End Dams, and Seaming Shapes for Flashing: Flashing manufacturer's standard products or products recommended by flashing manufacturer for waterproofing openings.
- E. Solder and Sealants for Sheet Metal Flashings: **[As specified in Section 076200 "Sheet Metal**

Flashing and Trim."

1. Solder for Stainless Steel: ASTM B32, **[Grade Sn60][Grade Sn96]** , with acid flux of type recommended by stainless steel sheet manufacturer.
2. Solder for Copper: ASTM B32, **[Grade Sn50][with maximum lead content of 0.2 percent]** .
3. Elastomeric Sealant: ASTM C920, chemically curing **[urethane][polysulfide][silicone]** sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.

F. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

G. Termination Bars for Flexible Flashing:

1. Material: **[Aluminum][Stainless steel][Rigid PVC]** .
2. Size: **[0.075 by 1 inch (1.90 by 25 mm)][1/8 by 1 inch (3.2 by 25 mm)][1/8 by 1-1/8 inch (3.2 by 29 mm)]** .

H. Termination Bars for Flexible Flashing, Flanged:

1. Material: **[Stainless steel sheet 0.019 by 1-1/2 inches (0.48 by 38 mm)][Aluminum sheet 0.064 by 1-1/2 inches (1.63 by 38 mm)]** .
2. Fabricate with a **3/8-inch (10-mm)** flange at top **[and bottom]** .

2.8 ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from **[neoprene][urethane][or][PVC]** .

B. Weep/Vent Products: Use the following unless otherwise indicated:

1. Wicking Material: Absorbent rope, made from cotton, **1/4 to 3/8 inch (6.4 to 10 mm)** in diameter, in length required to produce **2-inch (51-mm)** exposure on exterior and **18 inches (457 mm)** in cavity. Use only for weeps.
2. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, **3/8-inch (10-mm)** OD by **4 inches (102 mm)** long.
3. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, **3/8 by 1-1/2 by 3-1/2 inches (10 by 38 by 89 mm)** long.
4. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth **1/8 inch (3.2 mm)** less than depth of outer wythe, in color selected from manufacturer's standard.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - 1) **[Advanced Building Products Inc.]**
 - 2) **[Heckmann Building Products, Inc.]**
 - 3) **[Hohmann & Barnard, Inc]**
 - 4) **[Mortar Net Solutions]**
 - 5) **[Wire-Bond]**
 - 6) **<Insert manufacturer's name>**

- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- 1) **[Advanced Building Products Inc.]**
 - 2) **[Heckmann Building Products, Inc.]**
 - 3) **[Hohmann & Barnard, Inc]**
 - 4) **[Mortar Net Solutions]**
 - 5) **[Wire-Bond]**
 - 6) **<Insert manufacturer's name>**
5. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth **1/8 inch (3.2 mm)** less than depth of outer wythe; in color selected from manufacturer's standard.
- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
- 1) **[CavClear; a division of Archovations, Inc.]**
 - 2) **[Hohmann & Barnard, Inc]**
 - 3) **[Keene Building Products]**
 - 4) **[Mortar Net Solutions]**
 - 5) **<Insert manufacturer's name>**
- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- 1) **[CavClear; a division of Archovations, Inc.]**
 - 2) **[Hohmann & Barnard, Inc]**
 - 3) **[Keene Building Products]**
 - 4) **[Mortar Net Solutions]**
 - 5) **<Insert manufacturer's name>**
6. Vinyl Weep Hole/Vent: Units made from flexible PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color selected by Architect.
- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
- 1) **[Hohmann & Barnard, Inc]**
 - 2) **[Williams Products, Inc.]**
 - 3) **[Wire-Bond]**
 - 4) **<Insert manufacturer's name>**
- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- 1) **[Hohmann & Barnard, Inc]**
 - 2) **[Williams Products, Inc.]**

- 3) **[Wire-Bond]**
- 4) **<Insert manufacturer's name>**

C. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Mortar Deflector:

- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- 1) **[Advanced Building Products Inc.]**
- 2) **[Hohmann & Barnard, Inc]**
- 3) **[Keene Building Products]**
- 4) **[Mortar Net Solutions]**
- 5) **[Wire-Bond]**
- 6) **[York Manufacturing, Inc]**
- 7) **<Insert manufacturer's name>**

- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- 1) **[Advanced Building Products Inc.]**
- 2) **[Hohmann & Barnard, Inc]**
- 3) **[Keene Building Products]**
- 4) **[Mortar Net Solutions]**
- 5) **[Wire-Bond]**
- 6) **[York Manufacturing, Inc]**
- 7) **<Insert manufacturer's name>**

- c. Size: Strips **[full depth of cavity][3/4 inch (19 mm) thick][1 inch (25 mm)][1-1/2 inches (38 mm) thick][2 inches (51 mm)]<Insert thickness>** and **[10 inches (254 mm)][16 inches (406 mm)]<Insert thickness>** high.

- d. Surface Drainage: **[Dovetail-shaped notches][Dimpled surface]** that prevents clogging with mortar droppings.

2. Rainscreen Drainage Mat:

- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- 1) **[Advanced Building Products Inc.]**
- 2) **[CavClear; a division of Archovations, Inc.]**
- 3) **[Keene Building Products]**
- 4) **[Mortar Net Solutions]**
- 5) **[Wire-Bond]**
- 6) **<Insert manufacturer's name>**

- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of

the following:

- 1) [Advanced Building Products Inc.]
 - 2) [CavClear; a division of Archovations, Inc.]
 - 3) [Keene Building Products]
 - 4) [Mortar Net Solutions]
 - 5) [Wire-Bond]
 - 6) <Insert manufacturer's name>
- c. Size: Sheets or strips not less than **[full depth of cavity][3/4 inch (19 mm)][1 inch (25 mm)][1-1/2 inches (38 mm) thick][2 inches (51 mm)]<Insert thickness>** thick and installed to full height of cavity.
- d. Surface Drainage: Provide additional strips **4 inches (102 mm)** high at weep holes and thick enough to fill entire depth of cavity to prevent weep holes from clogging with mortar.
- D. Offset Angle Supports: Steel plate brackets anchored to structure, allowing continuous insulation behind shelf angle supporting veneer for thermal bridging. Component and anchor size and spacing engineered by manufacturer.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
- a. [FERO Corporation]
 - b. [Halfen USA, Inc.]
 - c. [Hohmann & Barnard, Inc]
 - d. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. [FERO Corporation]
 - b. [Halfen USA, Inc.]
 - c. [Hohmann & Barnard, Inc]
 - d. <Insert manufacturer's name>
- E. Proprietary Acidic Masonry Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
- a. [Diedrich Technologies, Inc.; a Hohmann & Barnard company]
 - b. [EaCo Chem, Inc.]
 - c. [PROSOCO, Inc]
 - d. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Diedrich Technologies, Inc.; a Hohmann & Barnard company]**
- b. **[EaCo Chem, Inc.]**
- c. **[PROSOCO, Inc]**
- d. **<Insert manufacturer's name>**

F. Modular Panel System: Manufacturer's approved modular panels designed for adhering thin brick units or mechanically securing thin brick to the panel with attachment hardware.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- a. **[Acme Brick Company]**
- b. **[Tabs Wall Systems, LLC]**
- c. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Acme Brick Company]**
- b. **[Tabs Wall Systems, LLC]**
- c. **<Insert manufacturer's name>**

3. Panel Type: Use **[Metal, G90 galvanized steel 0.018 inch (0.46 mm) thick, structural Grade 33 steel][Composite made of polypropylene and fiberglass]** .

4. Size: **<Insert manufacturer's standard size>** .

G. Expanded Metal Lath: **3.4 lb/sq. yd. (1.8 kg/sq. m)**, self-furring, diamond-mesh lath complying with ASTM C847. Fabricate from structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, **G60 (Z180)**.

H. Woven-Wire Lath: ASTM C1032/C1032M, fabricated into **1-1/2-inch (38-mm)** hexagonal-shaped mesh with minimum **0.0510-inch- (1.3-mm-)** diameter, galvanized-steel wire.

I. Welded-Wire Lath: ASTM C933, fabricated into **2-by-2-inch (50-by-50-mm)** mesh with minimum **0.0625-inch- (1.6-mm-)** diameter, galvanized-steel wire.

J. Lath Attachment Devices and Fasteners: Corrosion-resistant material and type required by ASTM C1063 for installations indicated.

K. Weep Screed: Fabricated from hot-dip galvanized steel sheet ASTM A653/ASTMA653M, **G60 (Z180)** zinc coating.

2.9 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use **[portland cement-lime][masonry cement][or][mortar cement]** mortar unless otherwise indicated.
3. For exterior masonry, use **[portland cement-lime][masonry cement][or][mortar cement]**

- mortar.
- 4. For reinforced masonry, use **[portland cement-lime][masonry cement][or][mortar cement]** mortar.
- 5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Masonry Veneer: Comply with ASTM C270, **[Proportion][Property]** Specification. Use Type N unless another type is indicated.
 - 1. For masonry below grade or in contact with earth, use **[Type M][Type S]** .
- D. Pigmented Mortar: Use colored cement product **[or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored mortar cement] .**
 - 1. Pigments do not exceed 10 percent of portland cement by weight.
 - 2. Pigments do not exceed 5 percent of **[masonry cement][or][mortar cement]** by weight.
 - 3. Mix to match Architect's sample.
 - 4. Application: Use pigmented mortar for exposed mortar joints.
- E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 - 1. Mix to match Architect's sample.
 - 2. Application: Use colored-aggregate mortar for exposed mortar joints.
- F. Thinset Mortar: Polymer-modified, thinset mortar per ANSI A118.4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install all accessories in accordance with manufacturer's written instructions.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow

units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

- D. Select and arrange units for exposed masonry veneer to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- E. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds **30 g/30 sq. in. (30 g/194 sq. cm)** per minute when tested in accordance with ASTM C67/C67M. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

- 1. For dimensions in cross section or elevation, do not vary by more than plus **1/2 inch (13 mm)** or minus **1/4 inch (6.4 mm)**.
- 2. For location of elements in plan, do not vary from that indicated by more than plus or minus **1/2 inch (13 mm)**.
- 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus **1/4 inch (6.4 mm)** in a story height or **1/2 inch (13 mm)** total.

B. Lines and Levels:

- 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than **1/4 inch in 10 ft. (6.4 mm in 3 m)**, or **1/2-inch (13-mm)** maximum.
- 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than **1/8 inch in 10 ft. (3.2 mm in 3 m)**, **1/4 inch in 20 ft. (6.4 mm in 6 m)**, or **1/2-inch (13-mm)** maximum.
- 3. For vertical lines and surfaces, do not vary from plumb by more than **1/4 inch in 10 ft. (6.4 mm in 3 m)**, **3/8 inch in 20 ft. (10 mm in 6 m)**, or **1/2-inch (13-mm)** maximum.
- 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than **1/8 inch in 10 ft. (3.2 mm in 3 m)**, **1/4 inch in 20 ft. (6.4 mm in 6 m)**, or **1/2-inch (13-mm)** maximum.
- 5. For lines and surfaces, do not vary from straight by more than **1/4 inch in 10 ft. (6.4 mm in 3 m)**, **3/8 inch in 20 ft. (10 mm in 6 m)**, or **1/2-inch (13-mm)** maximum.
- 6. For vertical alignment of exposed head joints, do not vary from plumb by more than **1/4 inch in 10 ft. (6.4 mm in 3 m)**, or **1/2-inch (13-mm)** maximum.
- 7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than **1/16 inch (1.6 mm)** except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

- 1. For bed joints, do not vary from thickness indicated by more than plus or minus **1/8 inch (3.2 mm)**, with a maximum thickness limited to **1/2 inch (13 mm)**.
- 2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than **1/8 inch (3.2 mm)**.
- 3. For head and collar joints, do not vary from thickness indicated by more than plus **3/8 inch (10 mm)** or minus **1/4 inch (6.4 mm)**.
- 4. For exposed head joints, do not vary from thickness indicated by more than plus or minus **1/8 inch (3.2 mm)**. [**Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3.2 mm).**]

5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than **1/16 inch (1.6 mm)** from one masonry unit to the next.

3.4 INSTALLATION OF MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in **[running bond][stack bond][one-third running bond][Flemish bond][English bond][bond pattern indicated on Drawings]** ; do not use units with less-than-nominal **4-inch (102-mm)** horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.5 INSTALLATION OF MORTAR BEDDING AND JOINTING

- A. Lay masonry units with face shells fully bedded in mortar and with head joints of depth equal to bed joints. At starting course, fully bed entire units, including area under cells.
 1. At anchors and ties, fully bed units and fill cells with mortar as needed to fully embed anchors and ties in mortar.
- B. Hollow Clay Facing Brick: Lay units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Solid Masonry Units: Lay units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- D. Trim Units: Set **[stone][cast-stone]** trim units in full bed of mortar with full vertical joints.
 1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 2. Allow cleaned surfaces to dry before setting.
 3. Wet joint surfaces thoroughly before applying mortar.
 4. Rake out mortar joints for pointing with sealant.
- E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
 1. For glazed masonry units, use a nonmetallic jointer **3/4 inch (19 mm)** or more in width.

3.6 INSTALLATION OF ANCHORED MASONRY VENEERS

- A. Masonry-veneer anchors to comply with the following requirements:

1. Fasten [**screw-attached**][**and**][**seismic**] anchors [**through sheathing to wall framing**][**and**][**to concrete and masonry backup**] with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed [**tie sections**][**connector sections and continuous wire**] in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than **18 inches (457 mm)** o.c. vertically and **24 inches (610 mm)** o.c. horizontally, with not less than one anchor for each **2 sq. ft. (0.2 sq. m)** of wall area. Install additional anchors within **12 inches (305 mm)** of openings and at intervals, not exceeding **8 inches (203 mm)**, around perimeter.
5. Space anchors as indicated, but not more than **16 inches (406 mm)** o.c. vertically and **25 inches (635 mm)** o.c. horizontally, with not less than one anchor for each **2.67 sq. ft. (0.25 sq. m)** [**3.5 sq. ft. (0.33 sq. m)**] of wall area. Install additional anchors within **12 inches (305 mm)** of openings and at intervals, not exceeding **36 inches (914 mm)**, around perimeter.
6. Space anchors as indicated, but not more than **18 inches (457 mm)** o.c. vertically and horizontally. Install additional anchors within **12 inches (305 mm)** of openings and at intervals, not exceeding **24 inches (610 mm)**, around perimeter.

- B. Provide not less than [**2 inches (51 mm)**][**1 inch (25 mm)**]**<Insert distance>** of airspace between back of masonry veneer and face of [**sheathing**][**insulation**] .

1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.7 INSTALLATION OF THE ANCHORING OF MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete to comply with the following:
1. Provide an open space not less than [**1/2 inch (13 mm)**][**1 inch (25 mm)**][**2 inches (51 mm)**] wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 3. Space anchors as indicated, but not more than **24 inches (610 mm)** o.c. vertically and **36 inches (914 mm)** o.c. horizontally.

3.8 INSTALLATION OF ADHERED THIN BRICK VENEER

- A. Thickset Method:

1. Mechanically fasten metal lath or mesh securely to substrate per manufacturer's written instructions.
2. Apply scratch coat and then bond coat over prepared lath or mesh.
3. Set thin brick into mortar bed, ensuring full coverage on back of thin brick units.
4. Maintain consistent spacing, coursing, joint width, and alignment.

- B. Thinset Method:

1. Apply thinset latex-modified mortar to backer board as recommended in writing by manufacturer with notched trowel.
2. Set thin brick, pressing firmly into mortar for full bond.
3. Maintain consistent spacing, coursing, joint width, and alignment.

C. Modular Panel Systems:

1. General: Follow manufacturers' modular panel systems written instructions for the following:
 - a. Mortar: Type N or latex modified.
2. Panels and Adhesive: Per panel manufacturer's written instructions.
3. Interior Applications:
 - a. Install, secure and prepare modular panels per manufacturer's written instructions.
 - b. Provide polymer-modified mortar as recommended in writing by thin brick manufacturer.
 - c. Trowel the mortar onto the panel and expose the coursing on the modular panel.
 - d. Back face of thin brick must be dry and clean, free of dirt, oil, or any other foreign contaminant.
 - e. Apply a uniform layer of mortar to the entire back surface of each thin brick with notched trowel immediately prior to setting.
 - f. Place thin veneer on the panel leg and bag in joints with Type N or Type S mortar.
 - g. Strike joints using a joint profile tool.
4. Exterior Applications:
 - a. Install, secure and prepare modular panels per manufacturer's written instructions.
 - b. Back face of thin brick must be dry and clean, free of dirt, oil, or any other foreign contaminant.
 - c. Where applicable, insert thin brick into panel grooves, rails, or tabs to support and align thin brick courses.
 - d. Where panel requires mortar method installation, trowel the scratch coat onto the panel and expose the coursing on the modular panel.
 - e. Thin brick to be applied within 10 minutes after thinset adhesive has been applied and before film begins to form on the thinset adhesive.
 - f. Lay thin brick in course pattern as indicated on Drawings.
 - g. Leave a uniform **3/8- to 1/2-inch (9.5- to 12.7-mm)** gap at openings to allow for movement joint installation.
 - h. Keep areas intended to receive sealant clean of thin brick, adhesive, and other materials during construction.
 - i. Place thin brick on the panel leg and bag in joints with Type N or Type S mortar.
 - j. Strike joints using a joint profile tool.
 - k. Do not allow masonry units to bridge movement joints in substrate.

3.9 INSTALLATION OF ADHERED THIN CMU VENEER

- A. General: Construct thin CMU in compliance with TMS 402/602.
- B. Mechanically fasten metal lath or mesh securely to moisture-resistant substrate per manufacturer's written instructions.
- C. Apply ANSI A118.4 mortar scratch coat over prepared lath or mesh.
- D. Horizontally score mortar surface while plastic to form mechanical key.
- E. Brush neat portland cement paste onto both the scratch coat surface and the back of the thin CMU unit completely.
- F. Maintain consistent spacing, coursing, joint width, and alignment.

- G. Press, tap veneer units into place, and bed firmly to achieve **3/8-inch (9-mm)** minimum to **1-1/4-inch (302-mm)** maximum mortar behind the units after setting.
- H. Ensure full continuous contact without gaps behind the veneer units.
- I. Tool joints with a round jointer when mortar is thumbprint hard for uniform appearance.
- J. Remove and clean excess mortar promptly.
- K. Grout the joints only after there is sufficient cure time of installing thin CMU units, when mild contact will not break the bonding.
- L. Extra precaution should be taken while raking the joints to desired depth so the surface of the thin CMU is undamaged. Clean off remaining grout debris on the thin CMU surface with a dry, soft-bristled brush.
- M. See thin CMU manufacturer's written instructions on cleaning and maintenance. Do not use harsh chemicals for cleaning, such as muriatic acid, or abusive tools, such as wire brushes to clean the surface.

3.10 INSTALLATION OF EXPANSION JOINTS

- A. General: Install expansion-joint materials in masonry veneer as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form expansion joints as follows:
 - 1. Build flanges of metal expansion strips into masonry. Lap each joint **4 inches (102 mm)** in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
 - 2. Build flanges of factory-fabricated, expansion-joint units into masonry.
 - 3. Build in compressible joint fillers where indicated.
 - 4. Form open joint full depth of brick wythe and of width indicated, but not less than **[3/8 inch (10 mm)][1/2 inch (13 mm)]<Insert minimum width>** for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."
- C. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than **[3/8 inch (10 mm)]<Insert minimum width>** .
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.11 INSTALLATION OF OFFSET ANGLE SUPPORTS

- A. Provide offset angle supports where indicate and where openings of more than **12 inches (305 mm)** for brick-size units and **24 inches (610 mm)** for block-size units are indicated without structural steel or other supporting lintels.
- B. Provide minimum bearing of **8 inches (203 mm)** at each jamb unless otherwise indicated.

3.12 INSTALLATION OF EMBEDDED FLASHING

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. [**Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.**]
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape [**as recommended by flashing manufacturer**] .
 - 2. Extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least **8 inches (203 mm)**; with upper edge tucked under [**water-resistive barrier**][**air barrier**] , lapping at least **4 inches (102 mm)**. [**Fasten upper edge of flexible flashing to sheathing through termination bar.**]
 - 3. At lintels and shelf angles, extend flashing **6 inches (152 mm)** minimum [, **to edge of next full unit**] at each end. At heads and sills, extend flashing **6 inches (152 mm)** minimum [, **to edge of next full unit**] and turn ends up not less than **2 inches (51 mm)** to form end dams.
 - 4. Interlock end joints of sawtooth sheet metal flashing by overlapping ribs not less than **1-1/2 inches (38 mm)** or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 - 5. Install metal [**drip edges**][**and**][**sealant stops**] with sawtooth sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
 - 6. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing **1/2 inch (13 mm)** back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
 - 7. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing **1/2 inch (13 mm)** back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
 - 8. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install reglets and nailers for flashing and other related construction where they are indicated to be built into masonry.

3.13 INSTALLATION OF WEEP/CAVITY VENTS

- A. Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing.
 - 1. Use [**specified weep/cavity vents**][**or**][**open-head joints**] to form weep holes.
 - 2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
 - 3. Space weep holes **24 inches (610 mm)** o.c. unless otherwise indicated.
 - 4. Space weep holes formed from [**plastic tubing**][**or**][**wicking material**] **16 inches (406 mm)** o.c.
 - 5. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
 - 6. Trim wicking material flush with outside face of wall after mortar has set.
- B. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Accessories" Article.
- C. Install vents in head joints in exterior wythes at spacing indicated. Use [**specified weep/cavity vent products**][**or**][**open-head joints**] to form vents.

1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.14 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements will be at Contractor's expense.
- B. Inspections: Special inspections in accordance with Level 2 in TMS 402/602.
 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
- C. Testing Prior to Construction: One set of tests.
- D. Clay Masonry Units: Test each type of unit provided, in accordance with ASTM C67/C67M for compressive strength.
- E. Concrete Masonry Units: Test each type of unit provided, in accordance with ASTM C140/C140M for compressive strength.
- F. Mortar Aggregates: Ratio test (proportion specification) for each mix provided, in accordance with ASTM C780.
- G. Mortar: Test each mix provided, in accordance with ASTM C780. Test mortar for **[mortar air content][and][compressive strength]** .

3.15 REPAIRING AND POINTING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

3.16 CLEANING

- A. In-Progress Cleaning: Clean masonry veneer as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.

3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean masonry with a proprietary acidic cleaner applied in accordance with manufacturer's written instructions.

3.17 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of masonry veneer work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 1. Crush masonry waste to less than **4 inches (102 mm)** in each dimension.
 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
 3. Do not dispose of masonry waste as fill within **18 inches (457 mm)** of finished grade.
- C. Masonry Waste Recycling: Return broken masonry units not used as fill to manufacturer for recycling.
- D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 20 00 00A

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Task	Specification	Specification Description
04 21 00 00	04 20 00 00a	Masonry Veneer
04 21 13 00	04 20 00 00	Unit Masonry
04 21 13 00	04 20 00 00a	Masonry Veneer
04 21 19 00	04 20 00 00	Unit Masonry
04 21 19 00	04 20 00 00a	Masonry Veneer
04 21 26 00	04 20 00 00	Unit Masonry
04 21 26 00	04 20 00 00a	Masonry Veneer
04 21 29 00	04 20 00 00	Unit Masonry
04 21 29 00	04 20 00 00a	Masonry Veneer



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SECTION 04 22 00 00 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Lintels.
3. Mortar and grout materials.
4. Reinforcement.
5. Ties and anchors.
6. Embedded flashing.
7. Accessories.
8. Mortar and grout mixes.

B. Products Installed, but Not Furnished, under This Section:

1. Precast architectural concrete trim in concrete unit masonry.
2. Glass unit masonry in concrete unit masonry.
3. Brick veneer in concrete unit masonry.
4. Cast-stone trim in concrete unit masonry.
5. Steel lintels in concrete unit masonry.
6. Steel shelf angles for supporting concrete unit masonry.

C. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for [**installing**] dovetail slots for masonry anchors.
2. Section 034500 "Precast Architectural Concrete" for precast concrete trim.
3. Section 042300 "Glass Unit Masonry" for glass block.
4. Section 042613 "Masonry Veneer" for unit masonry set as veneer.
5. Section 047200 "Cast Stone Masonry" for cast stone trim units.
6. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
7. Section 055000 "Metal Fabrications" for furnishing steel lintels and shelf angles.
8. Section 071900 "Water Repellents" for water repellents applied to surface of unit masonry assemblies.
9. Section 072119 "Foamed-in-Place Insulation" for foam insulation installed in CMU cores.
10. Section 076200 "Sheet Metal Flashing and Trim" for [**exposed**] sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.
11. Section 323223 "Segmental Retaining Walls" for dry-laid, concrete unit retaining walls.

1.2 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.
- C. Exposed: Weather-exposed side of a constructed wall.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference **[at Project site][by web conference]<Insert location>** .

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
- B. Shop Drawings:
1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI PRC 315R. **[Indicate elevations of reinforced walls.]**
 3. Lintel design and types required.
 4. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Initial Selection:
1. Architectural CMUs: **[Small-scale units][Full-size units, minimum of five]** .
 2. Prefaced CMUs: **[Small-scale units][Full-size units, minimum of five]** .
 3. Colored Mortar: Full range of manufacturer's standard colors.
 4. Aggregate for Mortar: Range of aggregate colors for colored-aggregate mortar.
- D. Samples for Verification: For each type and color of the following:
1. Architectural CMUs: **[Small-scale units][Full-size units, minimum of five]** .
 2. Prefaced CMUs: **[Small-scale units][Full-size units, minimum of five]** .
 3. Colored mortar.
 4. Pigmented Mortar: Make Samples using same sand and mortar ingredients to be used on Project.
 5. Colored-Aggregate Mortar: Make Samples using same sand and mortar ingredients to be used on Project.
- E. Sustainable Design Submittals:
1. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
 2. Type III Environmental Product Declaration (EPD): For each product.
 3. Type III Environmental Product Declaration (EPD): For each product.
 4. Multi-Attribute Optimization: For each product, provide documentation of third-party certification, indicating impact reduction in global warming potential, depletion of stratospheric ozone layer, acidification of land and water sources, eutrophication, and/or formation of tropospheric ozone.
 5. Multi-Attribute Optimization: For each product, provide documentation of third-party certification, indicating impact reduction in global warming potential, depletion of stratospheric ozone layer, acidification of land and water sources, eutrophication, and/or formation of tropospheric ozone.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of the following:

1. Masonry units.
 - a. Include [data on material properties][material test reports substantiating compliance with requirements][documentation of carbon-reduction methods] .
 - b. For masonry units [used in structural masonry] , include data and calculations establishing average net-area compressive strength of units.
 2. Integral water repellent used in CMUs, if not surface treated.
 3. Cementitious materials. Include name of manufacturer, brand name, and type.
 4. Mortar admixtures.
 5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 6. Grout mixes. Include description of type and proportions of ingredients.
 7. Reinforcing bars.
 8. Joint reinforcement.
 9. Anchors, ties, and metal accessories.
- B. Mix Designs: For each type of mortar [and grout] . Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
 2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.
- C. Qualification Statements: For testing agency.
- D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined in accordance with TMS 402/602.
- E. Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements for [cold][and][hot] weather.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: All masonry flashing installers must complete the International Masonry Institute Flashing Upgrade training course.
- B. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in [state]<Insert jurisdiction> where Project is located and who is experienced in providing engineering services of the type indicated.
- C. Testing Agency: Qualified in accordance with ASTM C1093 for testing indicated.

1.7 MOCKUPS

- A. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
 1. Build sample panels for [each type of exposed unit masonry construction][typical exterior wall][typical interior wall][typical exterior and interior walls] in sizes approximately [48 inches (1200 mm)][60 inches (1500 mm)]<Insert dimension> long by [36 inches (900 mm)][48 inches

(1200 mm)]<Insert dimension> high [by full thickness] .

2. Build sample panels facing south.
3. Where masonry is to match existing, build panels adjacent and parallel to existing surface.
4. Clean [**one-half of**] exposed faces of panels with masonry cleaner indicated.
5. Protect approved sample panels from the elements with weather-resistant membrane.
6. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless Owner specifically approves such deviations by Change Order.

B. Wall Mockups: Build mockups [to verify selections made under Sample submittals][to demonstrate aesthetic effects][to set quality standards for materials and execution][and][to set quality standards for installation] . [See Section 014339 "Mockups" for additional construction requirements for integrated exterior mockups.]

1. Build mockup [as indicated on Drawings]<Insert mockup requirements> .
2. Build mockups for [each type of exposed unit masonry construction][typical exterior wall][typical interior wall][typical exterior and interior walls] in sizes approximately [48 inches (1200 mm)][60 inches (1500 mm)][72 inches (1800 mm)][96 inches (2400 mm)]<Insert dimension> long by [36 inches (900 mm)][48 inches (1200 mm)][60 inches (1500 mm)][72 inches (1800 mm)]<Insert dimension> high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least **16 inches (406 mm)** long in [each][exterior wall] mockup.
 - b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately **12 inches (305 mm)** wide by **16 inches (406 mm)** high.
 - c. Include through-wall flashing installed for a **24-inch (600-mm)** length in corner of exterior wall mockup approximately **16 inches (406 mm)** down from top of mockup, with a **12-inch (305-mm)** length of flashing left exposed to view (omit masonry above half of flashing).
3. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
4. Clean [**one-half of**] exposed faces of mockups with masonry cleaner as indicated.
5. Protect accepted mockups from the elements with weather-resistant membrane.
6. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
7. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of **24 inches (600 mm)** down both sides of walls, and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 402/602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is **40 deg F (4 deg C)** and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 402/602.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain **[exposed masonry units][cementitious mortar components][and][mortar aggregate]** from single **[source][producer][or][manufacturer]** .
- B. For **[exposed masonry units][and][cementitious mortar components]** , obtain each color and grade from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide [**structural**] unit masonry that develops indicated net-area compressive strengths at 28 days.
 - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) in accordance with TMS 402/602.
 - 2. Determine net-area compressive strength of masonry by testing masonry prisms in accordance with ASTM C1314.

2.3 CONCRETE UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 402/602 except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work [**and will be within 20 ft. (6 m) vertically and horizontally of a walking surface**] .
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, [**use the equivalent thickness method for masonry units in accordance with Tech Note TEK 07-01D**][units are listed by UL or a qualified testing agency acceptable to authorities having jurisdiction] .

2.4 CONCRETE MASONRY UNITS

- A. Regional Materials: Verify CMUs are manufactured within **100 miles (160 km)** of Project site from aggregates [**and cement**] that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- B. Regional Materials: Verify CMUs are manufactured within **500 miles (800 km)** of Project site from aggregates [**and cement**] that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, multiply the distance by 0.25 to determine the distance to Project site.
- C. General: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide [**square-edged**][**bullnose**] units for outside corners unless otherwise indicated.
- D. CMUs: ASTM C90, [**normal weight**][**medium weight**][**lightweight**][**unless otherwise indicated**] .
 - 1. Size (Width): Manufactured to dimensions **3/8 inch (10 mm)** less-than-nominal dimensions.
 - 2. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
 - 3. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

- E. Architectural CMUs: ASTM C90, **[normal-weight][medium-weight][lightweight]** architectural units.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Angelus Block Co., Inc.]**
 - b. **[Echelon Masonry, an Oldcastle APG brand]**
 - c. **[York Building Products]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Angelus Block Co., Inc.]**
 - b. **[Echelon Masonry, an Oldcastle APG brand]**
 - c. **[York Building Products]**
 - d. **<Insert manufacturer's name>**
 3. Size (Width): Manufactured to dimensions **3/8 inch (10 mm)** less-than-nominal dimensions.
 4. Pattern and Texture: **[Standard pattern, ground-face finish][Standard pattern, split-face finish][Standard pattern, split-ribbed finish][Scored vertically to appear square in stacked bond, standard finish][Triple scored vertically to appear as soldier courses in stacked bond, standard finish]<Insert pattern> . [Match Architect's samples.]**
 5. Colors: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]** .
 6. Special Aggregate: Provide units made with aggregate matching aggregate in Architect's sample.
- F. Prefaced CMUs: ASTM C90, lightweight, with manufacturer's standard smooth resinous facing complying with ASTM C744.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Echelon; an Oldcastle APG brand]**
 - b. **[York Building Products]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Echelon; an Oldcastle APG brand]**
 - b. **[York Building Products]**
 - c. **<Insert manufacturer's name>**
 3. Composition: **[Hollow][Solid]** units.
 4. Size: Manufactured to dimensions specified in "CMUs" Paragraph but with prefaced surfaces having **1/16-inch- (1.5-mm-)** wide returns of facing to create **1/4-inch- (6-mm-)** wide mortar joints with modular coursing.
 5. Colors and Patterns: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]** .

G. Acoustical CMUs: ASTM C90, [**lightweight**][**medium-weight**][**normal-weight**] sound-absorbing units.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**] :
 - a. [**Acme Brick Company**]
 - b. [**Echelon; an Oldcastle APG brand**]
 - c. [**RPG Acoustical Systems, Inc.**]
 - d. [**Sound Seal**]
 - e. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. [**Acme Brick Company**]
 - b. [**Echelon; an Oldcastle APG brand**]
 - c. [**RPG Acoustical Systems, Inc.**]
 - d. [**Sound Seal**]
 - e. **<Insert manufacturer's name>**
3. Surface Characteristics: [**Slotted**][**Textured**] .
4. Size: **<Insert dimensions>** .
5. Cavity Fill: [**Fibrous filler**][**Galvanized steel septum**][**Unfilled**]**<Insert filler>** .
6. Sound Transmission Classification (STC): **<Insert STC>** , minimum as measured [**by an independent, accredited NVLAP facility**] in accordance with ASTM E90 and ASTM E413.
7. Noise Reduction Coefficient (NRC): Not less than **<Insert NRC>** as measured [**by an independent, accredited NVLAP facility**] in accordance with ASTM C423 and ASTM E795.

H. Rigid, Cellular Thermal Insulation CMUs: ASTM C90, [**lightweight**][**medium-weight**][**normal-weight**] units containing rigid, specially shaped, molded-polystyrene insulation complying with ASTM C578, Type I, designed for installing in cores of CMUs.

1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**] :
 - a. [**Concrete Block Insulating Systems**]
 - b. [**Echelon Masonry, an Oldcastle APG brand**]
 - c. [**Shelter Enterprises Inc.**]
 - d. [**York Building Products**]
 - e. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. [**Concrete Block Insulating Systems**]
 - b. [**Echelon Masonry, an Oldcastle APG brand**]
 - c. [**Shelter Enterprises Inc.**]
 - d. [**York Building Products**]
 - e. **<Insert manufacturer's name>**

3. Size: Manufactured to dimensions **3/8 inch (10 mm)** less than nominal dimensions.
 4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
- I. Low-Carbon CMUs: ASTM C90, **[lightweight][medium-weight][normal-weight]** units with low embodied carbon.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[CarbonBuilt]**
 - b. **[CarbonCure]**
 - c. **[CarbonKind]**
 - d. **[CarbonX]**
 - e. **[Pozzotive (Glenwood Mason Supply)]**
 - f. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CarbonBuilt]**
 - b. **[CarbonCure]**
 - c. **[CarbonKind]**
 - d. **[CarbonX]**
 - e. **[Pozzotive (Glenwood Mason Supply)]**
 - f. **<Insert manufacturer's name>**
 3. Size: Manufactured to dimensions specified in "CMUs" Paragraph but with prefaced surfaces having **1/16-inch- (1.5-mm-)** wide returns of facing to create **1/4-inch- (6-mm-)** wide mortar joints with modular coursing.
 4. Colors and Patterns: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]** .
- J. Concrete Building Brick: ASTM C55, **[normal-weight][medium-weight][lightweight]** solid units.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Acme Brick Company]**
 - b. **[Belden Brick Company (The)]**
 - c. **[Bilco Brick Company]**
 - d. **[Echelon Masonry, an Oldcastle APG brand]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Acme Brick Company]**
 - b. **[Belden Brick Company (The)]**
 - c. **[Bilco Brick Company]**
 - d. **[Echelon Masonry, an Oldcastle APG brand]**

e. <Insert manufacturer's name>

3. Size (Actual Dimensions): **3-5/8 inches (92 mm)** wide by **[2-1/4 inches (57 mm)][2-3/4 inches (70 mm)][3-5/8 inches (92 mm)]** high by **7-5/8 inches (194 mm)** long.

K. CMU Admixtures:

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested in accordance with ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, will show no visible water or leaks on the back of test specimen.

a. Location: **[For exposed units][and][where indicated on Drawings]** .

2.5 LINTELS

- A. Solid Concrete Masonry Lintels: ASTM C1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. **[Provide lintels with net-area compressive strength of not less than that of CMUs.][Provide lintels with net-area compressive strength as indicated.]**
- B. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Section 033000 "Cast-in-Place Concrete" and with reinforcing bars indicated.
- C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.6 MORTAR AND GROUT MATERIALS

- A. Regional Materials: Verify aggregate for mortar and grout [, **cement, and lime**] is manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- B. Regional Materials: Verify aggregate for mortar and grout [, **cement, and lime**] is manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, multiply the distance by 0.25 to determine the distance to Project site.
- C. General: Provide mortar and grout materials to achieve performance requirements as specified in mortar and grout mixes.
- D. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 1. Alkali content is not more than 0.1 percent when tested in accordance with ASTM C114.
- E. Hydrated Lime: ASTM C207, Type S.
- F. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other

ingredients.

G. Masonry Cement: ASTM C91/C91M.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Argos USA LLC]**
 - b. **[Cemex S.A.B. de C.V.]**
 - c. **[Fairborn Cement Company]**
 - d. **[Federal White Cement, Ltd.]**
 - e. **[Heidelberg Materials]**
 - f. **[Holcim (US) Inc]**
 - g. **[Lafarge North America Inc.]**
 - h. **[Lehigh White Cement Company]**
 - i. **[Quikrete; The QUIKRETE Companies, LLC]**
 - j. **[Sakrete; CRH Americas, Oldcastle APG]**
 - k. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Argos USA LLC]**
 - b. **[Cemex S.A.B. de C.V.]**
 - c. **[Fairborn Cement Company]**
 - d. **[Federal White Cement, Ltd.]**
 - e. **[Heidelberg Materials]**
 - f. **[Holcim (US) Inc]**
 - g. **[Lafarge North America Inc.]**
 - h. **[Lehigh White Cement Company]**
 - i. **[Quikrete; The QUIKRETE Companies, LLC]**
 - j. **[Sakrete; CRH Americas, Oldcastle APG]**
 - k. **<Insert manufacturer's name>**

H. Mortar Cement: ASTM C1329/C1329M.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Lafarge North America Inc.]**
 - b. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Lafarge North America Inc.]**
 - b. **<Insert manufacturer's name>**

- I. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory

performance in masonry mortar.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Davis Colors]**
 - b. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - c. **[Lanxess Corporation]**
 - d. **[Solomon Colors Inc.]**
 - e. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Davis Colors]**
 - b. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - c. **[Lanxess Corporation]**
 - d. **[Solomon Colors Inc.]**
 - e. **<Insert manufacturer's name>**

J. Colored Mortar: Packaged blend made from **[portland cement-lime mix lime][or][masonry cement]** and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - 1) **[Argos USA LLC]**
 - 2) **[Heidelberg Materials]**
 - 3) **[Holcim (US) Inc]**
 - 4) **[Lafarge North America Inc.]**
 - 5) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[Argos USA LLC]**
 - 2) **[Heidelberg Materials]**
 - 3) **[Holcim (US) Inc]**
 - 4) **[Lafarge North America Inc.]**
 - 5) **<Insert manufacturer's name>**
2. Colored Masonry Cement:
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- 1) [Argos USA LLC]
- 2) [Cemex S.A.B. de C.V.]
- 3) [Fairborn Cement Company]
- 4) [Heidelberg Materials]
- 5) [Holcim (US) Inc]
- 6) [Lafarge North America Inc.]
- 7) <Insert manufacturer's name>

- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- 1) [Argos USA LLC]
- 2) [Cemex S.A.B. de C.V.]
- 3) [Fairborn Cement Company]
- 4) [Heidelberg Materials]
- 5) [Holcim (US) Inc]
- 6) [Lafarge North America Inc.]
- 7) <Insert manufacturer's name>

3. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
4. Pigments does not exceed 10 percent of portland cement by weight.
5. Pigments does not exceed 5 percent of [masonry cement][or][mortar cement] by weight.

- K. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than **1/4 inch (6 mm)** thick, use aggregate graded with 100 percent passing the **No. 16 (1.18-mm)** sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

- L. Aggregate for Grout: ASTM C404.

- M. Epoxy Pointing Mortar: ASTM C395, epoxy-resin-based material formulated for use as pointing mortar for glazed or prefaced masonry units (and approved for such use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.

- N. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- a. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
- b. [GCP Applied Technologies Inc.]
- c. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the

following:

- a. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
- b. **[GCP Applied Technologies Inc.]**
- c. **<Insert manufacturer's name>**

O. Water-Repellent Mortar Admixture: Liquid water-repellent admixture added to mortar, intended for use with CMUs containing integral water repellent from same manufacturer.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- a. **[ACM Chemistries]**
- b. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
- c. **[GCP Applied Technologies Inc.]**
- d. **[Master Builders Solutions]**
- e. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[ACM Chemistries]**
- b. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
- c. **[GCP Applied Technologies Inc.]**
- d. **[Master Builders Solutions]**
- e. **<Insert manufacturer's name>**

P. Water: Potable.

2.7 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, **Grade 60 (Grade 420)**.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from **0.148-inch (3.77-mm)** steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- a. **[Heckmann Building Products, Inc.]**
- b. **[Hohmann & Barnard, Inc]**
- c. **[Wire-Bond]**
- d. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. [Heckmann Building Products, Inc.]
- b. [Hohmann & Barnard, Inc]
- c. [Wire-Bond]
- d. <Insert manufacturer's name>

C. Masonry-Joint Reinforcement: Ladder type complying with ASTM A951/A951M.

- 1. Interior Walls: [Mill-][Hot-dip] galvanized carbon steel.
- 2. Exterior Walls: [Hot-dip galvanized carbon][Stainless] steel.
- 3. Wire Size for Side Rods: [0.148-inch (3.77-mm)][0.187-inch (4.76-mm)] diameter.
- 4. Wire Size for Cross Rods: [0.148-inch (3.77-mm)][0.187-inch (4.76-mm)] diameter.
- 5. Spacing of Cross Rods: Not more than 16 inches (406 mm) o.c.
- 6. Provide in lengths of not less than 10 ft. (3 m)[, with prefabricated corner and tee units] .

2.8 TIES AND ANCHORS

A. General: Ties and anchors extend at least 1-1/2 inches (38 mm) into masonry but with at least a 5/8-inch (16-mm) cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

- 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A641/A641M, Class 1 coating.
- 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
- 3. Stainless Steel Wire: ASTM A580/A580M, [Type 304][Type 316] .
- 4. Mill Galvanized-Steel Sheet: ASTM A653/A653M, Commercial Steel, G60 (Z180) zinc coating.
- 5. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M commercial steel, with ASTM A153/A153M, Class B coating.
- 6. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, [Type 304][Type 316] .
- 7. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

- 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6-mm-) diameter, [hot-dip galvanized steel][stainless steel] wire. [Mill-galvanized wire may be used at interior walls unless otherwise indicated.]
- 2. Tie Section: Triangular-shaped wire tie made from [0.187-inch- (4.76-mm-)][0.25-inch- (6.35-mm-)] diameter, [hot-dip galvanized steel][stainless steel] wire. [Mill-galvanized wire may be used at interior walls unless otherwise indicated.]

D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

- 1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from [0.060-inch- (1.52-mm-) thick steel sheet, galvanized after fabrication][0.105-inch- (2.66-mm-) thick steel sheet, galvanized after fabrication][0.062-inch- (1.59-mm-) thick, stainless steel sheet][0.109-inch- (2.78-mm-) thick, stainless steel sheet] .
 - a. [0.064-inch- (1.63-mm-)][0.108-inch- (2.74-mm-)] thick, hot-dip galvanized-steel sheet may be used at interior walls unless otherwise indicated.

2. Tie Section: Triangular-shaped wire tie made from **[0.187-inch- (4.76-mm-)]****[0.25-inch- (6.35-mm-)]** diameter, **[hot-dip galvanized steel]****[stainless steel]** wire. **[Mill-galvanized carbon steel wire may be used at interior walls unless otherwise indicated.]**
3. Corrugated-Metal Ties: Metal strips not less than **7/8 inch (22 mm)** wide with corrugations having a wavelength of **0.3 to 0.5 inch (7.6 to 12.7 mm)** and an amplitude of **0.06 to 0.10 inch (1.5 to 2.5 mm)** made from **[0.060-inch- (1.52-mm-) thick steel sheet, galvanized after fabrication]****[0.075-inch- (1.90 mm-) thick steel sheet, galvanized after fabrication]****[0.105-inch- (2.66-mm-) thick steel sheet, galvanized after fabrication]****[0.062-inch- (1.59-mm-) thick, stainless steel sheet]****[0.078-inch- (1.98-mm-) thick, stainless steel sheet]****[0.109-inch- (2.78-mm-) thick, stainless steel sheet]** with dovetail tabs for inserting into dovetail slots in concrete.
 - a. **[0.064-inch- (1.63-mm-)]****[0.079-inch- (2.01-mm-)]****[0.108-inch- (2.74-mm-)]** thick, galvanized sheet may be used at interior walls unless otherwise indicated.
- E. Partition Top Anchors: **0.105-inch- (2.66-mm-) thick metal plate** with a **3/8-inch- (9.5-mm-) diameter metal rod 6 inches (152 mm) long** welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from **[steel, hot-dip galvanized after fabrication]****[stainless steel]** .
- F. Rigid Anchors: Fabricate from steel bars **[1-1/2 inches (38 mm) wide by 1/4 inch (6 mm) thick by 24 inches (610 mm) long, with ends turned up 2 inches (51 mm) or with cross pins unless otherwise indicated]****[bent to configuration indicated]** .
 1. Corrosion Protection: **[Hot-dip galvanized to comply with ASTM A 153/A153M]****[Epoxy coating 0.020 inch (0.51 mm) thick]****[Rust-inhibitive paint]** .

2.9 EMBEDDED FLASHING

- A. Embedded Flashing Applications: Unless otherwise indicated, use the following:
 1. Where flashing is indicated to receive counterflashing, use metal flashing.
 2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
 3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing **[with a drip edge]****[with a sealant stop]****[or flexible flashing with a metal drip edge]****[or elastomeric thermoplastic flashing with a drip edge]****[or flexible flashing with a metal sealant stop]** .
 4. Where flashing is fully concealed, use **[metal flashing]****[or]****[flexible flashing]** .
- B. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual":
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following]****[provide products by one of the following]****[available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Cheney Flashing Company]**
 - b. **[Hohmann & Barnard, Inc]**
 - c. **[Keystone Flashing Company, Inc]**
 - d. **[Wire-Bond]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the

following:

- a. **[Cheney Flashing Company]**
 - b. **[Hohmann & Barnard, Inc]**
 - c. **[Keystone Flashing Company, Inc]**
 - d. **[Wire-Bond]**
 - e. **<Insert manufacturer's name>**
3. Stainless Steel: ASTM A240/A240M or ASTM A666, **[Type 304][Type 316]** , **0.016 inch (0.40 mm)** thick.
 4. Copper: **[ASTM B370, Temper H00, cold-rolled copper sheet, 16 oz./sq. ft. (4.9 kg/sq. m) weight or 0.0216 inch (0.55 mm) thick][or][ASTM B370, Temper H01, high-yield copper sheet, 12 oz./sq. ft. (3.7 kg/sq. m) weight or 0.0162 inch (0.41 mm) thick]** .
 5. Fabricate continuous flashings in sections **96 inches (2400 mm)** long minimum, but not exceeding **12 ft. (3.7 m)**. Provide splice plates at joints of formed, smooth metal flashing.
 6. Fabricate through-wall metal flashing embedded in masonry from **[stainless steel][copper]** , with ribs at **3-inch (76-mm)** intervals along length of flashing to provide an integral mortar bond.
 7. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
 8. Fabricate through-wall flashing with drip edge **[where][unless otherwise]** indicated. Fabricate by extending flashing **1/2 inch (13 mm)** out from wall, with outer edge bent down 30 degrees **[and hemmed]** .
 9. Fabricate through-wall flashing with sealant stop **[where][unless otherwise]** indicated. Fabricate by bending metal back on itself **3/4 inch (19 mm)** at exterior face of wall and down into joint **1/4 inch (6 mm)** to form a stop for retaining sealant backer rod.
 10. Fabricate metal **[drip edges][and][sealant stops]** for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least **3 inches (76 mm)** into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam sheds water.
- C. Flexible Flashing: Where flashing is fully concealed in masonry, use one of the following unless otherwise indicated:
1. Copper-Fabric Flashing: Copper sheet bonded between two layers of glass-fiber cloth.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - 1) **[Advanced Building Products Inc.]**
 - 2) **[Hohmann & Barnard, Inc]**
 - 3) **[STS Coatings, Inc.]**
 - 4) **[Wire-Bond]**
 - 5) **[York Manufacturing, Inc]**
 - 6) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[Advanced Building Products Inc.]**
 - 2) **[Hohmann & Barnard, Inc]**
 - 3) **[STS Coatings, Inc.]**
 - 4) **[Wire-Bond]**
 - 5) **[York Manufacturing, Inc]**

- 6) <Insert manufacturer's name>
 - c. Sheet Weight: [3 oz./sq. ft. (0.9 kg/sq. m)][5 oz./sq. ft. (1.5 kg/sq. m)][7 oz./sq. ft. (2 kg/sq. m)] .
 - d. Sheet Type: [Non-adhesive][Self-adhesive] .
2. Asphalt-Coated Copper Flashing: Copper sheet coated with flexible asphalt.
 - a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - 1) [Hohmann & Barnard, Inc]
 - 2) [Wire-Bond]
 - 3) <Insert manufacturer's name>
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - 1) [Hohmann & Barnard, Inc]
 - 2) [Wire-Bond]
 - 3) <Insert manufacturer's name>
 - c. Sheet Weight: [5 oz./sq. ft. (1.5 kg/sq. m)][7 oz./sq. ft. (2 kg/sq. m)] .
 3. Stainless Steel Fabric Flashing: Composite, flashing product consisting of minimum 2-mil- (0.05-mm-) thick stainless steel sheet, bonded to a layer of polymeric fabric.
 - a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - 1) [Fiberweb, a brand of Clark/Hammerbeam Corp.]
 - 2) [Hohmann & Barnard, Inc]
 - 3) [PROSOCO, Inc]
 - 4) [STS Coatings, Inc.]
 - 5) [Wire-Bond]
 - 6) [York Manufacturing, Inc]
 - 7) <Insert manufacturer's name>
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - 1) [Fiberweb, a brand of Clark/Hammerbeam Corp.]
 - 2) [Hohmann & Barnard, Inc]
 - 3) [PROSOCO, Inc]
 - 4) [STS Coatings, Inc.]
 - 5) [Wire-Bond]
 - 6) [York Manufacturing, Inc]
 - 7) <Insert manufacturer's name>

- c. Grade: **[Type 304][Type 316]** .
 - d. Overall Thickness: Manufacturer's standard.
- 4. Self-Adhering, Stainless Steel Fabric Flashing: Composite, flashing product consisting of minimum **2-mil- (0.05-mm-)** thick stainless steel sheet, bonded to a layer of polymeric fabric.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - 1) **[Hohmann & Barnard, Inc]**
 - 2) **[STS Coatings, Inc.]**
 - 3) **[VaproShield LLC]**
 - 4) **[Wire-Bond]**
 - 5) **[York Manufacturing, Inc]**
 - 6) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[Hohmann & Barnard, Inc]**
 - 2) **[STS Coatings, Inc.]**
 - 3) **[VaproShield LLC]**
 - 4) **[Wire-Bond]**
 - 5) **[York Manufacturing, Inc]**
 - 6) **<Insert manufacturer's name>**
 - c. Grade: **[Type 304][Type 316]** .
 - d. Bonding Agent: **[Butyl][Permanent, clear]** adhesive.
 - e. Overall Thickness: Manufacturer's standard.
- 5. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - 1) **[Advanced Building Products Inc.]**
 - 2) **[Carlisle Coatings & Waterproofing Inc]**
 - 3) **[Fiberweb, a brand of Clark/Hammerbeam Corp.]**
 - 4) **[GCP Applied Technologies Inc.]**
 - 5) **[Heckmann Building Products, Inc.]**
 - 6) **[Hohmann & Barnard, Inc]**
 - 7) **[Polyguard Products, Inc.]**
 - 8) **[W. R. Meadows, Inc]**
 - 9) **[Williams Products, Inc.]**
 - 10) **[Wire-Bond]**
 - 11) **[York Manufacturing, Inc]**
 - 12) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of

the following:

- 1) [Advanced Building Products Inc.]
 - 2) [Carlisle Coatings & Waterproofing Inc]
 - 3) [Fiberweb, a brand of Clark/Hammerbeam Corp.]
 - 4) [GCP Applied Technologies Inc.]
 - 5) [Heckmann Building Products, Inc.]
 - 6) [Hohmann & Barnard, Inc]
 - 7) [Polyguard Products, Inc.]
 - 8) [W. R. Meadows, Inc]
 - 9) [Williams Products, Inc.]
 - 10) [Wire-Bond]
 - 11) [York Manufacturing, Inc]
 - 12) <Insert manufacturer's name>
- c. Overall Thickness: Not less than [30 mils (0.76 mm)][40 mils (1.0 mm)][60 mils (1.5 mm)] .
6. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin.
- a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
- 1) [DuPont de Nemours, Inc.]
 - 2) [GCP Applied Technologies Inc.]
 - 3) [Kingspan Insulation LLC]
 - 4) [Protecto Wrap Company]
 - 5) [Wire-Bond]
 - 6) <Insert manufacturer's name>
- b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- 1) [DuPont de Nemours, Inc.]
 - 2) [GCP Applied Technologies Inc.]
 - 3) [Kingspan Insulation LLC]
 - 4) [Protecto Wrap Company]
 - 5) [Wire-Bond]
 - 6) <Insert manufacturer's name>
- c. Overall Thickness: Not less than [35 mils (0.89 mm)][40 mils (1.0 mm)] .
7. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.
- a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :

- 1) [Hohmann & Barnard, Inc]
 - 2) [Hyload; IKO Industries, Inc.]
 - 3) [Mortar Net Solutions]
 - 4) [Wire-Bond]
 - 5) <Insert manufacturer's name>
- b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- 1) [Hohmann & Barnard, Inc]
 - 2) [Hyload; IKO Industries, Inc.]
 - 3) [Mortar Net Solutions]
 - 4) [Wire-Bond]
 - 5) <Insert manufacturer's name>
- c. Monolithic Sheet: Elastomeric thermoplastic flashing, **0.040 inch (1.02 mm)** thick.
- d. Self-Adhesive Sheet: Elastomeric thermoplastic flashing, **0.025 inch (0.64 mm)** thick, with a **0.015-inch- (0.38-mm-)** thick coating of adhesive.
- 1) Color: [Gray][White][Tan/buff][Black] .
8. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D4637/D4637M.
- a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
- 1) [Carlisle Coatings & Waterproofing Inc]
 - 2) [Elevate; Amrize Building Envelope LLC]
 - 3) [Heckmann Building Products, Inc.]
 - 4) [Hohmann & Barnard, Inc]
 - 5) [Wire-Bond]
 - 6) <Insert manufacturer's name>
- b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- 1) [Carlisle Coatings & Waterproofing Inc]
 - 2) [Elevate; Amrize Building Envelope LLC]
 - 3) [Heckmann Building Products, Inc.]
 - 4) [Hohmann & Barnard, Inc]
 - 5) [Wire-Bond]
 - 6) <Insert manufacturer's name>
- c. Thickness: **40 mils (1.0 mm)**.
- D. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from UV-resistant, high-density polyethylene. Cell flashing pans have integral weep spouts designed to be built into mortar bed joints and that extend into the cell to prevent clogging with mortar.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering

products that may be incorporated into the Work include, but are not limited to, the following] :

- a. [Mortar Net Solutions]
- b. <Insert manufacturer's name>

- 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Mortar Net Solutions]
- b. <Insert manufacturer's name>

- E. Preformed Corners, End Dams, and Seaming Shapes for Flashing: Flashing manufacturer's standard products or products recommended by flashing manufacturer for waterproofing openings.
- F. Solder and Sealants for Sheet Metal Flashings: [**As specified in Section 076200 "Sheet Metal Flashing and Trim."**]
 - 1. Solder for Stainless Steel: ASTM B32, [Grade Sn60][Grade Sn96] , with acid flux of type recommended by stainless steel sheet manufacturer.
 - 2. Solder for Copper: ASTM B32, [Grade Sn50][with maximum lead content of 0.2 percent] .
 - 3. Elastomeric Sealant: ASTM C920, chemically curing [urethane][polysulfide][silicone] sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.
- G. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.10 ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from [neoprene][urethane][or][PVC] .
- B. Preformed Control-Joint Gaskets: Made from [styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805][or][PVC, complying with ASTM D2287, Type PVC-65406] and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).
- D. Proprietary Acidic Masonry Cleaner: Manufacturer's standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [Diedrich Technologies, Inc.; a Hohmann & Barnard company]

- b. [EaCo Chem, Inc.]
 - c. [PROSOCO, Inc]
 - d. <Insert manufacturer's name>
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Diedrich Technologies, Inc.; a Hohmann & Barnard company]
 - b. [EaCo Chem, Inc.]
 - c. [PROSOCO, Inc]
 - d. <Insert manufacturer's name>
- E. Masonry-Cell Fill: [Loose-fill insulation, perlite complying with ASTM C549, Type II (surface treated for water repency and limited moisture absorption) or Type IV (surface treated for water repency and to limit dust generation)][Lightweight-aggregate fill, ASTM C331/C331M][Foamed-in-place masonry cell fill] .

2.11 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use [portland cement-lime][masonry cement][or][mortar cement] mortar unless otherwise indicated.
 - 3. For exterior masonry, use [portland cement-lime][masonry cement][or][mortar cement] mortar.
 - 4. For reinforced masonry, use [portland cement-lime][masonry cement][or][mortar cement] mortar.
 - 5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C270, [Proportion][Property] Specification. Provide the following types of mortar for applications stated unless another type is indicated [or needed to provide required compressive strength of masonry] .
 - 1. For masonry below grade or in contact with earth, use Type M.
 - 2. For reinforced masonry, use [Type M][Type S][Type N] .
 - 3. For mortar parge coats, use [Type S][or][Type N] .
 - 4. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 - 5. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- D. Pigmented Mortar: Use colored cement product [or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products] .
 - 1. Pigments does not exceed 10 percent of portland cement by weight.
 - 2. Pigments does not exceed 5 percent of [masonry cement][or][mortar cement] by weight.
 - 3. Mix to match Architect's sample.

4. Application: Use pigmented mortar for exposed mortar joints with the following units: **<Insert masonry unit types>** .
- E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 1. Mix to match Architect's sample.
 2. Application: Use colored-aggregate mortar for exposed mortar joints with the following units: **<Insert masonry unit types>** .
- F. Grout for Unit Masonry: Comply with ASTM C476.
 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 402/602 for dimensions of grout spaces and pour height.
 2. Proportion grout in accordance with ASTM C476, **[Table 1][or][paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa)]** .
 3. Provide grout with a slump of **[8 to 11 inches (200 to 280 mm)][10 to 11 inches (250 to 280 mm)]** as measured in accordance with ASTM C143/C143M.
- G. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's written instructions.
 1. Application: Use epoxy pointing mortar for exposed mortar joints with the following units: **<Insert masonry unit types>** .

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
 4. Verify that substrates are free of substances that would impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit

adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

- D. Exposed Masonry: Mix units to produce uniform blend of colors and textures.
- E. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- F. Temperature Control: Perform temperature-sensitive construction procedures while masonry Work is progressing. Temperature ranges indicated below apply to air temperatures existing at time of installation except for grout. For grout, temperature ranges apply to anticipated minimum night temperatures. In heating mortar and grout materials, maintain mixing temperature selected within **10 deg F (6 deg C)**.
 - 1. 40 to 32 Deg F (4 to 0 Deg C):
 - a. Mortar: Heat mixing water to produce mortar temperature between **40 and 120 deg F (4 and 49 deg C)**.
 - b. Grout: Follow normal masonry procedures.
 - 2. 32 to 25 Deg F (0 to Minus 4 Deg C):
 - a. Mortar: Heat mixing water and sand to produce mortar temperatures between **40 and 120 deg F (4 and 49 deg C)**; maintain temperature of mortar on boards above freezing.
 - b. Grout: Heat grout materials to **90 deg F (32 deg C)** to produce in-place grout temperature of **70 deg F (21 deg C)** at end of workday.
 - 3. 25 to 20 Deg F (Minus 4 to 7 Deg C):
 - a. Mortar: Heat mixing water and sand to produce mortar temperatures between **40 and 120 deg F (4 and 49 deg C)**; maintain temperature of mortar on boards above freezing.
 - b. Grout: Heat grout materials to **90 deg F (32 deg C)** to produce in-place grout temperature of **70 deg F (21 deg C)** at end of workday.
 - c. Heat both sides of walls under construction using salamanders or other heat sources.
 - d. Use windbreaks or enclosures when wind is in excess of 15 mph.
 - 4. 20 Deg F (Minus 7 Deg C) and Below:
 - a. Mortar: Heat mixing water and sand to produce mortar temperatures between **40 and 120 deg F (4 and 49 deg C)**.
 - b. Grout: Heat grout materials to **90 deg F (32 deg C)** to produce in-place grout temperature of **70 deg F (21 deg C)** at end of workday.
 - c. Masonry Units: Heat masonry units so that they are above **20 deg F (minus 7 deg C)** at time of laying.
 - d. Provide enclosure and auxiliary heat to maintain an air temperature of at least **40 deg F (4 deg C)** for 24 hours after laying units.
 - 5. Do not heat water for mortar and grout to above **160 deg F (71 deg C)**.
- G. Masonry Protection: Protect completed masonry and masonry not being worked on in the following manner. Temperature ranges indicated apply to mean daily air temperatures except for grouted masonry. For grouted masonry, temperature ranges apply to anticipated minimum night temperatures.
 - 1. 40 to 32 Deg F (4 to 0 Deg C): Protect masonry from rain or snow for at least 24 hours by

- covering with weather-resistive membrane.
2. 32 to 25 Deg F (0 to Minus 4 Deg C): Completely cover masonry with weather-resistive membrane for at least 24 hours.
 3. 25 to 20 Deg F (Minus 4 to 7 Deg C): Completely cover masonry with weather-resistive insulating blankets or similar protection for at least 24 hours, 48 hours for grouted masonry.
 4. 20 Deg F (Minus 7 Deg C) and Below: Except as otherwise indicated, maintain masonry temperature above 32 deg F (0 deg C) for 24 hours using enclosures and supplementary heat, electric heating blankets, infrared lamps or other methods proven to be satisfactory. For grouted masonry, maintain heated enclosure to **40 deg F (4 deg C)** for 48 hours.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus **1/2 inch (13 mm)** or minus **1/4 inch (6 mm)**.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus **1/2 inch (13 mm)**.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus **1/4 inch (6 mm)** in a story height or **1/2 inch (13 mm)** total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than **1/4 inch in 10 ft. (6 mm in 3 m)**, or **1/2 inch (13 mm)** maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than **1/8 inch in 10 ft. (3 mm in 3 m)**, **1/4 inch in 20 ft. (6 mm in 6 m)**, or **1/2 inch (13 mm)** maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than **1/4 inch in 10 ft. (6 mm in 3 m)**, **3/8 inch in 20 ft. (9 mm in 6 m)**, or **1/2 inch (13 mm)** maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than **1/8 inch in 10 ft. (3 mm in 3 m)**, **1/4 inch in 20 ft. (6 mm in 6 m)**, or **1/2 inch (13 mm)** maximum.
5. For lines and surfaces, do not vary from straight by more than **1/4 inch in 10 ft. (6 mm in 3 m)**, **3/8 inch in 20 ft. (9 mm in 6 m)**, or **1/2 inch (13 mm)** maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than **1/4 inch in 10 ft. (6 mm in 3 m)** or **1/2 inch (13 mm)** maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than **1/16 inch (1.5 mm)**.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus **1/8 inch (3 mm)**, with a maximum thickness limited to **1/2 inch (13 mm)**.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than **1/8 inch (3 mm)**.
3. For head and collar joints, do not vary from thickness indicated by more than plus **3/8 inch (9 mm)** or minus **1/4 inch (6 mm)**.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus **1/8 inch (3 mm)**.

3.4 INSTALLATION OF MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in **[running bond][bond pattern indicated on Drawings]** ; do not use units with less-than-nominal **4-inch (100-mm)** horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than **[2 inches (50 mm)][4 inches (100 mm)]** . Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal **4-inch (100-mm)** horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout **24 inches (600 mm)** under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Rigid, Cellular Thermal Insulation, CMUs: Install molded-polystyrene insulation units into masonry unit cells before laying units.
- J. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of hollow CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide **1/2-inch (13-mm)** clearance between end of anchor rod and end of tube. Space anchors **[48 inches (1200 mm)]<Insert spacing>** o.c. unless otherwise indicated.
 - 3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."
 - 5. Joint Sealants: Comply with ASTM C1193 for use of joint sealants, including acoustic sealants as applicable to materials, applications and Project conditions.
 - 6. Penetration Firestopping: Install penetration firestopping systems for Project applications to comply with manufacturer's written installation instructions.

3.5 INSTALLATION OF MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.

3. Bed webs in mortar in grouted masonry, including starting course on footings.
 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
- B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Where applicable, set masonry trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
 2. Wet joint surfaces thoroughly before applying mortar.
 3. Rake out mortar joints for pointing with sealant.
- D. Prefaced CMUs: Rake out mortar joints at units to a uniform depth of **1/4 inch (6 mm)** and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.
- E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- F. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- G. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 INSTALLATION OF MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of **5/8 inch (16 mm)** on exterior side of walls, **1/2 inch (13 mm)** elsewhere. Lap reinforcement a minimum of **6 inches (150 mm)**.
1. Space reinforcement not more than **16 inches (406 mm)** o.c.
 2. Space reinforcement not more than **8 inches (203 mm)** o.c. in foundation walls and parapet walls.
 3. Provide reinforcement not more than **8 inches (203 mm)** above and below wall openings and extending **12 inches (305 mm)** beyond openings [**in addition to continuous reinforcement**] .
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at [**corners,**] returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 INSTALLATION OF ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
1. Provide an open space not less than [**1/2 inch (13 mm)**][**1 inch (25 mm)**][**2 inches (50 mm)**]

wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.

2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than **24 inches (610 mm)** o.c. vertically and **36 inches (915 mm)** o.c. horizontally.

3.8 INSTALLATION OF CONTROL JOINTS

- A. General: Install control joint materials in CMUs as masonry progresses. Do not allow materials to span control joints without provision to allow for in-plane wall or partition movement.
- B. Locate control joints. **[See Drawings][Comply with CMU-TEC-009-25]** .
- C. Form control joints in CMUs as follows:
 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 2. Install preformed control joint gaskets designed to fit standard sash block.
 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.9 INSTALLATION OF LINTELS

- A. Install lintels over openings as indicated.
- B. Provide concrete or formed-in-place masonry lintels where shown and where openings of more than **12 inches (305 mm)** for brick-size units and **24 inches (610 mm)** for block-size units are shown without structural steel or other supporting lintels. Provide minimum bearing of **8 inches (200 mm)** at each jamb unless otherwise indicated.
- C. Install loose steel over openings [.]**[as follows:] [See Drawings.]**
 1. Provide minimum bearing of **8 inches (200 mm)** at each jamb unless otherwise indicated.
- D. Lintels at Fire-Rated Openings: Provide fire-rated masonry required or steel lintels with applied fireproofing in thickness required to maintain fire rating of wall or partition rating.

3.10 INSTALLATION OF EMBEDDED FLASHING

- A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.
- B. Install flashing as follows unless otherwise indicated:
 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape **[as recommended by flashing manufacturer]** .
 2. At lintels, extend flashing a minimum of **6 inches (150 mm)** into masonry at each end. At heads and sills, extend flashing **6 inches (150 mm)** at ends and turn up not less than **2 inches (50 mm)**

to form end dams.

3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than **1-1/2 inches (38 mm)** or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
4. Install metal **[drip edges][and][sealant stops]** with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing **1/2 inch (13 mm)** back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
6. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing **1/2 inch (13 mm)** back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
7. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

- C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.
- D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.11 INSTALLATION OF REINFORCED UNIT MASONRY

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 402/602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 1. Comply with requirements in TMS 402/602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than **[60 inches (1500 mm)][12.67 ft. (3.86 m)]<Insert height>**.

3.12 INSTALLATION OF MASONRY-CELL FILL

- A. Loose-Fill Insulation: Pour into cavities to fill void spaces. Maintain inspection ports to show presence of fill at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of fill to one story high, but not more than **20 ft. (6 m)**.
- B. Lightweight-Aggregate Fill: Pour into cavities to fill void spaces. Maintain inspection ports to show presence of fill at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of fill to one story high, but not more than **20 ft. (6 m)**.

- C. Foamed-In-Place Masonry Cell Fill: Drill holes in mortar bed joints at spacing as indicated in writing by foamed-in-place masonry fill manufacturer, and inject foam to fill masonry cell voids.

3.13 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements is done at Contractor's expense.
- B. Inspections: Special inspections in accordance with **[Level 2][Level 3]** in TMS 402/602.
 - 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 - 2. Place grout only after inspectors have verified compliance of grout spaces, grades, sizes, and locations of reinforcement.
 - 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction: One set of tests.
- D. Testing Frequency: One set of tests for each **5000 sq. ft. (464.5 sq. m)** of wall area or portion thereof.
- E. Concrete Masonry Units: Test for each type of unit provided, in accordance with ASTM C140/C140M for compressive strength.
- F. Mortar Aggregates: Ratio test (Proportion Specification) for each mix provided, in accordance with ASTM C780.
- G. Mortar: Test for each mix provided, in accordance with ASTM C780. Test mortar for **[mortar air content][and][compressive strength]** .
- H. Grout: Test for each mix provided, in accordance with ASTM C1019.
- I. Prism Test: For each type of construction provided, in accordance with ASTM C1314 at **[7 days and at]** 28 days.
- J. Fire-Resistance-Rated Construction: Where applicable, inspect fire-rated CMU construction to determine compliance with construction documents per building code compliance.

3.14 PARGING

- A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of **3/4 inch (19 mm)**. Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of **1/8 inch per ft. (3 mm per 300 mm)**. Form a wash at top of parging and a cove at bottom.
- C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.15 REPAIRING AND POINTING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

3.16 CLEANING

- A. In-Progress Cleaning: Clean unit masonry as Work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid-strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean concrete masonry by applicable cleaning methods indicated in TEK 08-04A.

3.17 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 - 1. Crush masonry waste to less than **4 inches (100 mm)** in each dimension.
 - 2. Mix masonry waste with at least 2 parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
 - 3. Do not dispose of masonry waste as fill within **18 inches (450 mm)** of finished grade.
- C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 22 00 00



Task	Specification	Specification Description
04 22 00 00	04 20 00 00a	Masonry Veneer
04 22 23 00	04 22 00 00	Concrete Unit Masonry
04 22 23 00	04 20 00 00a	Masonry Veneer
04 22 23 13	04 20 00 00	Unit Masonry
04 22 23 13	04 22 00 00	Concrete Unit Masonry
04 22 23 13	04 20 00 00a	Masonry Veneer
04 22 23 23	04 20 00 00	Unit Masonry
04 22 23 23	04 22 00 00	Concrete Unit Masonry
04 22 23 23	04 20 00 00a	Masonry Veneer
04 22 23 26	04 20 00 00	Unit Masonry
04 22 23 26	04 22 00 00	Concrete Unit Masonry
04 22 23 26	04 20 00 00a	Masonry Veneer
04 22 23 29	04 20 00 00	Unit Masonry
04 22 23 29	04 22 00 00	Concrete Unit Masonry
04 22 23 29	04 20 00 00a	Masonry Veneer
04 22 23 31	04 20 00 00	Unit Masonry
04 22 23 31	04 22 00 00	Concrete Unit Masonry
04 22 23 31	04 20 00 00a	Masonry Veneer



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SECTION 04 23 00 00 - GLASS UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass block.
2. Mortar materials.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for **[steel frames][and][loose steel lintels]** at glass unit masonry assemblies.

1.2 SEQUENCING AND SCHEDULING

- A. Sequence and coordinate completion of glass unit masonry assemblies so sealants can be installed immediately after mortar has attained final set.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

- B. Shop Drawings: Fabrication and installation details for **[glass unit masonry, including vertical and horizontal coursing, anchors, reinforcement, and expansion strips][and][glass-block panel systems][and][glass-block grid systems]**. Include accessories where indicated.

- C. Samples for Initial Selection: **[Manufacturer's actual glass-block units][glass-block grid material][and][joint materials involving color selection]**.

D. Samples for Verification:

1. **[Glass-block units][glass-block grid material][and][joint materials involving color selection]**.
2. Panels consisting of four full-size glass-block units with **[glass-block grid][mortar][and][sealant]** joints.
 - a. Provide Samples for each form, pattern, and color of glass block and color of joint material indicated or selected by Architect.

- E. Delegated Design Submittals: For installed products, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

1.4 INFORMATIONAL SUBMITTALS

- A. Research Reports: For post-installed anchors, from ICC-ES.
- B. Qualification Statements: For professional engineer.

1.5 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup of typical **[exterior][and][interior]** panel, **48 by 48 inches (1200 by 1200 mm)** in size.
 - 2. Build mockup of typical **[exterior wall area][and][interior partition]** containing glass unit masonry assembly as shown on Drawings.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store glass block in unopened cartons on elevated platforms, under cover, and in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.
- B. Store glass-block grid materials in unopened cartons in an enclosed, dry location.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- E. Store accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with installation of glass unit masonry assemblies only when ambient and material temperatures are **40 deg F (5 deg C)** or higher.
 - 1. Maintain temperature in installation areas at **40 deg F (5 deg C)** or above for 48 hours after installing.
 - 2. Do not install sealants when ambient and substrate temperatures are outside limits permitted by sealant manufacturer or when joint substrates are wet.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. For glass block, obtain[**each type and pattern of**] glass block from single source from single manufacturer.
- B. For accessory materials, obtain each [**cementitious material**][**admixture**][**and**][**accessory component**] from single source from single manufacturer[**and each aggregate from single source or producer**].

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glass-block grid systems, including attachment to building construction.
- B. Structural Performance: Glass-block grid systems, including attachment to building construction, to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Loads: As indicated on Drawings.
 - 2. Wind Load: Uniform pressure of **<Insert wind-load pressure>**, acting inward or outward.
 - 3. Floor Live Load: **<Insert load>**.
 - 4. Roof Live Load: **<Insert load>**.
- C. Glass-Block Panels - General:
 - 1. Non-load bearing, isolated within opening glass fiber or white polyethylene foam expansion strips at jambs and head.
 - 2. Head and Jamb Channels: Size and material as recommended by manufacturer for glass-block units selected. Provide bond breaker as recommended by manufacturer at sill where required by glass-block panel design.

2.3 FIRE-RATED GLASS UNIT MASONRY

- A. Assemblies are listed by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing at positive pressure in accordance with NFPA 257.

2.4 GLASS BLOCK

- A. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
 - 1. [**Seves Glass Block, Inc.**]
 - 2. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1. [**Seves Glass Block, Inc.**]

2. <Insert manufacturer's name>

C. Glass Unit Masonry: .

1. Sizes, General: Provide manufacturer's standard sizes unless indicated as custom.
2. Square Glass-Block Size: [5-3/4 inches (146 mm)][7-3/4 inches (197 mm)][7-3/4 inches (197 mm)][12.99 inches (33 cm)] square by [3-1/8 inches (79 mm)][4.72 inches (12 cm)] thick.
3. Other Glass-Block Size: [13 inches (33 cm)][5-3/4 inches (146 mm)][7-3/4 inches (197 mm)][11-3/4 inches (299 mm)] by [5-3/4 inches (146 mm)][7-3/4 inches (197 mm)][11-3/4 inches (299 mm)] by 3-1/8 inches (79 mm) thick.
4. Glass Unit Masonry Patterns:
 - a. Pattern:
 - 1) Smooth, undistorted inner and outer faces.
 - 2) Wavy, light-diffusive design on inner faces, and smooth outer faces.
 - 3) Fluted, light-diffusive design, horizontal on one inner face, vertical on other, and smooth outer faces.
 - 4) Linear prismatic design, horizontal on one inner face, vertical on other, and smooth outer faces.
 - 5) Prismatic pyramid, light-diffusive design on inner faces, and smooth outer faces.
 - 6) As indicated by manufacturer's designation.
 - 7) Manufacturer's standard decorative pattern to match Architect's sample.
 - 8) As selected by Architect from manufacturer's full range.
5. Glass Color: [**Colorless**][**As indicated by manufacturer's designations**][**Match Architect's samples**][**As selected by Architect from manufacturer's full range**].
6. Edge-Coating Color: [**White**][**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**].
 - a. Provide one color throughout for each pattern indicated.
 - b. Provide multiple colors as indicated for each size and pattern.
7. [**45**][**60**][**90**]-minute fire rating complying with NFPA 257.
8. High-Performance, Prefabricated, Panel Glass-Block System:
 - a. Hurricane Resistant: [**Complies with large missile impact test ASTM E1886 and ASTM 1996**][**Tested to Florida and Dade County approval protocols TAS 201, TAS 202, and TAS 203**][**Window Size and Design Pressure Rating: As recommended by manufacturer**].
 - b. Tornado Resistant: [**Complies with ASTM E330**][**Air pressure test as recommended by manufacturer**].
 - c. Blast Resistant: [**Complies with GSA and UFC 04-0110-01 blast glass standards**].
 - d. Security and Detention: [**ANSI Z97.1**][**16 CFR 1201**].
9. Performance Requirements:
 - a. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of [0.30 Btu/sq. ft. x h x deg F (1.71 W/sq. m x K)][0.32 Btu/sq. ft. x h x deg F (1.83 W/sq. m x K)][0.35 Btu/sq. ft. x h x deg F (2.0 W/sq. m x K)][0.60 Btu/sq. ft. x h x deg F (3.43 W/sq. m x K)]<Insert value>.
 - b. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of [0.40][0.30][0.27]<Insert value>.
 - c. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and

surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

- d. Sound Transmission Class (STC): Rated for not less than [43][48][50][53]<Insert rating> STC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E413.

10. Special Shapes and Finishing Units: .

- a. Corner-Block Sizes and Shapes: Manufacturer's standard units designed to form [90][45][22.5]-degree corners when joined with straight units of same height.
- b. End-Block Size and Shape: [7-1/2 inches (19 cm)][7-3/4 inches (95 by 197 mm)] square by [3-7/8 inches (98 mm)][3-1/8 inches (79 mm)] thick.
- c. Curved-Block Size and Shape: [7-1/2 inches (19 cm)] square by [3-7/8 inches (98 mm)][3-1/8 inches (79 mm)] thick.
- d. Radius-Block Sizes and Shapes: End unit with top matching finished end and with rounded finished corner in manufacturer's standard size to match end units.

11. Glass Blocks for Crafting: .

- a. Glass-Block Size: <Insert dimensions>.
- b. Glass-Block Shape: <Insert shape and mass design>.
- c. Glass-Block Color: <Insert color>.
- d. Glass-Block Pattern: <Insert pattern>.
- e. Glass-Block Performance: <Insert performance requirements>.
- f. Glass-Block Joint Size and Type: <Insert dimensions>.

12. Graphic-Applied Glass Block: .

- a. Transparent, colorless, pressed glass units, with a smooth top surface and a decorative, light-diffusing, patterned bottom surface; [6 inches (152 mm) square by 1 inch (25 mm)][4-3/4 inches (120 mm) square by 1-9/16 inches (40 mm)][6-5/16 inches (160 mm) square by 1-3/16 inches (30 mm)][7-1/2 inches (190 mm) square by 1-15/16 inches (50 mm)][7-1/2 inches (190 mm) square by 2-3/4 inches (70 mm)][7-7/8 inches (200 mm) square by 7/8 inch (22 mm)][7-7/8 inches (200 mm) square by 1-15/16 inches (50 mm)][4-5/8 inches (117 mm) in diameter by 2-3/8 inches (60 mm)] thick, actual size.

13. Solar Glass Block: .

- a. Glass Block for Solar Wall Tubes: Transparent, colorless, pressed glass units, with a smooth top surface and a decorative, light-diffusing, patterned bottom surface.
- b. Size: [8 inches (20 mm) square][8 by 16 inches (20 by 40 mm)].
- c. Depth: <Insert dimension>.
- d. U-Value: <Insert value>.

2.5 GLASS-BLOCK PAVERS

- A. Horizontal Block and Glass-Pavers: . Transparent, colorless, pressed glass units, with a smooth top surface and a decorative, light-diffusing, patterned bottom surface; [4.33 inches (11 cm) square by 2.36 inches (6 cm)][5.57 inches (14 cm) square by 1.96 inches (5 cm)][5.57 inches (14 cm) square by 4.33 inches (11 cm)][6.29 inches (16 cm) square by 1.18 inches (3 cm)][7.48 inches (19 cm) square by 2.75 inches (7 cm)][7.48 inches (19 cm) square by 3.15 inches (8 cm)][7.48 inches (19 cm) square by 3.93 inches (10 cm)][7.87 inches (20 cm) square by 0.78 inch (2 cm)].

- B. Glass-Paver Round Blocks: . Transparent, colorless, pressed glass units, with a smooth top surface and a decorative, light-diffusing, patterned bottom surface; **[4.33 inches (11 cm) in diameter by 2.36 inches (6 cm)][7.48 inches (19 cm) in diameter by 1.96 inches (5 cm)][7.48 inches (19 cm) in diameter by 3.93 inch (10 cm)]** thick.
- C. Horizontal Glass-Pavers, Fire-Resistant: . Transparent, colorless, pressed glass units, with a smooth top surface and a decorative, light-diffusing, patterned bottom surface; **[7.48 inches (19 cm) square by 3.12 inches (8 cm)][7.48 inches (19 cm) square by 6.29 inches (16 cm)]** thick.
1. **[45][60][90]**-minute fire rating complying with NFPA 257.
- D. Horizontal Glass-Pavers, Historical Design: . Transparent, colorless, pressed glass units, with a smooth top surface and a decorative, light-diffusing, patterned bottom surface; **[2.7 inches (7 cm) square by 1.88 inches (4.8 cm)][3.54 inches (9 cm) square by 0.74 inch (1.9 cm)][3.54 inches (9 cm) square by 0.98 inch (2.5 cm)]** thick.
- E. Horizontal Glass-Solar-Powered (Photovoltaic) Pavers: . Transparent, colorless, half-shell glass block, with a smooth top surface and a decorative, light-diffusing, patterned bottom surface.
1. Round: **4.33 inches (11 cm)** in diameter by **2.36 inches (6 cm)** thick.
 2. Square: **4.33 inches (11 cm)** square by **2.36 inches (6 cm)** thick.
 3. Performance: Internal lithium battery (LiFePO4 3.2v) and high-luminosity LED diodes (3000-3500MCD).
 4. Light Color: Cool white.
 5. Service Life: 50,000 hours.

2.6 PREFABRICATED GLASS-BLOCK PANELS AND WINDOWS

- A. Glass Unit Masonry: .
1. Sizes, General: Provide manufacturer's standard sizes unless indicated as custom.
 2. Square Glass-Block Size: **[5-3/4 inches (146 mm)][7-3/4 inches (197 mm)]** square by **3-7/8 inches (98 mm)** thick.
 3. Other Glass-Block Size: **[3-3/4 inches (95 mm)][5-3/4 inches (146 mm)][7-3/4 inches (197 mm)][11-3/4 inches (299 mm)]** by **[5-3/4 inches (146 mm)][7-3/4 inches (197 mm)][11-3/4 inches (299 mm)]** by **3-7/8 inches (98 mm)** thick.
 4. Glass Unit Masonry Patterns:
 - a. Pattern:
 - 1) Smooth, undistorted inner and outer faces.
 - 2) Wavy, light-diffusive design on inner faces, and smooth outer faces.
 - 3) Fluted, light-diffusive design, horizontal on one inner face, vertical on other, and smooth outer faces.
 - 4) Linear prismatic design, horizontal on one inner face, vertical on other, and smooth outer faces.
 - 5) Prismatic pyramid, light-diffusive design on inner faces, and smooth outer faces.
 - 6) As indicated by manufacturer's designation.
 - 7) Manufacturer's standard decorative pattern to match Architect's sample.
 - 8) As selected by Architect from manufacturer's full range.
 5. Glass Color: **[Color][As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]**.
 6. Edge-Coating Color: **[Color][As indicated by manufacturer's designations][Match Architect's**

sample][As selected by Architect from manufacturer's full range].

- a. Provide one color throughout for each pattern indicated.
- b. Provide multiple colors as indicated for each size and pattern.

B. Special Shapes and Finishing Units: .

1. Corner-Block Sizes and Shapes: Manufacturer's standard units designed to form [90][45][22.5]-degree corners when joined with straight units of same height.
2. End-Block Size and Shape: [7-1/2 inches (19 cm)][7-3/4 inches (95 by 197 mm)] square by [3-7/8 inches (98 mm)][3-1/8 inches (79 mm)] thick.
3. Curved-Block Size and Shape: [7-1/2 inches (19 cm)] square by [3-7/8 inches (98 mm)][3-1/8 inches (79 mm)] thick.
4. Radius-Block Sizes and Shapes: End unit with top matching finished end and with rounded finished corner in manufacturer's standard size to match end units.
5. Glass-Block Window Vents:
 - a. Vinyl sash windows.
 - b. Vinyl air vents.
 - c. Vinyl dryer vents.

2.7 MORTAR MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or Type II. Provide natural color or white cement as required to produce mortar color indicated.
 1. Where joints are indicated to be raked out and pointed, gray cement may be used for setting mortar.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C91/C91M.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Cemex S.A.B. de C.V.]
 - b. [Heidelberg Materials]
 - c. [Holcim (US) Inc]
 - d. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Cemex S.A.B. de C.V.]
 - b. [Heidelberg Materials]
 - c. [Holcim (US) Inc]
 - d. <Insert manufacturer's name>

- E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Davis Colors]**
 - b. **[Lanxess Corporation]**
 - c. **[Solomon Colors Inc.]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Davis Colors]**
 - b. **[Lanxess Corporation]**
 - c. **[Solomon Colors Inc.]**
 - d. **<Insert manufacturer's name>**
- F. Colored Cement Product: Packaged blend made from **[portland cement and hydrated lime][or][masonry cement]** and mortar pigments, all complying with specified requirements, and containing no other ingredients.
1. Colored Portland Cement-Lime Mix:
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - 1) **[Heidelberg Materials]**
 - 2) **[Holcim (US) Inc]**
 - 3) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[Heidelberg Materials]**
 - 2) **[Holcim (US) Inc]**
 - 3) **<Insert manufacturer's name>**
 2. Colored Masonry Cement:
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - 1) **[Cemex S.A.B. de C.V.]**
 - 2) **[Heidelberg Materials]**

- 3) [Holcim (US) Inc]
 - 4) <Insert manufacturer's name>
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - 1) [Cemex S.A.B. de C.V.]
 - 2) [Heidelberg Materials]
 - 3) [Holcim (US) Inc]
 - 4) <Insert manufacturer's name>
3. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
4. Pigments do not exceed 10 percent of portland cement by weight.
5. Pigments do not exceed 5 percent of masonry cement by weight.
- G. Aggregate: ASTM C144, with 100 percent passing **No. 8 (2.36-mm)** sieve.
 1. For [pointing mortar][and]joints narrower than 1/4 inch (6 mm)], use aggregate graded with 100 percent passing **No. 16 (1.18-mm)** sieve.
 2. White Aggregates: Natural white sand or crushed white stone.
 3. Colored Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- H. Dry Water-Repellent Admixture: Dry mixture of stearates, water-reducing agents, and fine aggregates intended to reduce capillarity in mortar.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [ACM Chemistries]
 - b. [GCP Applied Technologies Inc.]
 - c. [Master Builders Solutions]
 - d. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [ACM Chemistries]
 - b. [GCP Applied Technologies Inc.]
 - c. [Master Builders Solutions]
 - d. <Insert manufacturer's name>
- I. Liquid Water-Repellent Admixture: Liquid polymeric water-repellent mortar admixture that does not reduce flexural bond strength of mortar.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [ACM Chemistries]

- b. **[GCP Applied Technologies Inc.]**
- c. **[Master Builders Solutions]**
- d. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[ACM Chemistries]**
- b. **[GCP Applied Technologies Inc.]**
- c. **[Master Builders Solutions]**
- d. **<Insert manufacturer's name>**

- J. Water: Potable.

2.8 GLASS UNIT MASONRY ACCESSORIES

- A. Aluminum Perimeter Channels: Two-piece aluminum channel.

- 1. Sizes: As recommended by manufacturer.
- 2. Finish: **[Mill][Anodized clear][Anodized bronze][Powder coating]**.

- B. Mortarless Glass-Block Grid System: Custom glass-block grid system for windows and walls.

- 1. Finish: As selected from manufacturer's standard finishes and colors.

- C. Panel Reinforcement: Ladder-type units, butt welded, not lapped and welded; complying with ASTM A951/A951M in straight lengths of not less than **10 ft. (3 m)**, and as follows:

- 1. Interior Walls: Hot-dip galvanized, carbon steel wire.
- 2. Exterior Walls: **[Hot-dip galvanized, carbon][Stainless]** steel wire.
- 3. Wire Size: W1.7 or **0.148-inch (3.8-mm)** diameter.
- 4. Width: **[2 inches (50 mm)][1-5/8 inches (40 mm)]**.
- 5. Spacing of Cross Rods: Not more than **16 inches (407 mm)** apart.

- D. Panel Anchors: Glass-block manufacturer's standard perforated steel strips, **0.0359 inch (0.9 mm)** by **1-3/4 inches (44 mm)** wide by **24 inches (600 mm)** long, hot-dip galvanized after fabrication to comply with ASTM A153/A153M.

- E. Mortarless Installation System: System of **[aluminum][or][plastic]** perimeter framing, anchors, and spacers designed for installing glass block with sealant-filled joints.

- F. Fasteners, General: Unless otherwise indicated, provide Type 304 or Type 316 stainless steel fasteners at exterior walls and zinc-plated fasteners with coating complying with ASTM B633, Class Fe/Zn 5, at interior walls. Select fasteners for type, grade, and class required.

- G. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193[**or ICC-ES AC308**].

- H. Asphalt Emulsion: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M or ASTM D1227/D1227M.

- I. Mineral-Fiber Expansion Strips: Comply with requirements of fire-rated assembly listing and glass-block manufacturer.
 - 1. Use for fire-rated assemblies.
- J. Plastic-Foam Expansion Strips: Polyethylene foam complying with requirements of glass-block manufacturer; **3/8 inch (9 mm)** thick by **[4 inches (100 mm)][3-1/2 inches (89 mm)][2-1/2 inches (63 mm)]** wide.
 - 1. Use plastic-foam expansion strips for[**fire-rated and**] non-fire-rated assemblies.
- K. Sealants: Manufacturer's standard elastomeric sealants of base polymer and characteristics indicated below that comply with applicable requirements in Section 079200 "Joint Sealants."
 - 1. Silicone: Nonstaining, S, NS, 50, NT **<Insert joint sealant>**,.
 - 2. Urethane: S, NS, 25, NT **<Insert joint sealant>**, .
 - 3. Acrylic Latex: **<Insert joint sealant>**, .
 - 4. Sealant shall have a VOC content of 250 g/L or less.
 - 5. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 6. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 - 7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- L. Sealant Accessories: Provide sealant accessories, including primers, bond-breaker tape, and cylindrical sealant backing, that comply with applicable requirements in Section 079200 "Joint Sealants."

2.9 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, or antifreeze compounds unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar.
 - 2. For mortar in exterior panels, use water-repellent admixture in accordance with admixture manufacturer's written instructions.
 - 3. For pointing mortar in exterior panels, use water-repellent admixture in accordance with admixture manufacturer's written instructions.
 - 4. Limit cementitious materials in mortar to portland cement and lime.
- B. Mortar for Glass Unit Masonry Assemblies:
 - 1. Provide mortar, mixed in accordance with glass-block manufacturer's listing with testing and inspecting agency, for fire-resistance rating indicated.
 - 2. Comply with ASTM C270, Proportion Specification for Type S mortar.
 - a. Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer unless otherwise indicated. Mix mortar to produce a stiff but workable consistency that is drier than mortar for brick or concrete masonry. Discard

mortar when it has reached initial set.

- C. Pigmented Mortar: Use colored cement product[**or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products**].
 - 1. Pigments do not exceed 10 percent of portland cement by weight.
 - 2. Pigments do not exceed 5 percent of masonry cement by weight.
 - 3. Mix to match Architect's sample.
- D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 - 1. Mix to match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine sills, jambs, and heads surrounding glass unit masonry assemblies, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF GLASS BLOCK WITH MORTAR

- A. General: Install masonry units in accordance with manufacturer's written instructions.
 - 1. Where applicable, fasten frames and anchors or clips securely to surrounding construction.
 - 2. Shim starting track as needed to make it level.
 - 3. Arrange coursing pattern to provide consistent joint work throughout.
- B. Apply a heavy coat of asphalt emulsion to sill and adhere expansion strips to jambs and heads with asphalt emulsion. Allow asphalt emulsion to dry before placing mortar. Trim expansion strips to width required to fit glass block and to full lengths of heads and jambs.
- C. Set glass block with completely filled bed and head joints, with no furrowing, accurately spaced and coordinated with other construction. Maintain **[1/4-inch (6-mm)][3/8-inch (10-mm)]** exposed joint widths unless otherwise indicated.
- D. Install panel reinforcement in horizontal joints at spacing indicated and continuously from end to end of panels; comply with the following requirements:
 - 1. Vertical Spacing of Panel Reinforcement for Exterior Panels: **[Every other course, but not more than 16 inches (407 mm) o.c., starting with first course above sill][As indicated on Drawings]**.
 - 2. Vertical Spacing of Panel Reinforcement for Interior Panels: **[Not more than 16 inches (407 mm) o.c.][As indicated on Drawings]**.
 - 3. Do not bridge expansion joints with panel reinforcement.
 - 4. Place panel reinforcement in joints immediately above and below all openings within glass unit masonry assemblies.

5. Lap panel reinforcement not less than **6 inches (150 mm)** if more than one length is necessary.
 6. Embed panel reinforcement in mortar bed by placing lower half of mortar bed first, pressing panel reinforcement into place, and covering with upper half of mortar bed.
- E. Install panel anchors at locations indicated and in same horizontal joints where panel reinforcement occurs. Extend panel anchors at least **12 inches (300 mm)** into joints, and bend within expansion joints at edges of panels and across the head. Attach panel anchors as follows:
1. For in-place unit masonry assemblies and concrete, attach panel anchors with **1/4-inch- (6-mm-)** diameter, bolt-size post-installed anchors, two per panel anchor.
 2. For new unit masonry assemblies, embed other ends of panel anchors, after bending portions crossing expansion joint, in horizontal mortar joints closest in elevation to joints in glass unit masonry assemblies containing panel anchors.
 3. For steel members, attach panel anchors with **1/4-inch- (6-mm-)** diameter through bolts and nuts or bolts in tapped holes in steel members.
- F. Use rubber mallet to tap units into position. Do not use steel tools, and do not allow units to come into contact with metal accessories and frames.
- G. Use **[plastic spacers][or][temporary wedges]** in mortar joints to produce uniform joint widths and to prevent mortar from being squeezed out of joints.
1. If temporary wedges are used, remove them after mortar has set and fill voids with mortar.
- H. Keep expansion joints free of mortar.
- I. Rake out joints indicated to be pointed to a uniform depth sufficient to accommodate pointing material, but not less than joint width.
1. If temporary wedges are used, remove them before raking out and pointing joints.
 2. Point joints at **[exterior face][both faces]** of exterior panels with mortar.
 3. Point joints at **[exterior face][both faces]** of exterior panels with sealant.
 4. Point joints at both faces of exterior and interior panels with sealant.
- J. Point joints with mortar by filling raked joints and voids. Place and compact pointing mortar in layers not more than **3/8 inch (10 mm)** thick. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.
1. Tool exposed joints slightly concave when pointing mortar is thumbprint hard. Use a smooth plastic jointer larger than joint width.
- K. Point joints by filling with sealant to comply with requirements in Section 079200 "Joint Sealants."
- L. Clean glass unit masonry assemblies as work progresses. Remove mortar fins and smears immediately, using a clean, wet sponge or a scrub brush with stiff fiber bristles. Do not use harsh cleaners, acids, abrasives, steel wool, or wire brushes when removing mortar or cleaning glass unit masonry assemblies.
- M. Install sealant at jambs, heads, mullions, and other locations indicated. Prepare joints, including installation of primer and bond-breaker tape or cylindrical sealant backing, and apply elastomeric sealants to comply with requirements in Section 079200 "Joint Sealants."
- N. Construction Tolerances: Set glass block to comply with the following tolerances:
1. Variation from Plumb: For vertical lines and surfaces, do not exceed **[1/4 inch in 10 ft. (6 mm in 3 m), 3/8 inch in 20 ft. (9 mm in 6 m), or 1/2 inch in 40 ft.]**

(12 mm in 12 m)][1/8 inch in 10 ft. (3 mm in 3 m), 1/4 inch in 20 ft. (6 mm in 6 m), or 3/8 inch in 40 ft. (9 mm in 12 m)] or more.

2. Variation from Level: For bed joints and other conspicuous lines, do not exceed 1/8 inch in 10 ft. (3 mm in 3 m), 1/4 inch in 20 ft. (6 mm in 6 m), or 1/2 inch in 40 ft. (12 mm in 12 m) or more.
3. Variation of Location in Plan: For location of elements in plan, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm).
4. Variation in Mortar-Joint Thickness: Do not vary from joint thickness indicated by more than plus or minus 1/16 inch (1.5 mm).
5. For faces of adjacent exposed units, do not vary from flush alignment by more than 1/16 inch (1.5 mm).

3.3 INSTALLATION OF GLASS BLOCK WITH SEALANT

- A. General: Install mortarless glass-block systems in accordance with manufacturer's written instructions.
 1. Fasten frames and anchors or clips securely to surrounding construction.
 2. Shim starting track as needed to make it level.
 3. Adhere glass block to starting track and spacers with silicone sealant.
- B. After glass blocks are installed, apply sealant to completely fill channel around each glass block, and tool flush with exterior surface. Remove excess sealant and smears.

3.4 CLEANING

- A. On surfaces adjacent to glass unit masonry assemblies, remove mortar, sealants, and other residue resulting from glass-block installation, in a manner approved by manufacturers of materials involved.
- B. Remove excess sealants with commercial solvents in accordance with sealant manufacturer's written instructions. Exercise care not to damage sealant in joints.
- C. Perform final cleaning of glass unit masonry assemblies when surface is not exposed to direct sunlight. Start at top of panel using generous amounts of clean water. Remove water with clean, dry, soft cloths; change cloths frequently[**to eliminate dried mortar particles and aggregate**].

END OF SECTION 04 23 00 00



Task	Specification	Specification Description
04 23 00 00	04 20 00 00a	Masonry Veneer
04 23 13 00	04 20 00 00	Unit Masonry
04 23 13 00	04 23 00 00	Glass Unit Masonry
04 23 13 00	04 20 00 00a	Masonry Veneer



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SECTION 04 41 00 00 - STONE WALL FACING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Granite.
2. Limestone.
3. Marble.
4. Quartz-based stone.
5. Serpentine.
6. Slate.
7. Travertine.
8. Carvings and inscriptions.
9. Setting materials.
10. Grout.
11. Pointing mortar.
12. Sealants.
13. Stone anchors and attachments.
14. Stone accessories.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing concrete inserts for anchoring stone wall facing.
2. Section 042000 "Unit Masonry" for installing masonry inserts for anchoring stone wall facing.
3. Section 079200 "Joint Sealants" for sealing joints in stone wall facing system with elastomeric sealants.
4. Section 093033 "Stone Tiling" for stone wall tile.
5. Section 096340 "Stone Flooring" for stone flooring.
6. Section 097519 "Stone Trim" for stone trim.

1.2 COORDINATION

- A. Coordinate installation of inserts that are to be embedded in concrete or masonry and similar items to be used by Installer for anchoring and supporting stone wall facing. Furnish setting drawings, templates, and directions for installing such items and deliver to Project site in time for installation.
- B. Time delivery and installation of stone wall facing to avoid extended on-site storage and to coordinate with adjacent Work.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference [at Project site] [by web conference] <Insert location>.

1.4 ACTION SUBMITTALS

- A. Product Data: For each variety of stone wall facing, stone accessory, and manufactured product.
- B. Shop Drawings: Show fabrication and installation details for stone wall facing assembly, including dimensions and profiles of stone units.
 - 1. Show locations and details of joints both within stone wall facing assembly and between stone wall facing system and adjacent Work.
 - 2. Show locations and details of anchors, including locations of supporting construction.
 - 3. Show direction of veining, grain, or other directional pattern.
 - 4. Include large-scale details of **[carvings] [and] [inscriptions]**.
- C. Samples for Initial Selection: For stone wall facing and joint materials involving color selection.
- D. Samples for Verification:
 - 1. For each stone type indicated, in sets of Samples not less than 12 inches (300 mm) square. Include **[two] [three] [four] [five] <Insert number>** or more Samples in each set and show the full range of variations in appearance characteristics in completed Work.
 - 2. For each color of **[grout] [pointing mortar] [and] [sealant]** required for jointing.
 - 3. For **[carvings] [and] [inscriptions]**.
- E. Delegated Design Submittals: For stone wall facing assembly.
- F. Sustainable Design Submittals:
 - 1. <Double click to insert sustainable design text for regional materials.>
 - 2. <Double click to insert sustainable design text for recycled content.>
 - 3. <Double click to insert sustainable design text for regional materials.>
 - 4. <Double click to insert sustainable design text for EPDs and HPDs.>
 - 5. <Double click to insert sustainable design text for low-emitting sealers.>

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[Fabricator] [and] [Installer] [, and professional engineer]**.
- B. Material Test Reports:
 - 1. Stone Test Reports: For **[each]** stone variety proposed for use on Project, by a qualified testing agency, indicating compliance with required physical properties, other than abrasion resistance, in accordance with referenced ASTM standards. Base reports on testing done within previous **[three] [five] <Insert number>** years.
 - 2. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer indicating that sealants will not stain or damage stone. Include interpretation of test results and recommendations for primers and substrate preparation needed for adhesion.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Include product data for stone-care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate stone wall facing assemblies similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications: **[Fabricator of stone wall facings] [or] [A firm or individual experienced in installing stone wall facing assemblies similar in material, design, and extent to that indicated for this Project, whose work has a record of successful in-service performance].**

1.8 MOCKUPS

- A. Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Build mockups for the following:
 - a. Typical stone wall facing, not less than 72 inches (1800 mm) long by 96 inches (2400 mm) high.
 - b. Typical stone wainscot wall facing, not less than 72 inches (1800 mm) long by full wainscot height.
 - c. Typical column facing, one complete column.
 - d. **[Grouting] [Pointing] [Sealing]** of joints.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Sealant Adhesion and Compatibility Testing: Submit Samples of materials that will contact or affect joint sealants to joint-sealant manufacturers, for compatibility and adhesion testing in accordance with sealant manufacturer's standard testing methods and Section 079200 "Joint Sealants."

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle stone and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, and other causes.
 - 1. Lift stone with wide-belt slings; do not use wire rope or ropes that might cause staining. Move stone, if required, using dollies with cushioned wood supports.
 - 2. Store stone on wood A-frames or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to stone. Ventilate under covers to prevent condensation.
- B. Mark stone units, on surface that will be concealed after installation, with designations used on Shop Drawings to identify individual stone units. Orient markings on vertical stone wall facing so that they are right side up when units are installed.



- C. Deliver sealants to Project site in original unopened containers labeled with manufacturer's name, product name and designation, color, expiration period, pot life, curing time, and mixing instructions for multicomponent materials.
- D. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

1.11 FIELD CONDITIONS

- A. Maintain air and material temperatures to comply with requirements of installation material manufacturers, but not less than 50 deg F (10 deg C) during installation and for seven days after completion.
- B. Field Measurements: Verify dimensions of construction to receive stone wall facing by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain **[each variety of]** stone, **[regardless of finish,]**from a single quarry, **whether specified in this Section or in another Section of the Specifications,** with resources to provide materials of consistent quality in appearance and physical properties.
 - 1. For stone types that include same list of varieties and sources, provide same variety from same source for each.
 - 2. Make quarried blocks available for examination by Architect.
 - 3. Make stone slabs available for examination by Architect.
 - a. Architect will select aesthetically acceptable slabs **[and will indicate aesthetically unacceptable portions of slabs]**.
 - b. Segregate slabs selected for use on Project and mark backs indicating approval.
 - c. Mark and photograph portions of slabs that are not aesthetically acceptable as directed by Architect.
- B. Varieties and Sources: Subject to compliance with requirements, provide stone of varieties and from sources in accordance with Section 044200 "Exterior Stone Cladding."
- C. Stone Fabricators: Subject to compliance with requirements, **[provide products by the following] [provide products by one of the following] [available fabricators whose products may be incorporated into the Work include, but are not limited to, the following]:**
 - 1. **<Insert, in separate subparagraphs, names and possibly contact information for preapproved stone fabrication firms>.**

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stone wall facing assembly.

- B. General: Design stone anchors and anchoring systems in accordance with ASTM C1242.
- C. Seismic Performance: Stone wall facing assembly to withstand the effects of earthquake motions determined in accordance with [ASCE/SEI 7] <Insert requirement>.
 - 1. Component Importance Factor: [1.5] [1.0].

2.3 GRANITE

- A. Wall Facing Application: Granite [wall panels] [column panels] [wall cladding] [column cladding] [wainscot panels] <Insert wall facing application>.
- B. Material Standard: Comply with ASTM C615/C615M.
 - 1. <Double click to insert sustainable design text for stone.>
- C. Description: Uniform, [fine] [medium]-grained, [white] [pink] [gray] [black] <Insert color> stone[without veining].
- D. Varieties and Sources: Subject to compliance with requirements, [provide the following] [provide one of the following] [available stone varieties that may be incorporated into the Work include, but are not limited to, the following]:
 - 1. <Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers>.
- E. Cut: [Vein] [Fleuri].
 - 1. Orientation of Veining: [Horizontal] [Vertical] [As indicated on Drawings].
- F. Cut stone from one block or contiguous, matched blocks in which natural markings occur.
- G. Finish: [Polished] [Honed] [Thermal] [As indicated on Drawings] [Match existing] <Insert finish>.
- H. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.
- I. Dimensions:
 - 1. Nominal Thickness: [3/4 inch (20 mm)] [7/8 inch (22 mm)] [1-1/4 inches (32 mm)] [1-1/2 inches (40 mm)] [As indicated on Drawings].
 - 2. Edge Detail: [Straight, slightly eased at corners] [3/8-inch (10-mm) bevels] [3/4-inch (20-mm) radii] [3/8-inch (10-mm) radii] [As indicated on Drawings].
 - 3. Joints: [1/16-inch- (1.5-mm-) wide, grouted joints] [1/8-inch- (3-mm-) wide, grouted joints] [1/8-inch- (3-mm-) wide, sealant-filled joints] [Bonded joints, 1/32 inch (0.8 mm) or less in width].

2.4 LIMESTONE

- A. Wall Facing Application: Limestone [wall panels] [column panels] [wall cladding] [column cladding] [wainscot panels] <Insert wall facing application>.
- B. Material Standard: Comply with ASTM C568/C568M.

1. Classification: **[I Low] [II Medium] [III High]** Density.
2. <Double click to insert sustainable design text for stone.>

C. Description: **[Shell] [Oolitic] [Dolomitic]** limestone.

D. Varieties and Sources:

1. Subject to compliance with requirements, **[provide the following] [provide one of the following] [available stone varieties that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **<Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers>**.
2. Indiana oolitic limestone quarried in Lawrence, Monroe, or Owen Counties, Indiana.
 - a. Indiana Oolitic Limestone Grade and Color: **[Select, buff] [Select, gray] [Standard, buff] [Standard, gray] [Rustic, buff] [Rustic, gray] [Variegated]**, in accordance with grade and color classification established by ILI.

E. Cut: **[Vein] [Fleuri]**.

1. Orientation of Veining: **[Horizontal] [Vertical] [As indicated on Drawings]**.

F. Cut stone from one block or contiguous, matched blocks in which natural markings occur.

G. Finish: **[Smooth] [Sand rubbed] [Machine tooled, four bats per 1 inch (25 mm)] [Machine tooled, six bats per 1 inch (25 mm)] [Machine tooled, eight bats per 1 inch (25 mm)] [As indicated on Drawings] [Match existing] <Insert finish> [, matching standard ILI finish]**.

H. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

I. Dimensions:

1. Nominal Thickness: **[3/4 inch (20 mm)] [7/8 inch (22 mm)] [1-1/4 inches (32 mm)] [1-1/2 inches (40 mm)] [As indicated on Drawings]**.
2. Edge Detail: **[Straight, slightly eased at corners] [3/8-inch (10-mm) bevels] [3/4-inch (20-mm) radii] [3/8-inch (10-mm) radii] [As indicated on Drawings]**.
3. Joints: **[1/16-inch- (1.5-mm-) wide, grouted joints] [1/8-inch- (3-mm-) wide, grouted joints] [1/8-inch- (3-mm-) wide, sealant-filled joints] [Bonded joints, 1/32 inch (0.8 mm) or less in width]**.

2.5 MARBLE

A. Wall Facing Application: Marble **[wall panels] [column panels] [wall cladding] [column cladding] [wainscot panels] <Insert wall facing application>**.

B. Material Standard: Comply with ASTM C503/C503M[, **Classification I Calcite**] [, **Classification II Dolomite**] [, **Group A**] [, **Group B**] [, **Group C**] [, **Group D**].

1. <Double click to insert sustainable design text for stone.>

C. Description: Uniform, fine- to medium-grained, **[white] <Insert color>** stone with only slight veining.

- D. Varieties and Sources: Subject to compliance with requirements, **[provide the following]** **[provide one of the following]** **[available stone varieties that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **<Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers>.**
- E. Cut: **[Vein]** **[Fleuri]**.
 - 1. Orientation of Veining: **[Horizontal]** **[Vertical]** **[As indicated on Drawings]**.
- F. Cut stone from one block or contiguous, matched blocks in which natural markings occur.
- G. Finish: **[Polished]** **[Honed]** **[As indicated on Drawings]** **[Match existing]** **<Insert finish>.**
- H. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.
- I. Dimensions:
 - 1. Nominal Thickness: **[3/4 inch (20 mm)]** **[7/8 inch (22 mm)]** **[1-1/4 inches (32 mm)]** **[1-1/2 inches (40 mm)]** **[As indicated on Drawings]**.
 - 2. Edge Detail: **[Straight, slightly eased at corners]** **[3/8-inch (10-mm) bevels]** **[3/4-inch (20-mm) radii]** **[3/8-inch (10-mm) radii]** **[As indicated on Drawings]**.
 - 3. Joints: **[1/16-inch- (1.5-mm-) wide, grouted joints]** **[1/8-inch- (3-mm-) wide, grouted joints]** **[1/8-inch- (3-mm-) wide, sealant-filled joints]** **[Bonded joints, 1/32 inch (0.8 mm) or less in width]**.

2.6 QUARTZ-BASED STONE

- A. Wall Facing Application: Quartz-based stone **[wall panels]** **[column panels]** **[wall cladding]** **[column cladding]** **[wainscot panels]** **<Insert wall facing application>.**
- B. Material Standard: Comply with ASTM C616/C616M, **[Classification I Sandstone]** **[Classification II Quartzitic Sandstone]** **[Classification III Quartzite]** **[, except for minimum free silica content]**.
 - 1. **<Double click to insert sustainable design text for stone.>**
- C. Varieties and Sources: Subject to compliance with requirements, **[provide the following]** **[provide one of the following]** **[available stone varieties that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **[Brownstone]** **[Bluestone]** **[Flagstone]** **[Silver quartzite]** **[White quartzite]** **[Golden quartzite]**.
 - 2. **<Insert, in separate subparagraphs, names of additional varieties and producers, distributors, or importers>.**
- D. Cut: **[Sawcut]** **[Split face]**.
- E. Finish: **[Honed]** **[Sandblasted]** **[Bush-hammered]** **[Polished]** **[As indicated on Drawings]** **[Match existing]** **<Insert finish>.**
- F. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.
- G. Dimensions:

1. Nominal Thickness: [3/4 inch (20 mm)] [7/8 inch (22 mm)] [1-1/4 inches (32 mm)] [1-1/2 inches (40 mm)] [As indicated on Drawings].
2. Edge Detail: [Straight, slightly eased at corners] [3/8-inch (10-mm) bevels] [3/4-inch (20-mm) radii] [3/8-inch (10-mm) radii] [As indicated on Drawings].
3. Joints: [1/16-inch- (1.5-mm-) wide, grouted joints] [1/8-inch- (3-mm-) wide, grouted joints] [1/8-inch- (3-mm-) wide, sealant-filled joints] [Bonded joints, 1/32 inch (0.8 mm) or less in width].

2.7 SERPENTINE

- A. Wall Facing Application: Serpentine [wall panels] [column panels] [wall cladding] [column cladding] [wainscot panels] <Insert wall facing application>.
- B. Material Standard: Comply with ASTM C1526, [Classification I Exterior] [Classification II Interior].
 1. <Double click to insert sustainable design text for stone.>
- C. Varieties and Sources: Subject to compliance with requirements, [provide the following] [provide one of the following] [available stone varieties that may be incorporated into the Work include, but are not limited to, the following]:
 1. <Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers>.
- D. Cut stone from one block or contiguous, matched blocks in which natural markings occur.
- E. Finish: [Polished] [Honed] [As indicated on Drawings] [Match existing] <Insert finish>.
- F. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.
- G. Dimensions:
 1. Nominal Thickness: [3/4 inch (20 mm)] [7/8 inch (22 mm)] [1-1/4 inches (32 mm)] [1-1/2 inches (40 mm)] [As indicated on Drawings].
 2. Edge Detail: [Straight, slightly eased at corners] [3/8-inch (10-mm) bevels] [3/4-inch (20-mm) radii] [3/8-inch (10-mm) radii] [As indicated on Drawings].
 3. Joints: [1/16-inch- (1.5-mm-) wide, grouted joints] [1/8-inch- (3-mm-) wide, grouted joints] [1/8-inch- (3-mm-) wide, sealant-filled joints] [Bonded joints, 1/32 inch (0.8 mm) or less in width].

2.8 SLATE

- A. Wall Facing Application: Slate [wall panels] [column panels] [wall cladding] [column cladding] [wainscot panels] <Insert wall facing application>.
- B. Material Standard: Comply with ASTM C629/C629M, [Classification I Exterior] [Classification II Interior].
 1. <Double click to insert sustainable design text for stone.>
- C. Description: [Black] [Blue-black] [Gray] [Blue-gray] [Green] [Purple] [Mottled purple and green] [Red] slate with a fine, even grain[and unfading color,] from clear, sound stock.

- D. Varieties and Sources: Subject to compliance with requirements, **[provide the following]** **[provide one of the following]** **[available stone varieties that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **<Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers>.**
- E. Finish: **[Honed]** **[Sand rubbed]** **[Natural cleft]** **[As indicated on Drawings]** **[Match existing]** **<Insert finish>.**
- F. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.
- G. Dimensions:
 - 1. Nominal Thickness: **[3/4 inch (20 mm)]** **[7/8 inch (22 mm)]** **[1-1/4 inches (32 mm)]** **[1-1/2 inches (40 mm)]** **[As indicated on Drawings].**
 - 2. Edge Detail: **[Straight, slightly eased at corners]** **[3/8-inch (10-mm) bevels]** **[3/4-inch (20-mm) radii]** **[3/8-inch (10-mm) radii]** **[As indicated on Drawings].**
 - 3. Joints: **[1/16-inch- (1.5-mm-) wide, grouted joints]** **[1/8-inch- (3-mm-) wide, grouted joints]** **[1/8-inch- (3-mm-) wide, sealant-filled joints]** **[Bonded joints, 1/32 inch (0.8 mm) or less in width].**

2.9 TRAVERTINE

- A. Wall Facing Application: Travertine **[wall panels]** **[column panels]** **[wall cladding]** **[column cladding]** **[wainscot panels]** **<Insert wall facing application>.**
- B. Material Standard: Comply with ASTM C1527/C1527M, **[Classification I Exterior]** **[Classification II Interior].**
 - 1. **<Double click to insert sustainable design text for stone.>**
- C. Varieties and Sources: Subject to compliance with requirements, **[provide the following]** **[provide one of the following]** **[available stone varieties that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **<Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers>.**
- D. Cut: **[Vein]** **[Fleuri].**
 - 1. Orientation of Veining: **[Horizontal]** **[Vertical]** **[As indicated on Drawings].**
- E. Cut stone from one block or contiguous, matched blocks in which natural markings occur.
- F. Filling: Fill pores on faces of stone with cementitious filler of color **[selected by Architect]** **[matching Architect's sample].**
- G. Finish: **[Polished]** **[Honed]** **[As indicated on Drawings]** **[Match existing]** **<Insert finish>.**
- H. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.
- I. Dimensions:

1. Nominal Thickness: [3/4 inch (20 mm)] [7/8 inch (22 mm)] [1-1/4 inches (32 mm)] [1-1/2 inches (40 mm)] [As indicated on Drawings].
2. Edge Detail: [Straight, slightly eased at corners] [3/8-inch (10-mm) bevels] [3/4-inch (20-mm) radii] [3/8-inch (10-mm) radii] [As indicated on Drawings].
3. Joints: [1/16-inch- (1.5-mm-) wide, grouted joints] [1/8-inch- (3-mm-) wide, grouted joints] [1/8-inch- (3-mm-) wide, sealant-filled joints] [Bonded joints, 1/32 inch (0.8 mm) or less in width].

2.10 CARVINGS AND INSCRIPTIONS

- A. Carve and cut [inscriptions] [and] [decorative surfaces]. Use skilled stone carvers experienced in the successful performance of work similar to that indicated for Project.
- B. Abrasively etch [inscriptions] [and] [decorative surfaces].
- C. Laser etch [inscriptions] [and] [decorative surfaces].

2.11 SETTING MATERIALS

- A. Molding Plaster: ASTM C59/C59M.
- B. Portland Cement: ASTM C150/C150M, Type I or Type II.
 1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested in accordance with ASTM C114.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Aggregate: ASTM C144.
- E. Water: Potable.

2.12 GROUT

- A. Grout Colors: [Match stone] [As indicated by manufacturer's designations] [Match Architect's samples] [As selected by Architect from manufacturer's full range].
- B. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate to produce required color.
- C. Standard Cement Grout: ANSI A118.6, packaged.
 1. Grout Type: [Sanded] [Unsanded].
- D. High-Performance Tile Grout: ANSI A118.7, packaged.
 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 2. Polymer Additive Type: [Acrylic resin] [or] [ethylene vinyl acetate]. [In dry, redispersible form, packaged with other dry ingredients] [In liquid-latex form for addition to packaged dry-grout mix].
 3. Grout Type: [Sanded] [Unsanded].

- E. Water-Cleanable Epoxy Grout: ANSI A118.3, packaged, chemical-resistant, water-cleanable, tile-setting and -grouting epoxy.

- 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

2.13 POINTING MORTAR

- A. Portland Cement: ASTM C150/C150M, Type I or Type II. Provide natural color or white cement as required to produce mortar color indicated.

- 1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested in accordance with ASTM C114.

- B. Hydrated Lime: ASTM C207, Type S.

- C. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Pigments are to have a record of satisfactory performance in mortar.

- 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

- D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime.

- E. Colored Portland Cement-Lime Mix: Packaged blend of portland cement, hydrated lime, and mortar pigments. Use a mix of formulation required to produce color indicated or, if not indicated, as selected from manufacturer's standard formulations. Pigments should not exceed 10 percent of portland cement by weight.

- 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

- F. Aggregate: ASTM C144, except with 100 percent passing No. 16 (1.18-mm) sieve.

- 1. White Aggregates: Natural white sand or ground white stone.
 - 2. Colored Aggregates: Natural-colored sand or ground marble, granite, or other durable stone; of color necessary to produce required mortar color.

- G. Water: Potable.

2.14 SEALANTS

- A. Joint Sealants: Manufacturer's standard sealants that comply with applicable requirements in Section 079200 "Joint Sealants" and will not stain the stone to which they are applied.

- 1. Use mildew-resistant joint sealant at plumbing fixtures and for control and expansion joints in toilet rooms **[and other wet locations]**.
 - 2. Colors: Provide colors of exposed sealants to match other joints in stone adjoining sealed joints unless otherwise indicated.

- B. Sealant for Filling Kerfs: **[Same sealant used for joints in stone cladding.] [Manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated below that comply with applicable requirements in Section 079200 "Joint Sealants" and that do not stain stone:]**

1. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
 - a. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. Urethane, M, NS, 25, T, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
 - a. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.15 STONE ANCHORS AND ATTACHMENTS

- A. Stainless Steel Anchors: ASTM A240/A240M or ASTM A666/A666M, Type 304.
 1. Fasteners for Stainless Steel Anchors: Annealed stainless steel bolts, nuts, and washers; ASTM F593 for bolts and ASTM F594 for nuts, Alloy Group 1 (A1).
- B. Stainless Steel Dowels: ASTM A276/A276M, Type 304.
- C. Extruded-Aluminum Anchors: ASTM B221 (ASTM B221M), Alloy 6063-T6.
 1. Fasteners for Extruded-Aluminum Anchors: Annealed stainless steel bolts, nuts, and washers; ASTM F593 for bolts and ASTM F594 for nuts, Alloy Group 1 (A1).
- D. Anchor Support Grids: Roll-formed steel channels, of size and shape required for application indicated, formed from galvanized-steel sheet not less than 0.108 inch (2.8 mm) thick and complying with ASTM A653/A653M, G90 (Z275).
 1. Fittings and Fasteners: System manufacturer's standard components of design, size, and material required to securely attach grids to building structure and stone anchors to grids. Fabricate components in contact with stone from same material specified for anchors.
- E. Wire Tiebacks: **[No. 9 AWG copper or copper-alloy] [or] [0.120-inch- (3.0-mm-) diameter, stainless steel] wire.**
- F. Dovetail Slots: Furnish dovetail slots with filler strips of slot size required to receive anchors provided, fabricated from 0.034-inch- (0.86-mm-) thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 (Z275).
- G. Direct-Mount Anchoring Systems: Stainless steel**[or aluminum]** stone anchors designed to be applied directly to wall surfaces**[or to metal grids]**. System is secured to wall framing, furring, or sheet-metal reinforcing strips built into wall with**[stainless steel]** self-drilling screws. Anchors fit into kerfs or holes in edges of stone wall facing**[and do not need setting spots]**.
 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 2. Setting Shims for Direct-Mount Anchoring Systems: Strips of resilient plastic or neoprene, nonstaining to stone, of thickness needed to prevent point loading of stone on anchors and of depths to suit anchors without intruding into required depths of pointing materials.

2.16 STONE ACCESSORIES

- A. Temporary Setting Shims: Rigid plastic shims, nonstaining to stone, sized to suit joint thickness.
- B. Stone Cleaner: Cleaning system compound and accessories specifically formulated for stone types, finishes, and applications indicated, as recommended in writing by stone producer. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.
- C. Stone Sealer: Colorless, stain-resistant sealing solution that does not affect color or physical properties of stone surfaces, as recommended in writing by stone producer for application indicated.
 - 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 - 2. <Double click to insert sustainable design text for sealant.>

2.17 FABRICATION OF STONE WALL FACING, GENERAL

- A. Select stone for intended use free from damage, cracks, and starts that could impair structural integrity or function.
 - 1. Repairs that are characteristic of the stone varieties specified may be acceptable provided they do not impair structural integrity or function and are aesthetically acceptable, as judged by Architect.
- B. Fabricate stone wall facing in sizes and shapes required to comply with requirements indicated.
 - 1. Comply with published recommendations in NSI's "Dimension Stone Design Manual."
 - 2. For limestone, comply with published recommendations in ILI's "Indiana Limestone Handbook."
- C. Cut stone to produce pieces of thickness, size, and shape indicated and to comply with fabrication and construction tolerances recommended by applicable stone association.
 - 1. Where items are installed with adhesive or where stone edges are visible in the finished work, make items uniform in thickness and of identical thickness for each type of item; gage back of stone if necessary.
 - 2. Clean sawed backs of stones to remove rust stains and iron particles.
 - 3. Dress joints straight and at right angle to face unless otherwise indicated.
 - 4. Cut and drill sinkages and holes in stone for anchors, supports, and lifting devices as indicated or needed to set stone securely in place; shape beds to fit supports.
 - 5. Provide openings, reveals, and similar features as needed to accommodate adjacent work.
- D. Finish exposed faces and edges of stone to comply with requirements indicated for finish of each stone type required and to match approved Samples and mockups.
- E. Carefully inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units.
 - 1. Grade and mark stone for overall uniform appearance when assembled in place. Natural variations in appearance are acceptable if installed stone units match range of colors and other appearance characteristics represented in approved Samples[**and mockups**].

2.18 FABRICATION OF STONE WALL FACING UNITS

- A. Arrange facing units in shop or other suitable space in proposed orientation and sequence for examination by Architect. Mark units with temporary sequence numbers to indicate position in proposed layout.
 - 1. Lay out one elevation at a time if approved by Architect.
 - 2. Notify Architect seven days in advance of date and time when layout will be available for viewing.
 - 3. Provide lighting of similar type and level as that of final installation for viewing layout unless otherwise approved by Architect.
 - 4. Rearrange facing as directed by Architect until layout is approved.
 - 5. Do not trim nonmodular-size units to less than modular size until after Architect's approval of layout, unless otherwise approved by Architect.
 - 6. Mark backs of units and Shop Drawings with sequence numbers based on approved layout. Mark backs of units to indicate orientation of units in completed Work.
- B. Control depth of stone to maintain minimum clearances of **[3/4 inch (20 mm)] [1 inch (25 mm)]** between backs of facing and structural members, fireproofing if any, backup walls, and other work behind stone. Do not back check stone less than 1 inch (25 mm) thick.
- C. Cut stone to produce uniform joints **[1/16 inch (1.5 mm)] [1/8 inch (3 mm)] [1/4 inch (6 mm)] [3/8 inch (10 mm)]** <Insert dimension> wide and in locations indicated.
- D. Quirk-miter corners unless otherwise indicated. Fabricate for anchorage in top and bottom bed joints of corner units.
- E. Pattern Arrangement: Fabricate and arrange stone wall facing panels with veining and other natural markings to comply with the following requirements:
 - 1. Arrange panels with veining horizontal.
 - 2. Arrange panels with veining vertical.
 - 3. Arrange panels with veining as indicated on Drawings.
 - 4. Arrange panels in blend pattern.
 - 5. Book and slip match units, single-course height.
 - 6. Book and slip match units, both vertically and horizontally.
 - 7. Book and slip match units in each course. No matching is required between successive courses.

2.19 MIXES

- A. Spotting Plaster: Stiff mix of molding plaster and water.
- B. Mortar, General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortar of uniform quality and with optimum performance characteristics.
 - 1. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated. Do not use calcium chloride.
 - 2. Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer unless otherwise indicated. Discard mortar when it has reached initial set.
- C. Setting Mortar: Comply with ASTM C270, Proportion Specification.
 - 1. Type: **[Type N] [Type O]**.

2. Mix Proportions: 1 part portland cement and 2-1/2 to 4 parts lime with aggregate ratio of 2-1/4 to 3 times the volume of cement and lime.
- D. Grout: Comply with mixing requirements of referenced ANSI standards and with manufacturer's written instructions.
- E. Pointing Mortar: Comply with ASTM C270, Proportion Specification, for mortar types indicated. Provide pointing mortar mixed to match Architect's sample and complying with the following:
 1. Pigmented Pointing Mortar: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1:10, by weight.
 2. Packaged Portland Cement-Lime Mix Mortar: Use portland cement-lime mix of selected color.
 3. Colored-Aggregate Pointing Mortar: Produce color required by combining colored aggregates with portland cement of selected color.
 4. Type: **[Type N]** **[Type O]**.
 5. Mix Proportions: 1 part portland cement and 2-1/2 to 4 parts lime with aggregate ratio of 2-1/4 to 3 times the volume of cement and lime.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 1. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of stone wall facing.
- B. Verify suitability of substrates, including surface conditions and compatibility. Proceed with stone wall facing installation only after unsatisfactory conditions have been corrected.
 1. Installation of stone wall facing indicates acceptance of substrates and conditions.

3.2 PREPARATION

- A. Clean substrate surfaces that are dirty or stained by removing soil, stains, and foreign materials.
- B. Clean stone wall facing with stone cleaner by thoroughly scrubbing with fiber brushes and then drenching with clear water.

3.3 INSTALLATION OF STONE WALL FACING, GENERAL

- A. Do necessary field cutting as stone is set. Use power saws with diamond blades to cut stone. Cut lines straight and true, with edges eased slightly to prevent snipping.
- B. Contiguous Work: Provide reveals and openings as required to accommodate contiguous work.
- C. Set stone to comply with requirements indicated. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure stone in place. Shim and adjust anchors, supports, and accessories to set stone accurately in locations indicated, with edges and faces aligned in accordance with established relationships and indicated tolerances.

- D. Erect stone units level, plumb, and true with uniform joint widths. Use temporary shims to maintain joint width.
- E. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated.
 - 1. Sealing of expansion and other joints is specified in Section 079200 "Joint Sealants."
 - 2. Keep expansion joints free of plaster, mortar, grout, and other rigid materials.

3.4 CONSTRUCTION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/8 inch in 96 inches (3 mm in 2400 mm), 1/4 inch (6 mm) maximum.
- B. Variation from Level: For lintels, sills, chair rails, horizontal bands, horizontal grooves, and other conspicuous lines, do not exceed 1/8 inch in 10 ft. (3 mm in 3 m), 1/4 inch in 20 ft. (6 mm in 6 m), 3/8 inch (10 mm) maximum.
- C. Variation of Linear Building Line: For position shown in plan and related portion of walls and partitions, do not exceed 1/8 inch in 10 ft. (3 mm in 3 m), 1/4 inch in 20 ft. (6 mm in 6 m), 3/8 inch (10 mm) maximum.
- D. Variation in Cross-Sectional Dimensions: For thickness of walls from dimensions indicated, do not exceed plus or minus 1/8 inch (3 mm).
- E. Variation in Joint Width: Do not vary from average joint width more than plus or minus 1/16 inch (1.5 mm) or one-fourth of nominal joint width, whichever is less.
- F. Variation in Plane between Adjacent Stone Units (Lipping): Do not exceed 1/32-inch (0.8-mm) difference between planes of adjacent units.

3.5 INSTALLATION OF STONE WALL FACING UNITS

- A. Set stone wall facing units firmly against setting spots. Locate setting spots at anchors and spaced not more than 18 inches (450 mm) apart across back of unit, but provide no fewer than one setting spot per 2 sq. ft. (0.18 sq. m) unless otherwise indicated.
 - 1. Moisture Exposure: Use portland cement mortar for setting spots where stone is applied to inside face of exterior walls and **[where indicated on Drawings] <Insert wet locations>**.
- B. Set stone wall facing units **[on direct-mount anchoring system]** with anchors securely attached to stone and to backup substrate surfaces. Comply with anchoring recommendations in ASTM C1242.
 - 1. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with sealant for filling kerfs.
 - 2. Set stone supported on clips or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths and to prevent point loading of stone on anchors. Hold shims back from face of stone a distance at least equal to width of joint.
 - 3. Provide anchors at a maximum of 24 inches (600 mm) o.c. around perimeter of stone wall facing with a minimum of four anchors per panel.
 - 4. Provide a minimum of four anchors per panel up to 12 sq. ft. (1.1 sq. m) in face area, plus a minimum of two additional anchors for each additional 8 sq. ft. (0.7 sq. m).

- C. [Grout] [Point] joints after setting stone wall facing units.
- D. Fill[indicated] joints with sealant after setting [and grouting] [and pointing] stone.

3.6 GROUTING JOINTS

- A. Remove temporary shims before grouting.
- B. Grout stone to comply with ANSI A108.10.
 - 1. Use sanded grout mixture for joints wider than 1/8 inch (3 mm).
 - 2. Use unsanded grout mixture for joints 1/8 inch (3 mm) and narrower.
- C. Tool joints uniformly and smoothly with plastic tool.

3.7 POINTING JOINTS

- A. Prepare stone-joint surfaces for pointing with mortar by removing temporary shims, dust, and mortar particles. Where setting spots occur at joints, rake out excess setting mortar or plaster to a depth of not less than 1/2 inch (13 mm).
- B. Point stone joints by placing pointing mortar in layers of not more than 3/8 inch (10 mm). Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer. Apply mortar first to areas where depths are greater than surrounding areas until a uniform depth is formed.
- C. Tool joints when pointing mortar is thumbprint hard. Use a round jointer having a diameter 1/8 inch (3 mm) larger than width of joint.

3.8 INSTALLATION OF JOINT SEALANT AT JOINTS

- A. Remove temporary shims before applying sealants.
- B. Prepare joints and apply sealants of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.9 ADJUSTING AND CLEANING

- A. In-Progress Cleaning: Clean stone wall facing as work progresses. Remove adhesive, grout, mortar, and sealant smears immediately.
- B. Remove and replace stone wall facing under following conditions:
 - 1. Broken, chipped, stained, or otherwise damaged or defective stone. Stone may be repaired if methods and results are approved in advance by Architect.
 - 2. Defective joints, including misaligned joints.
 - 3. Stone wall facing and joints not matching approved Samples and mockups.
- C. Replace in a manner that results in stone wall facing that matches approved Samples and mockups, complies with other specified requirements, and shows no evidence of replacement.



- D. Clean stone wall facing no fewer than six days after completion of grouting and pointing, using clean water and soft rags or stiff-bristle fiber brushes. Do not use wire brushes, acid-type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods that could damage stone.
- E. Apply stone sealer in accordance with stone producer's and sealer manufacturer's written instructions and recommendations.

3.10 PROTECTION

- A. Protect stone surfaces, edges, and corners from construction damage. Use securely fastened untreated wood, plywood, or heavy cardboard to prevent damage.
- B. Before inspection for Substantial Completion, remove protective coverings and clean surfaces.

END OF SECTION 04 41 00 00



Task	Specification	Specification Description
04 41 00 00	04 42 00 00	Exterior Stone Cladding



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SECTION 04 42 00 00 - EXTERIOR STONE CLADDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stone panels set with individual anchors.
2. Stone panels mechanically anchored on steel trusses.
3. Stone panels mechanically anchored on steel strongback frames.
4. Stone panels mechanically anchored on steel stud frames.
5. Stone panels mechanically anchored (field installed) on a metal-grid system.
6. Stone panels set in architectural precast concrete.
7. Stone panels glazed into aluminum curtain-wall framing system.
8. Stone trim units, including **[bands][copings][sills][jambs][and][soffits]**.
9. Stone units with carving or inscriptions.

B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for installing **[inserts][and][weld plates]** in concrete for anchoring stone cladding.
2. Section 034500 "Precast Architectural Concrete" for casting stone panels in architectural precast concrete units.
3. Section 042000 "Unit Masonry" **[for installing inserts in unit masonry for anchoring stone cladding][and][for stone trim in unit masonry walls]**.
4. Section 054000 "Cold-Formed Metal Framing" for steel stud frames supporting stone cladding.
5. Section 079200 "Joint Sealants" for sealing joints in stone cladding system with elastomeric sealants.
6. Section 084413 "Glazed Aluminum Curtain Walls" for installing stone panels in aluminum curtain-wall systems.
7. Section 096340 "Stone Flooring" for dimension stone used as paving and flooring.
8. Section 097513 "Stone Wall Facing" for dimension stone applied as paneling on building interiors.

1.2 ALLOWANCES

- A. **[Preconstruction][and][quality-control]** testing is part of testing and inspecting allowance.

1.3 DEFINITIONS

- A. Definitions contained in ASTM C119 apply to this Section.
- B. IBC: International Building Code.
- C. Stone Cladding Assembly: An exterior wall covering system consisting of stone panels **[and trim]** together with anchors, **[backup structure,][secondary weather barrier (sheathing),][mortar,][adhesives,]** fasteners, and sealants used to secure the stone to the building structure and to produce a weather-resistant covering.
1. Backup structure includes **[steel trusses][steel strongback frames][steel stud frames][metal-**

grid system][and][miscellaneous steel framing required to secure stone to the building structure].

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.5 ACTION SUBMITTALS

- A. Product Data: For each **[variety of stone,]** stone accessory, and manufactured product.
- B. Sustainable Design Submittals:
1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 2. Environmental Product Declaration (EPD): For each product.
 3. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
 4. Environmental Product Declaration: For each product.
 5. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
 6. Environmental Product Declaration: For each product.
 7. Environmental Product Declaration: For each product.
 8. Third-Party Certifications: For each product.
 9. Third-Party Certified Life Cycle Assessment: For each product.
- C. Shop Drawings: Show fabrication and installation details for stone cladding assembly, including dimensions and profiles of stone units.
1. Show locations and details of joints both within stone cladding assembly and between stone cladding assembly and other construction.
 2. Include details of **[mortar joints][sealant joints][and][mortar joints pointed with sealant]**.
 3. Show locations and details of anchors **[and backup structure]**.
 4. Show direction of veining, grain, or other directional pattern.
 5. Include large-scale shaded elevations and details of decorative surfaces and inscriptions.
- D. Samples for Initial Selection: For joint materials involving color selection.
- E. Stone Samples for Verification: Sets for each variety, color, and finish of stone required; not less than **12 inches (300 mm)** square.
1. Sets consist of at least **[two][three][four][five]<Insert number>** Samples, exhibiting extremes of the full range of color and other visual characteristics expected and will establish the standard by which stone will be judged.
- F. Colored Pointing Mortar Samples for Verification: For each color required. Make Samples using same sand and mortar ingredients to be used on Project.
- G. Sealant Samples for Verification: For each type and color of joint sealant required.

- H. Delegated Design Submittal: For stone cladding assembly.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For [Installer][fabricator][professional engineer][and][testing agency].
- B. Welding certificates.
- C. Material Test Reports:
 - 1. Stone Test Reports: For **each** stone variety proposed for use on Project, by a qualified testing agency, indicating compliance with required physical properties, other than abrasion resistance, according to referenced ASTM standards. Base reports on testing done within previous **[five][three]<Insert number>** years.
 - 2. For metal components, by a qualified testing agency, indicating chemical and physical properties of metal.
 - 3. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer complying with requirements in Section 079200 "Joint Sealants" and indicating that sealants will not stain or damage stone. Include interpretation of test results and recommendations for primers and substrate preparation needed for adhesion.
- D. Preconstruction test reports.
- E. Source quality-control reports.
- F. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Stone Units: Furnish **<Insert number>** finished stone panels **<Insert required dimensions>** for each finish and variety of stone specified.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate stone cladding assemblies similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: A firm or individual experienced in installing stone cladding assemblies similar in material, design, and extent to that indicated for this Project, whose work has a record of successful in-service performance.
- C. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
- D. Welding Qualifications: Qualify procedures and personnel according to [AWS D1.1/D1.1M, "Structural Welding Code - Steel"][AWS D1.2/D1.2M, "Structural Welding Code - Aluminum"][AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel"][and][AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel]."

- E. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Build mockups of typical exterior wall area **[as shown on Drawings][not less than 72 inches (1800 mm) long by 48 inches (1200 mm) high][not less than 15 feet (4.5 m) long by 10 feet (3 m) high]**.
 - a. Include typical components, attachments to building structure, and methods of installation.
 - b. Include window opening with stone **[returns][trim]**.
 - c. Include typical carved surface.
 - d. Include sealant-filled joint complying with requirements in Section 079200 "Joint Sealants."
 - e. Include an area that has been damaged and repaired.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Stone Testing Service: **[Owner will engage][Engage]** a qualified testing agency to perform preconstruction testing.
1. Retesting of materials that fail to meet specified requirements is done at Contractor's expense.
 2. Furnish test specimens that are representative of materials proposed for incorporation into the Work.
 3. Physical Property Tests: For **[each]** stone variety proposed for use on Project, tested for compliance with physical property requirements, other than abrasion resistance, according to referenced ASTM standards.
 4. Flexural Strength Tests: For **[each combination of]** stone variety, thickness, orientation of cut, and finish, proposed for use on Project, tested according to ASTM C880/C880M, in both wet and dry conditions.
 5. Anchorage Tests: For **[each combination of]** stone variety, orientation of cut, finish, and anchor type proposed for use on Project, tested according to ASTM C1354/C1354M.
 6. Anchoring System Mockup Test: For stone anchoring system, tested according to ASTM C1201/C1201M, Procedure B, with a maximum test load equal to 3 times the design load. Build laboratory mockup at testing agency facility; use personnel, materials, and methods of construction that will be used at Project site. Mockup consists of one panel **<Insert dimensions>** in size.
- B. Preconstruction Sealant Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for compatibility and adhesion testing according to sealant manufacturer's standard testing methods and Section 079200 "Joint Sealants," Samples of materials that will contact or affect joint sealants.
- C. Preconstruction Field Testing of Sealants: Before installing joint sealants, field test their adhesion to joint substrates according to Section 079200 "Joint Sealants."

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle stone and related materials to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, and other causes.
1. Lift stone with wide-belt slings; do not use wire rope or ropes that might cause staining. Move

- stone, if required, using dollies with cushioned wood supports.
- 2. Store stone on wood skids or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to stone. Ventilate under covers to prevent condensation.
- B. Mark stone units, on surface that will be concealed after installation, with designations used on Shop Drawings to identify individual stone units. Orient markings on vertical panels so that they are right side up when units are installed.
- C. Deliver sealants to Project site in original unopened containers labeled with manufacturer's name, product name and designation, color, expiration period, pot life, curing time, and mixing instructions for multicomponent materials.
- D. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- E. Store aggregates in locations where grading and other required characteristics can be maintained and where contamination can be avoided.

1.11 FIELD CONDITIONS

- A. Protect stone cladding during erection by doing the following:
 - 1. Cover tops of stone cladding installation with nonstaining, waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress. Extend cover a minimum of **24 inches (600 mm)** down both sides and hold securely in place.
 - 2. Prevent staining of stone from mortar, grout, sealants, and other sources. Immediately remove such materials without damaging stone.
 - 3. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on ground and over wall surface.
 - 4. Protect sills, ledges, and projections from mortar and sealant droppings.
- B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Remove and replace stone cladding damaged by frost or freezing conditions. Comply with cold-weather construction and protection requirements for masonry contained in TMS 602/ACI 530.1/ASCE 6.
- C. Hot-Weather Requirements: Comply with hot-weather construction and protection requirements for masonry contained in TMS 602/ACI 530.1/ASCE 6.
- D. Environmental Limitations for Sealants: Do not install sealants when ambient and substrate temperatures are outside limits permitted by sealant manufacturer or below **40 deg F (5 deg C)** or when joint substrates are wet.

1.12 COORDINATION

- A. Coordinate installation of inserts that are to be embedded in concrete or masonry, flashing reglets, and similar items to be used by stone cladding Installer for anchoring, supporting, and flashing of stone cladding assembly. Furnish setting drawings, templates, and directions for installing such items and deliver to Project site in time for installation.
- B. Time delivery and installation of stone cladding to avoid extended on-site storage and to coordinate with work adjacent to stone cladding.

PART 2 - PRODUCTS**2.1 SOURCE LIMITATIONS**

- A. Source Limitations for Stone: Obtain[**each variety of**] stone[, **regardless of finish,**] from single quarry[, **whether specified in this Section or in another Section of the Specifications,**] with resources to provide materials of consistent quality in appearance and physical properties.
 - 1. For stone types that include same list of varieties and sources, provide same variety from same source for each.
 - 2. Make quarried blocks available for examination by Architect.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.
- C. Source Limitations for Other Materials: Obtain each type of stone accessory[, **sealant,**] and other material from single manufacturer for each product.
- D. Stone Fabricators: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available fabricators whose products may be incorporated into the Work include, but are not limited to, the following]:
 - 1. <Insert, in separate subparagraphs, names and possibly contact information for preapproved stone fabrication firms>.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stone cladding assembly.
- B. General: Design stone anchors and anchoring systems according to ASTM C1242.
 - 1. Stone anchors withstand not less than two times the weight of the stone cladding in both compression and tension.
- C. Structural Performance: Stone cladding assembly withstands the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Wind Loads: As indicated.
 - 2. Equipment Loads: Allow for loads due to window cleaning and maintenance equipment.
- D. Seismic Performance: Stone cladding assembly withstands the effects of earthquake motions determined according to [ASCE/SEI 7]<Insert requirement>.
 - 1. Component Importance Factor: [1.5][1.0].
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: **120 deg F (67 deg C)**, ambient; **180 deg F (100 deg C)**, material surfaces.
- F. Horizontal Building Movement (Interstory Drift): Allow for maximum horizontal building movement equal to quotient resulting from dividing floor-to-floor height at any floor by 400.

- G. Shrinkage and Creep: Allow for progressive vertical shortening of building frame equal to **<Insert value>** in **10 feet (3 m)**.
- H. Safety Factors for Stone: Design stone cladding assembly to withstand loads indicated without exceeding stone's allowable working stress determined by dividing stone's average ultimate strength, as established by testing, by the following safety factors:
1. Safety Factor for Granite: **[3]<Insert number>**.
 2. Safety Factor for Oolitic Limestone: **[8]<Insert number>**.
 3. Safety Factor for Dolomitic Limestone: **[6]<Insert number>**.
 4. Safety Factor for Marble: **[5]<Insert number>**.
 5. Safety Factor for Quartz-Based Stone: **[6]<Insert number>**.
 6. Safety Factor for Serpentine: **[6]<Insert number>**.
 7. Safety Factor for Slate: **[5]<Insert number>**.
 8. Safety Factor for Travertine: **[8]<Insert number>**.
 9. Safety Factor for Concentrated Stresses: **[4][for granite][and][10][for stone varieties other than granite]**.
- I. Design stone anchors **[and backup structure]** to withstand loads indicated without exceeding allowable working stresses established by the following:
1. For Structural Steel: AISC 360.
 2. For Cold-Formed Steel: AISI's "North American Specification and Commentary for the Design of Cold-Formed Steel Structural Members."
 3. For Cold-Formed Stainless Steel: ASCE/SEI 8, "Specification for the Design of Cold-Formed Stainless Steel Structural Members."
 4. For Aluminum: AA ADM-1, "The Aluminum Design Manual."
 5. For Cast-in-Place and Postinstalled Fasteners in Concrete: One-fourth of tested capacity when installed in concrete with compressive strength indicated.
 6. For Postinstalled Fasteners in Masonry: One-sixth of tested capacity when installed in masonry units indicated.
- J. Limit deflection in each prefabricated assembly caused by indicated loads and thermal movements, acting singly or in combination with one another, to not more than **[1/720]<Insert ratio>** of assembly's clear span or the following, whichever is smaller:
1. **1/16 inch (1.5 mm)**, measured in plane of wall.
 2. **1/4 inch (6 mm)**, measured perpendicular to wall.
- K. Provisions for Fabrication and Erection Tolerances: Allow for fabrication and erection tolerances of building's structural system. **[Concrete fabrication and erection tolerances are specified in Section 033000 "Cast-in-Place Concrete."][Structural-steel fabrication and erection tolerances are specified in Section 051200 "Structural Steel Framing."]**
- L. Provision for Deflection of Building Structure:
1. Deflection Due to Weight of Stone Cladding Assembly: Allow for **[1/4-inch (6-mm)]<Insert dimension>** vertical deflection in **20-foot (6-m)** span of structural members supporting stone cladding assembly.
 2. Live Load Deflection: Allow for **[1/4-inch (6-mm)]<Insert dimension>** vertical deflection, in **20-foot (6-m)** span of structural members supporting stone cladding assembly, due to live loads imposed on building's structural frame after stone installation.
- M. Corrosion and Staining Control: Prevent galvanic and other forms of corrosion as well as staining by isolating metals and other materials from direct contact with incompatible materials. Materials do not stain exposed surfaces of stone and joint materials.

2.3 GRANITE

- A. Material Standard: Comply with ASTM C615/C615M.
- B. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
- C. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site.
- D. Regional Materials: Stone shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
- E. Indigenous Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- F. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- G. Description: Uniform, **[fine][medium]**-grained, **[white][pink][gray][black]<Insert color>** stone **[without veining]**.
- H. Varieties and Sources: Subject to compliance with requirements, **[provide the following][provide one of the following][available stone varieties that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **<Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers>**.
- I. Cut: **[Vein][Fleuri]**.
 - 1. Orientation of Veining: **[Horizontal][Vertical][As indicated]**.
- J. Cut stone from one block or contiguous, matched blocks in which natural markings occur.
- K. Finish: **[Polished][Honed][Thermal][As indicated][Match Architect's sample]<Insert finish>**.
- L. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.
- M. Thickness: Not less than **[3/4 inch (20 mm)][30 mm][1-1/4 inches (32 mm)][1-5/8 inches (40 mm)][2 inches (50 mm)]** unless otherwise indicated.

2.4 LIMESTONE

- A. Material Standard: Comply with ASTM C568/C568M.
 - 1. Classification: **[I Low-Density][II Medium-Density][II Medium-Density except as follows: absorption, 5 percent by weight maximum; density, 150 lb/cu. ft. (2400 kg/cu. m) minimum; compressive strength, 8000 psi (55 MPa) minimum; and modulus of rupture 800 psi (5.5 MPa) minimum][III High-Density]**.

- B. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
 - C. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site.
 - D. Regional Materials: Stone shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
 - E. Indigenous Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 - F. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 - G. Description: **[Dolomitic][Oolitic][Shell]** limestone.
 - H. Material: Subject to compliance with requirements, **[provide the following][provide one of the following][available stone varieties that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **<Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers>.**
 - I. Varieties and Sources: Indiana limestone quarried in Lawrence, Monroe, or Owen Counties, Indiana.
 - 1. Indiana Limestone Grade and Color: **[Select, buff][Select, gray][Standard, buff][Standard, gray][Rustic, buff][Rustic, gray][Variegated]**, according to grade and color classification established by ILI.
 - J. Cut: **[Vein][Fleuri]**.
 - 1. Orientation of Veining: **[Horizontal][Vertical][As indicated]**.
 - K. Cut stone from one block or contiguous, matched blocks in which natural markings occur.
 - L. Finish: **[Smooth finish][Sand rubbed][Machine tooled, four bats per 1 inch (25 mm)][Machine tooled, six bats per 1 inch (25 mm)][Machine tooled, eight bats per 1 inch (25 mm)][As indicated][Match Architect's sample]<Insert finish>[, matching standard ILI finish]**.
 - M. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.
 - N. Thickness: Not less than **[1-1/4 inches (32 mm)][2 inches (50 mm)][2-1/2 inches (64 mm)][3 inches (75 mm)][4 inches (100 mm)]** unless otherwise indicated.
- 2.5 MARBLE
- A. Material Standard: Comply with ASTM C503/C503M, **[Classification I Calcite][Classification II Dolomite][, Group A]**.
 - B. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials

that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.

- C. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site.
- D. Regional Materials: Stone shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
- E. Indigenous Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- F. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- G. Description: Uniform, fine- to medium-grained, [**white**]<Insert color> stone with only slight veining.
- H. Varieties and Sources: Subject to compliance with requirements, [**provide the following**][**provide one of the following**][**available stone varieties that may be incorporated into the Work include, but are not limited to, the following**]:
 - 1. <Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers>.
- I. Cut: [**Vein**][**Fleuri**].
 - 1. Orientation of Veining: [**Horizontal**][**Vertical**][**As indicated**].
- J. Cut stone from one block or contiguous, matched blocks in which natural markings occur.
- K. Finish: [**Polished**][**Honed**][**As indicated**][**Match Architect's sample**]<Insert finish>.
- L. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.
- M. Thickness: Not less than [**1 inch (25 mm)**][**30 mm**][**1-1/4 inches (32 mm)**][**1-5/8 inches (40 mm)**][**2 inches (50 mm)**] unless otherwise indicated.

2.6 QUARTZ-BASED STONE

- A. Material Standard: Comply with ASTM C616/C616M, [**Classification I Sandstone**][**Classification II Quartzitic Sandstone**][**Classification III Quartzite**][**except for minimum free silica content**].
- B. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
- C. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site.
- D. Regional Materials: Stone shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
- E. Indigenous Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials

that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.

- F. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- G. Varieties and Sources: Subject to compliance with requirements, **[provide the following][provide one of the following][available stone varieties that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **<Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers>**.
- H. Finish: **[Sand rubbed][Natural cleft][Thermal][As indicated][Match Architect's sample]<Insert finish>**.
- I. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.
- J. Thickness: Not less than **[2 inches (50 mm)][2-1/2 inches (64 mm)][3 inches (75 mm)][4 inches (100 mm)]** unless otherwise indicated.

2.7 SERPENTINE

- A. Material Standard: Comply with ASTM C1526, **[Classification I Exterior][Classification II Interior]**.
- B. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
- C. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site.
- D. Regional Materials: Stone shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
- E. Indigenous Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- F. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- G. Varieties and Sources: Subject to compliance with requirements, **[provide the following][provide one of the following][available stone varieties that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **<Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers>**.
- H. Cut stone from one block or contiguous, matched blocks in which natural markings occur.

- I. Finish: **[Polished][Honed][As indicated][Match Architect's sample]<Insert finish>**.
- J. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.
- K. Thickness: Not less than **[1 inch (25 mm)][30 mm][1-1/4 inches (32 mm)][1-5/8 inches (40 mm)][2 inches (50 mm)]** unless otherwise indicated.

2.8 SLATE

- A. Material Standard: Comply with ASTM C629/C629M, **[Classification I Exterior][Classification II Interior]**.
- B. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
- C. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site.
- D. Regional Materials: Stone shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
- E. Indigenous Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- F. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- G. Description: **[Black][Blue-black][Gray][Blue-gray][Green][Purple][Mottled purple and green][Red]** slate with a fine, even grain **[and unfading color,]** from clear, sound stock.
- H. Varieties and Sources: Subject to compliance with requirements, **[provide the following][provide one of the following][available stone varieties that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **<Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers>**.
- I. Finish: **[Honed][Sand rubbed][Natural cleft][As indicated][Match Architect's sample]<Insert finish>**.
- J. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.
- K. Thickness: Not less than **[1 inch (25 mm)][1-1/4 inches (32 mm)][1-1/2 inches (38 mm)]** unless otherwise indicated.

2.9 TRAVERTINE

- A. Material Standard: Comply with ASTM C1527/C1527M, **[Classification I Exterior][Classification II Interior]**.

- B. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
- C. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site.
- D. Regional Materials: Stone shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
- E. Indigenous Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- F. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- G. Varieties and Sources: Subject to compliance with requirements, **[provide the following][provide one of the following][available stone varieties that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **<Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers>.**
- H. Cut: **[Vein][Fleuri]**.
 - 1. Orientation of Veining: **[Horizontal][Vertical][As indicated]**.
- I. Cut stone from one block or contiguous, matched blocks in which natural markings occur.
- J. Filling: Fill pores on faces of stone with cementitious filler of color **[selected by Architect][matching Architect's sample]**.
- K. Finish: **[Polished][Honed][As indicated][Match Architect's sample]<Insert finish>.**
- L. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.
- M. Thickness: Not less than **[1 inch (25 mm)][30 mm][1-1/4 inches (32 mm)][1-5/8 inches (40 mm)][2 inches (50 mm)]** unless otherwise indicated.

2.10 OTHER STONE

- A. Material Standards:
 - 1. Maximum Absorption per ASTM C97/C97M: **<Insert value>.**
 - 2. Minimum Compressive Strength per ASTM C170/C170M: **<Insert value>.**
 - 3. Minimum Flexural Strength per ASTM C880/C880M: **<Insert value>.**
- B. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
- C. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site.

- D. Regional Materials: Stone shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
- E. Indigenous Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- F. Regional Materials: Stone shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- G. Varieties and Sources: Subject to compliance with requirements, **[provide the following][provide one of the following][available stone varieties that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **<Insert, in separate subparagraphs, names of varieties and producers, distributors, or importers>.**
- H. Finish: **[Polished][Honed][Sand rubbed][Natural cleft][As indicated][Match Architect's sample]<Insert finish>.**
- I. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.
- J. Thickness: Not less than **[2 inches (50 mm)][2-1/2 inches (64 mm)][3 inches (75 mm)][4 inches (100 mm)]** unless otherwise indicated.

2.11 FRAMING FOR BACKUP STRUCTURE

- A. **[Steel Trusses][Strongback Frames][and][Miscellaneous Steel Framing]**: For framing members in contact with stone, fabricate from same material and finish specified for anchors. For framing members not in contact with stone, comply with requirements indicated below:
 - 1. Steel Plates, Shapes, and Bars: ASTM A36/A36M or ASTM A992/A992M, minimum thickness of **3/16 inch (5 mm)**.
 - 2. Steel Tubing: ASTM A500/A500M or ASTM A513/A513M, minimum thickness of **3/16 inch (5 mm)**.
 - 3. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-4, made from **[galvanized steel complying with ASTM A653/A653M, structural steel, Grade 33 (Grade 230), with G90 (Z275) coating, and not less than 0.108-inch (2.74-mm) nominal thickness][steel sheet complying with ASTM A1008/A1008M, structural steel, Grade 33 (Grade 230), not less than 0.105-inch (2.66-mm) nominal thickness, hot-dip galvanized after fabrication to comply with ASTM A123/A123M]**.
- B. Steel Stud Frames: Galvanized-steel wall framing complying with Section 054000 "Cold-Formed Metal Framing."
 - 1. Secondary Weather Barrier (Sheathing): Galvanized-steel sheet complying with ASTM A653/A653M, commercial steel, coating designation **G90 (Z275)**.
- C. Metal-Grid Systems: Manufacturer's standard integrated system that combines metal struts, fittings, fasteners, and stone anchors and is engineered expressly for mechanically installing stone cladding.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Canaren Inc]**
 - b. **[Hohmann & Barnard, Inc]**
 - c. **[Meadow Burke]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Canaren Inc]**
 - b. **[Hohmann & Barnard, Inc]**
 - c. **[Meadow Burke]**
 - d. **<Insert manufacturer's name>**
3. Struts: Cold-formed metal channels with continuous slot complying with MFMA-4, of size and shape required for application indicated, made from **[galvanized steel complying with ASTM A653/A653M, with G90 (Z275) coating, and not less than 0.108-inch (2.74-mm) nominal thickness][steel sheet complying with ASTM A1008/A1008M, not less than 0.105-inch (2.66-mm) nominal thickness, hot-dip galvanized after fabrication to comply with ASTM A123/A123M]**.
4. Fittings and Fasteners: System manufacturer's standard components of design, size, and material required to securely attach struts to building structure, by method indicated or selected, and stone anchors to struts, as well as to prevent galvanic corrosion. Fabricate components in contact with stone from same material specified for anchors.
5. Stone Anchors: Shapes and sizes standard with system manufacturer, complying with "Anchors and Fasteners" Article.

2.12 ANCHORS AND FASTENERS

- A. Fabricate anchors[, **including shelf angles,**] from stainless steel, ASTM A240/A240M or ASTM A666, **[Type 304][Type 316]**; temper as required to support loads imposed without exceeding allowable design stresses. Fabricate dowels and pins for anchors from stainless steel, ASTM A276, **[Type 304][Type 316]**.
- B. Fabricate shelf angles for limestone from hot-dip galvanized steel, ASTM A36/A36M for materials and ASTM A123/A123M for galvanizing.
- C. Fabricate anchors, including shelf angles, from extruded aluminum, **ASTM B221 (ASTM B221M)**, alloy and temper as required to support loads imposed without exceeding allowable design stresses, but not less than strength and durability properties of Alloy 6063-T6.
- D. Cast-in-Place Concrete Inserts: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel, with capability to sustain, without failure, a load equal to 4 times the loads imposed as determined by testing per ASTM E488/E488M, conducted by a qualified independent testing agency. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329.
- E. Postinstalled Anchor Bolts for Concrete and Masonry: **[Chemical anchors][torque-controlled expansion anchors][or][undercut anchors]** made from stainless steel components complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 (ASTM F738M and ASTM F836M, Alloy Group A1

or A4) for bolts and nuts; ASTM A240/A240M, ASTM A276, or ASTM A666, Type 304 or 316, for anchors, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E488/E488M, conducted by a qualified independent testing agency.

F. Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers.

1. For **[stainless steel][and][aluminum]**, use annealed stainless steel bolts, nuts, and washers; for bolts, **ASTM F593 (ASTM F738M)**; and for nuts, **ASTM F594 (ASTM F836M)**, Alloy **[Group 1 (A1)][Group 2 (A4)]**.
2. For **[galvanized-steel shelf angles][and][backup structure]**, use carbon-steel bolts, nuts, and washers; for bolts, **ASTM A307, Grade A (ASTM F568M, Property Class 4.6)**; for nuts, **ASTM A563 (ASTM A563M)**, Grade A; and for washers, **ASTM F436 (ASTM F436M)**; all hot-dip or mechanically zinc coated.

G. Weld Plates for Installation in Concrete: Comply with Section 055000 "Metal Fabrications."

2.13 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type II, except Type III may be used for cold-weather construction, natural color or white as required to produce mortar color indicated.

1. Low-Alkali Cement: Portland cement for use with limestone contains no more than 0.60 percent total alkali when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207.

C. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Pigments have a record of satisfactory performance in mortar.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Davis Colors]**
 - b. **[Lanxess Corporation]**
 - c. **[Solomon Colors Inc.]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Davis Colors]**
 - b. **[Lanxess Corporation]**
 - c. **[Solomon Colors Inc.]**
 - d. **<Insert manufacturer's name>**

D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime.

E. Colored Portland Cement-Lime Mix: Packaged blend of portland cement, hydrated lime, and mortar pigments. Mix produces color indicated or, if not indicated, as selected from manufacturer's standard

colors. Pigments do not exceed 10 percent of portland cement by weight.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Heidelberg Materials]**
 - b. **[Holcim (US) Inc]**
 - c. **[Lafarge North America Inc.]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Heidelberg Materials]**
 - b. **[Holcim (US) Inc]**
 - c. **[Lafarge North America Inc.]**
 - d. **<Insert manufacturer's name>**
- F. Aggregate: ASTM C144; except for **[joints narrower than 1/4 inch (6 mm)][and][pointing mortar]**, 100 percent pass **No. 16 (1.18-mm)** sieve.
 1. White Aggregates: Natural white sand or ground white stone.
 2. Colored Aggregates: Natural-colored sand or ground marble, granite, or other durable stone; of color necessary to produce required mortar color.
- G. Water: Potable.

2.14 STONE ACCESSORIES

- A. Setting Shims: Strips of **[resilient plastic][or][vulcanized neoprene, Type A Shore durometer hardness of 50 to 70]**, nonstaining to stone, of thickness needed to prevent point loading of stone on anchors and of depths to suit anchors without intruding into required depths of pointing materials.
- B. Setting Buttons: Resilient plastic buttons, nonstaining to stone, sized to suit joint thicknesses and bed depths of stone units without intruding into required depths of pointing materials.
- C. Concealed Sheet Metal Flashing: Fabricated from **[zinc-tin, alloy-coated]** stainless steel in thicknesses indicated, but not less than **0.0156 inch (0.4 mm)** thick, and complying with Section 076200 "Sheet Metal Flashing and Trim."
- D. Cementitious Dampproofing **[for Limestone]**: Cementitious formulation recommended by ILI and nonstaining to stone; compatible with joint sealants and noncorrosive to anchors and attachments.
- E. Weep and Vent Tubes: **[Medium-density polyethylene tubing, 1/4-inch (6-mm) OD][Rectangular, cellular, polypropylene or clear butyrate extrusion, 3/8 by 1-1/2 inches (9 by 38 mm)]**, of length required to extend from exterior face of stone to cavity behind.
- F. Cellular Plastic Weep Hole/Vents: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, of length required to extend from exterior face of stone to cavity behind, in color selected from manufacturer's standard.
- G. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, of length required to extend

from exterior face of stone to cavity behind, in color selected from manufacturer's standard.

- H. Wicking Material: Absorbent rope, made from **[cotton][or][UV-resistant synthetic fiber]**, **1/4 to 3/8 inch (6 to 10 mm)** in diameter, of length required to produce **2-inch (50-mm)** exposure on exterior and **18 inches (450 mm)** in cavity between wythes.
- I. Sealants for Joints in Stone Cladding: Manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated below that comply with applicable requirements in Section 079200 "Joint Sealants" and do not stain stone:
1. Silicone: Nonstaining, **[S, NS, 100/50, NT][S, NS, 50, NT][S, NS, 100/50, T, NT][M, NS, 50, NT]**.
 2. Urethane: **[S, NS, 25, NT][S, NS, 100/50, T, NT][M, NS, 50, NT][M, NS, 50, T, NT][M, NS, 25, T, NT]**.
 3. Joint Sealant: **<Insert joint sealant>**.
 4. Joint-Sealant Colors: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range of colors][Match color of stone]<Insert color>**.
- J. Preformed Joint Seals: Preformed **[silicone][foam]** joint seals that comply with applicable requirements in Section 079100 "Preformed Joint Seals" and do not stain stone.
- K. Sealant for Filling Kerfs: **[Same sealant used for joints in stone cladding.][Manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated below that comply with applicable requirements in Section 079200 "Joint Sealants" and that do not stain stone:]**
1. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1) **[Adfast]**
 - 2) **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - 3) **[May National Associates, Inc.; a subsidiary of Sika Corporation]**
 - 4) **[Pecora Corporation]**
 - 5) **[The Dow Chemical Company]**
 - 6) **[Tremco Incorporated]**
 - 7) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[Adfast]**
 - 2) **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - 3) **[May National Associates, Inc.; a subsidiary of Sika Corporation]**
 - 4) **[Pecora Corporation]**
 - 5) **[The Dow Chemical Company]**
 - 6) **[Tremco Incorporated]**
 - 7) **<Insert manufacturer's name>**

2. Urethane, M, NS, 25, T, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - 1) **[Bostik; Arkema]**
 - 2) **[LymTal International, Inc.]**
 - 3) **[Master Builders Solutions]**
 - 4) **[Sika Corporation]**
 - 5) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[Bostik; Arkema]**
 - 2) **[LymTal International, Inc.]**
 - 3) **[Master Builders Solutions]**
 - 4) **[Sika Corporation]**
 - 5) **<Insert manufacturer's name>**

2.15 FABRICATION OF STONE

- A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated.
 1. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."
 2. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."
 3. For marble, serpentine, and travertine, comply with recommendations in MIA's "Dimension Stone - Design Manual VII."
- B. Control depth of stone and back check to maintain minimum clearance of **[1 inch (25 mm)][1-1/2 inches (38 mm)]<Insert dimension>** between backs of stone units and surfaces or projections of structural members, fireproofing (if any), backup walls, and other work behind stone.
- C. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated. Shape beds to fit supports.
- D. Cut and drill sinkages and holes in stone for anchors, fasteners, supports, and lifting devices as indicated or needed to set stone securely in place.
- E. Finish exposed faces and edges of stone[, **except sawed reveals,**] to comply with requirements indicated for finish and to match approved samples[**and mockups**].
- F. Quirk-miter corners unless otherwise indicated; provide for cramp anchorage in top and bottom bed joints of corner pieces.
- G. Cut stone to produce uniform joints **[3/8 inch (10 mm)][1/2 inch (13 mm)]<Insert dimension>** wide and in locations indicated.
- H. Contiguous Work: Provide chases, reveals, reglets, openings, and similar features as required to accommodate contiguous work.

- I. Fabricate molded work, including washes and drips, to produce stone shapes with a uniform profile throughout entire unit length, with precisely formed arris slightly eased to prevent snipping, and with matching profile at joints between units.
 - 1. Produce moldings and molded edges with machines that use abrasive shaping wheels made to reverse contour of molding shape.
- J. Carve and cut **[inscriptions][and][decorative surfaces]**. Use skilled stone carvers experienced in the successful performance of work similar to that indicated.
- K. Abrasively etch **[inscriptions][and][decorative surfaces]**.
- L. Laser etch **[inscriptions][and][decorative surfaces]**.
- M. Clean backs of stone to remove rust stains, iron particles, and stone dust.
- N. Inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units.
 - 1. Grade and mark stone for overall uniform appearance when assembled in place. Natural variations in appearance are acceptable if installed stone units match range of colors and other appearance characteristics represented in approved samples and mockups.

2.16 FABRICATION OF BACKUP STRUCTURE

- A. Fabrication of **[Steel Trusses][Strongback Frames][and][Miscellaneous Steel Framing]**: Fabricate in shop to comply with AISC 303.
 - 1. Weld shop connections to comply with applicable provisions of AWS D1.1/D1.1M.
 - 2. Fabricate joints to exclude water or to permit its escape to building exterior, at locations where water could accumulate because of condensation or other causes.
 - 3. Hot-dip galvanize backup structure after fabrication to comply with ASTM A123/A123M.
- B. Fabrication of Steel Stud Frames: Fabricate and assemble by welding to comply with requirements in Section 054000 "Cold-Formed Metal Framing."
 - 1. Weld secondary weather barrier (sheathing) to outside face of steel stud frames. Use continuous welds at all four edges of sheets to provide continuous weather seal.
 - 2. Clean welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

2.17 SHOP-PAINTED STEEL FINISHES

- A. Shop-Painted Steel Finishes: Paint uncoated steel backup structure before delivering to Project site to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel."
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. [Cloverdale Paint]
 - b. [Coronado Paint; Benjamin Moore & Co.]
 - c. [Dulux (formerly ICI Paints); a brand of AkzoNobel]
 - d. [Frazee Paint; Comex Group]
 - e. [General Paint]
 - f. [Sherwin-Williams Company (The)]
 - g. [SICO; PPG Architectural Coatings]
 - h. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Cloverdale Paint]
 - b. [Coronado Paint; Benjamin Moore & Co.]
 - c. [Dulux (formerly ICI Paints); a brand of AkzoNobel]
 - d. [Frazee Paint; Comex Group]
 - e. [General Paint]
 - f. [Sherwin-Williams Company (The)]
 - g. [SICO; PPG Architectural Coatings]
 - h. <Insert manufacturer's name>
- B. Surface Preparation: After fabricating steel items, prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- C. Apply one coat of fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#76. **[After primer has dried, apply one coat of exterior alkyd enamel complying with MPI#96 of a different color than primer.]**
- D. Apply two-coat, high-performance coating system consisting of epoxy zinc-rich primer, complying with MPI#20 and topcoat of high-build epoxy coating, complying with MPI#108.

2.18 MORTAR MIXES

- A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortar of uniform quality and with optimum performance characteristics.
 1. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated. Do not use calcium chloride.
 2. Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer unless otherwise indicated. Discard mortar when it has reached initial set.
- B. Portland Cement-Lime Setting Mortar: Comply with ASTM C270, Proportion Specification, **[Type S][Type N][for types of mortar indicated below:]**
 1. Set granite with Type S mortar.
 2. Set limestone with Type N mortar.
 3. Set marble with Type S mortar.
 4. Set quartz-based stone with **[Type S][Type N]** mortar.
 5. Set serpentine with Type S mortar.
 6. Set slate with Type S mortar.
 7. Set travertine with Type N mortar.
 8. Backparge travertine with Type O mortar.

- C. Pointing Mortar: Comply with ASTM C270, Proportion Specification, **[Type S][Type N][Type O][for types of mortar indicated]**. Provide pointing mortar mixed to match Architect's sample and complying with the following:

1. Pigmented Pointing Mortar: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1:10, by weight.
2. Packaged Portland Cement-Lime Mix Mortar: Use portland cement-lime mix of selected color.
3. Colored-Aggregate Pointing Mortar: Produce color required by combining colored aggregates with portland cement of selected color.
4. Point granite with **[Type S][Type N]** mortar.
5. Point limestone with **[Type N][Type O]** mortar.
6. Point marble with **[Type N][Type O]** mortar.
7. Point quartz-based stone with **[Type N][Type O]** mortar.
8. Point serpentine with **[Type N][Type O]** mortar.
9. Point slate with Type N mortar.
10. Point travertine with **[Type N][Type O]** mortar.

2.19 SOURCE QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform source quality-control testing.
1. Retesting of materials that fail to meet specified requirements is done at Contractor's expense.
 2. Furnish test specimens **[randomly selected][selected by testing agency]** from same blocks as actual materials proposed for incorporation into the Work.
 3. Flexural Strength Tests: ASTM C880/C880M, performed on specimens of same thickness, orientation of cut, and finish as installed stone. One set of test specimens is required to be tested for every **[10,000 sq. ft. (1000 sq. m)][5000 sq. ft. (500 sq. m)][3000 sq. ft. (300 sq. m)]**, but not fewer than two sets for each stone variety.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive stone cladding and conditions under which stone cladding will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone cladding.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of stone cladding.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF BACKUP STRUCTURE

- A. Installing **[Steel Trusses][Strongback Frames][and][Miscellaneous Steel Framing]**: Comply with AISC 303 and install to accommodate construction tolerances specified.
1. Maintain erection of backup structure within tolerances in AISC 303.
 2. For prefabricated units to which stone has been installed before erection, maintain tolerances of

- stone faces and edges as specified in "Installation Tolerances" Article.
- 3. Install by **[welding to steel weld-plates anchored in concrete][bolting to inserts cast into concrete][or][bolting to structural-steel frame]**.
- 4. Clean welds, bolted connections, and abraded areas immediately after erection.
 - a. Repair galvanizing to comply with ASTM A780/A780M.
 - b. Apply paint to exposed areas using same material as used for shop painting.
- B. Installing Steel Stud Frames: Install **[by welding to steel weld-plates anchored in concrete][by welding to structural-steel frame][by bolting to structural-steel frame]** to comply with requirements in Section 054000 "Cold-Formed Metal Framing."
 - 1. Install steel stud frames level, plumb, and true to line with no variation in plane or alignment exceeding **1/16 inch (1.5 mm)** and no variation in position exceeding **1/8 inch (3 mm)**.
 - 2. For prefabricated frames to which stone has been installed before erection, maintain tolerances of stone faces and edges as specified in "Installation Tolerances" Article.
 - 3. Clean welds, bolted connections, and abraded areas immediately after erection. Repair galvanizing to comply with ASTM A780/A780M.
- C. Installing Metal-Grid Systems: Comply with manufacturer's written instructions to provide integrated system that combines metal struts, fittings, fasteners, and stone anchors.
 - 1. Fasten struts by bolting to **[inserts in concrete][or][steel angle clips bolted to steel framing]**.
 - 2. Fasten stone supports and anchors by bolting to struts.
 - 3. Shim and adjust struts and stone supports and anchors to provide grid that is level, plumb, and true to line with no variation in plane or alignment exceeding **1/16 inch (1.5 mm)** and no variation in position exceeding **1/8 inch (3 mm)**.

3.3 INSTALLATION OF STONE CLADDING, GENERAL

- A. Before setting stone, clean surfaces that are dirty or stained by removing soil, stains, and foreign materials. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.
- B. Coat limestone with dampproofing to extent indicated below:
 - 1. Stone at Grade: Beds, joints, and back surfaces to at least **12 inches (300 mm)** above finish-grade elevations.
 - 2. Stone Extending Below Grade: Beds, joints, back surfaces, and face surfaces below grade.
 - 3. Allow dampproofing to cure before setting dampproofed stone. Do not damage or remove dampproofing while handling and setting stone.
- C. Parge back of travertine panels with mortar not less than **3/8 inch (10 mm)** thick.
- D. Execute stone cladding installation by skilled mechanics and employ skilled stone fitters at Project site to do necessary field cutting as stone is set.
 - 1. Use power saws with diamond blades to cut stone. Produce lines cut straight and true, with edges eased slightly to prevent snapping.
- E. Contiguous Work: Provide reveals, reglets, and openings as required to accommodate contiguous work.
- F. Set stone to comply with requirements indicated. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure stone cladding in place. Shim and adjust anchors, supports, and accessories to set stone accurately in locations indicated, with uniform joints of widths

indicated, and with edges and faces aligned according to established relationships and indicated tolerances.

- G. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated.
 - 1. Sealing expansion and other joints is specified in Section 079200 "Joint Sealants."
 - 2. Keep expansion joints free of mortar and other rigid materials.
- H. Install concealed flashing at continuous shelf angles, lintels, ledges, and similar obstructions to downward flow of water, to divert water to building exterior. Extend flashing **6 inches (150 mm)** at ends and turn up not less than **2 inches (50 mm)** to form end dams.
- I. Keep cavities open where unfilled space is indicated between back of stone units and backup wall; do not fill cavities with mortar or grout.
 - 1. Place weep holes in joints where moisture may accumulate, including at base of cavity walls and above shelf angles and flashing. Locate weep holes at intervals not exceeding **24 inches (600 mm)**. Use **[weep and vent tubes][plastic weep hole/vents][or][wicking material]**.
 - 2. Place vents in cavity walls at tops of cavities, below shelf angles and flashing, and at intervals not exceeding **20 feet (6 m)** vertically. Locate vents in joints at intervals not exceeding **60 inches (1500 mm)** horizontally. Use **[weep and vent tubes][or][plastic weep hole/vents]**.

3.4 INSTALLATION OF MECHANICALLY ANCHORED STONE CLADDING

- A. Set stone cladding with mechanical anchors without mortar unless otherwise indicated.
- B. Attach anchors securely to stone and to backup surfaces. Comply with recommendations in ASTM C1242.
- C. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with sealant indicated for filling kerfs.
- D. Set stone supported on clips or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths and to prevent point loading of stone on anchors. Hold shims back from face of stone a distance at least equal to width of joint.

3.5 INSTALLATION OF STONE CLADDING WITH MORTAR

- A. Set stone cladding with mortar and mechanical anchors **[where indicated][unless otherwise indicated]**.
- B. Set stone in full bed of mortar with head joints filled unless otherwise indicated.
 - 1. Use setting buttons of adequate size, in sufficient quantity, and of thickness required to maintain uniform joint width and to prevent mortar from extruding. Hold buttons back from face of stone a distance at least equal to width of joint, but not less than depth of pointing materials.
 - 2. Do not set heavy units or projecting courses until mortar in courses below has hardened enough to resist being squeezed out of joint.
 - 3. Support and brace projecting stones until wall above is in place and mortar has set.
 - 4. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with mortar.

- C. Fill space between back of stone units and backup wall solidly with mortar or grout.
- D. Embed ends of sills in mortar; leave remainder of joint open until final pointing.
- E. Rake out joints for pointing with mortar to depths of not less than **1/2 inch (12 mm)**. Rake joints to uniform depths with square bottoms and clean sides.
- F. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply first layer of pointing mortar in layers not more than **3/8 inch (10 mm)** until a uniform depth is formed.
- G. Point stone joints by placing pointing mortar in layers not more than **3/8 inch (10 mm)**. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.
- H. Tool joints with a round jointer having a diameter **1/8 inch (3 mm)** larger than width of joint, when pointing mortar is thumbprint hard.
- I. Rake out mortar from sealant-pointed joints to depths required for sealant and sealant backing, but not less than **1/2 inch (12 mm)**. Rake joints to uniform depths with square bottoms and clean sides.
- J. Set the following stone cladding with unfilled head joints for installing joint sealants:
 - 1. Cornices.
 - 2. Copings.
 - 3. Sills.
 - 4. Belt and other projecting courses.

3.6 INSTALLATION OF JOINT-SEALANTS

- A. Prepare joints and apply sealants of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.7 INSTALLATION TOLERANCES

- A. Variation from Plumb: For vertical lines and surfaces of walls, do not exceed **1/4 inch in 10 feet (6 mm in 3 m)**, **3/8 inch in 20 feet (10 mm in 6 m)**, or **1/2 inch in 40 feet (12 mm in 12 m)** or more. For external corners, corners and jambs within **20 feet (6 m)** of an entrance, expansion joints, and other conspicuous lines, do not exceed **1/8 inch in 10 feet (3 mm in 3 m)**, **1/4 inch in 20 feet (6 mm in 6 m)**, or **3/8 inch in 40 feet (10 mm in 12 m)** or more.
- B. Variation from Level: For lintels, sills, water tables, parapets, horizontal bands, horizontal grooves, and other conspicuous lines, do not exceed **1/8 inch in 10 feet (3 mm in 3 m)**, **1/4 inch in 20 feet (6 mm in 6 m)**, or **3/8 inch (10 mm)** maximum.
- C. Variation of Linear Building Line: For positions shown in plan and related portions of walls and partitions, do not exceed **1/4 inch in 20 feet (6 mm in 6 m)** or **1/2 inch in 40 feet (12 mm in 12 m)** or more.
- D. Variation in Cross-Sectional Dimensions: For thickness of walls from dimensions indicated, do not exceed plus or minus **1/4 inch (6 mm)**.
- E. Variation in Joint Width: Do not vary from average joint width more than plus or minus **1/8 inch (3 mm)** or a quarter of nominal joint width, whichever is less. For joints within **60 inches (1500 mm)** of each

other, do not vary more than **1/8 inch (3 mm)** or a quarter of nominal joint width, whichever is less from one to the other.

- F. Variation in Plane between Adjacent Stone Units (Lipping): Do not exceed **1/16-inch (1.5-mm)** difference between planes of adjacent units.

3.8 ADJUSTING AND CLEANING

- A. Remove and replace broken, chipped, stained, or otherwise damaged stone, defective joints, and stone cladding that does not match approved samples[**and mockups**]. Damaged stone may be repaired if Architect approves methods and results.
- B. Replace damaged or defective work in a manner that results in stone cladding's matching approved samples[**and mockups**], complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean stone cladding as work progresses.[**Remove mortar fins and smears before tooling joints.**] Remove excess sealant and smears as sealant is installed.
- D. Final Cleaning: Clean stone cladding no fewer than six days after completion of pointing and sealing, using clean water and stiff-bristle fiber brushes. Do not use wire brushes, acid-type cleaning agents, cleaning agents containing caustic compounds or abrasives, or other materials or methods that could damage stone.

END OF SECTION 04 42 00 00



Task	Specification	Specification Description
04 42 43 00	04 42 00 00	Exterior Stone Cladding
04 42 43 00	04 41 00 00	Stone Wall Facing
04 43 16 00	01 11 19 00	No Specification Required
04 43 16 00	04 42 00 00	Exterior Stone Cladding
04 43 16 00	04 41 00 00	Stone Wall Facing
04 51 00 00	04 20 00 00	Unit Masonry



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SECTION 04 72 00 00 - PRECAST ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Precast architectural concrete units.
2. Mold materials.
3. Reinforcing materials.
4. Prestressing tendons.
5. Concrete materials.
6. Steel connection materials.
7. Stainless steel connection materials.
8. Accessories.
9. Grout materials.
10. Clay facing materials.
11. Stone facing materials.
12. Insulated panel materials.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" site-cast concrete requirements and for installing connection anchors in concrete.
2. Section 034900 "Glass-Fiber-Reinforced Concrete (GFRC)."
3. Section 047200 "Cast Stone Masonry" for cast stone facings, trim, and accessories.
4. Section 051200 "Structural Steel Framing" for furnishing and installing connections attached to structural-steel framing.
5. Section 055000 "Metal Fabrications" for kickers and other miscellaneous steel shapes.
6. Section 071900 "Water Repellents" for water-repellent finish treatments.
7. Section 085113 "Aluminum Windows" for windows set into architectural precast concrete units.

1.2 DEFINITIONS

- ##### A. Design Reference Sample:
- Sample of approved architectural precast concrete color, finish, and texture, as directed by the Owner.

1.3 PREINSTALLATION MEETINGS

- ##### A. Preinstallation Conference:
- Conduct conference at **[Project site]**.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Precast architectural concrete unit design mixtures: Include compressive strength and water-absorption tests for each precast concrete mixture.
2. Mold materials.

3. Reinforcing materials.
4. Prestressing tendons.
5. Concrete materials.
6. Steel connection materials.
7. Stainless steel connection materials.
8. Accessories.
9. Grout materials.
10. Clay facing materials.
11. Stone facing materials.
12. Insulated panel materials.

B. Shop Drawings:

1. Detail fabrication and installation of architectural precast concrete units.
2. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.
3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
4. Indicate details at building corners.
5. Indicate separate face and backup mixture locations and thicknesses.
6. Indicate type, size, and length of welded connections by AWS standard symbols. Detail loose and cast-in hardware and connections.
7. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
8. Indicate locations, extent, and treatment of dry joints if two-stage casting is proposed.
9. Include plans and elevations showing unit locations, dimensions, erection sequences, and bracing plans for special conditions.
10. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
11. Indicate relationship of architectural precast concrete units to adjacent materials.
12. Indicate locations, type, dimensions, and details of facing units, including corner units, special shapes, joint treatment, and anchors.
13. Indicate multiple wythe connection details.
14. Coordinate and indicate openings and inserts required by other trades.
15. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and indicate modified areas on Shop Drawings. Do not adversely affect the appearance, durability, or strength of units.

C. Samples: Design reference samples for initial verification of design intent, for each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of three, representative of finish, color, and texture variations expected; approximately **12 by 12 by 2 inches (300 by 300 by 50 mm)**.

1. When other faces of precast concrete unit are exposed, include Samples illustrating workmanship, color, and texture of backup concrete as well as facing concrete.
2. Samples for each [**stone veneer**][**terra cotta**][**thin-brick**] unit required, showing full range of color and texture expected. Include Sample showing color and texture of joint treatment.
 - a. Grout Samples for Initial Selection: Color charts consisting of actual sections of grout showing manufacturer's full range of colors.
 - b. Grout Samples for Verification: Showing color and texture of joint treatment.

D. Sample Panels: After sample approval and before fabricating architectural precast concrete units, produce a minimum of [**two**] sample panels approximately [**16 sq. ft. (1.5 sq. m)**] in area as directed by the Owner. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.

1. Locate panels where indicated or, if not indicated, as directed by the Owner.
 2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
 3. After acceptance of repair technique, maintain one sample panel at manufacturer's plant and one at Project site in an undisturbed condition as a standard for judging the completed Work.
 4. Demolish and remove sample panels when directed.
- E. Range Samples: After sample panel approval and before fabricating architectural precast concrete units, produce a minimum of ~~[three]~~**[five]** sets of samples, approximately ~~[16 sq. ft. (1.5 sq. m)]~~ in area, representing anticipated range of each color and texture on Project's units. Maintain one set of range samples at Project site and remaining sets at manufacturer's plant as color and texture approval reference.
- F. Delegated Design Submittals: For architectural precast concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Show governing panel types, connections, types of reinforcement, including special reinforcement, and concrete cover on reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from architectural precast concrete.
- G. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 3. Environmental Product Declaration (EPD): For each product.
 4. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
 5. Environmental Product Declaration: For each product.
 6. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
 7. Environmental Product Declaration: For each product.
 8. Environmental Product Declaration: For each product.
 9. Third-Party Certifications: For each product.
 10. Third-Party Certified Life Cycle Assessment: For each product.
 11. Health Product Declaration (HPD): Provide documentation confirming product compliance with one of the following:
 - a. Inventory or HPD to at least 0.01 percent by weight with no GreenScreen LT-1 or GHS Category 1 hazards.
 - b. Inventory or HPD to at least 0.01 percent by weight, with at least 75 percent assessed using GreenScreen Benchmark assessment.
 - c. Third-party-verified Declare product label, designated "Red List Free."
 - d. Material Health Certificate or Cradle to Cradle certification with minimum Bronze level of Material Health.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Provide locations, setting diagrams, templates, instructions, and directions, as required, for furnishing and installation of loose connection hardware and anchorage items to be

embedded in or attached to other construction.

- B. Welding certificates.
- C. Material Test Reports: For each of the following items, for tests performed by **[manufacturer][qualified testing agency][manufacturer and witnessed by a qualified testing agency]**.
 - 1. Aggregates.
 - 2. Cementitious materials.
 - 3. Reinforcing materials and prestressing tendons.
 - 4. Admixtures.
 - 5. Bearing pads.
 - 6. Structural-steel shapes and hollow structural sections.
 - 7. Thin-brick units and accessories.
 - 8. Stone anchors.
 - 9. Insulation.

1.6 CLOSEOUT SUBMITTALS

- A. General Contractor/Construction Manager Project Survey: Complete the survey form, providing feedback of the certified precast producer's performance in accordance with PCI's Architectural Certification Program. Submit to PCI as directed on form; as directed by the Owner.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 - 1. Designated[**at time of bidding**] as a PCI-certified plant for **[Category AA][Category AB][Category AC][Category AD][Category AT][or designated as an APA-certified plant for production of architectural precast concrete products]**.
 - 2. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with **[PCI MNL 116][PCI MNL 117]** and PCI MNL 135.
- B. Certified Installer Qualifications: A precast concrete erector qualified and designated by PCI's Certificate of Compliance to erect **[Category A (Architectural Systems) for nonload][Category S2 (Complex Structural Systems) for load]**-bearing members.
- C. Installer Qualifications: A precast concrete erector who has retained a "PCI-Certified Field Auditor" to conduct a field audit of a project in same category as this Project and who can produce an Erectors' Post-Audit Declaration.
- D. Testing Agency Qualifications: An independent testing agency[, **acceptable to authorities having jurisdiction,**] qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
- E. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in **[state]** where Project is located and who is experienced in providing engineering services of the type indicated.
- F. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:

1. AWS D1.1/D1.1M.
2. AWS D1.4/D1.4M.
3. AWS D1.6/D1.6M.

1.8 MOCKUPS

- A. Build mockups **[to verify selections made under Sample submittals][to demonstrate aesthetic effects][to set quality standards for materials and execution][and][for preconstruction testing]**.
1. After sample panel **[and range sample]** approval, build mockup **[as indicated on Drawings]**, complete with anchors, connections, flashings, and joint fillers.
 - a. Build preconstruction testing mockup at testing agency facility.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, as directed by the Owner.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: **[the Owner will engage][Engage]** a qualified testing agency to perform preconstruction testing on **[stone anchors][mockups]**, as directed by the Owner.
1. Provide test specimens and assemblies representative of proposed materials and construction.
 2. Perform preconstruction testing in accordance with ASTM C1354/C1354M or ASTM E488/E488M, modified as follows:
 - a. Anchorage Tests: Test **12-inch- (300-mm-)** square samples for **[each combination of]** stone variety, orientation of cut, finish, and anchor type proposed for use on Project. Test for shear and tensile strength of anchorage system.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground or other rehandling.
- B. Support units during shipment on nonstaining shock-absorbing material.
- C. Store units with adequate dunnage and bracing, and protect units to prevent contact with soil, prevent staining, and prevent cracking, distortion, warping, or other physical damage.
- D. Place stored units so identification marks are clearly visible, and units can be inspected.
- E. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.
- F. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design architectural precast concrete units[**including stone facing system**].
- B. Design Standards: Comply with ACI 318 and design recommendations of PCI MNL 120 applicable to types of architectural precast concrete units indicated.
- C. Calculated Fire-Test-Response Characteristics: Provide architectural precast concrete units with fire-resistance rating indicated as calculated in accordance with [**ACI/TMS 216.1/216.1M**][**PCI 124**] and acceptable to authorities having jurisdiction.
- D. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:
 - 1. Design precast concrete units and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements as follows:
 - a. Upward and downward movement of [**1/2 inch (13 mm)**][**3/4 inch (19 mm)**][**1 inch (25 mm)**].
 - 2. Thermal Movements: Provide for in-plane thermal movements resulting from annual ambient temperature changes of [**80 deg F (26 deg C)**][**120 deg F (67 deg C)**].
 - 3. Fire-Resistance Rating: Select material and minimum thicknesses to provide [**1**][**2**]-hour fire rating.
 - 4. Stone Facing Anchorage: Provide anchors, as determined through preconstruction testing, in numbers, types, and locations required to satisfy specified performance criteria.
 - 5. Window-Washing System: Design precast units supporting window-washing system indicated to resist pull-out and horizontal shear forces transmitted from window-washing equipment.
 - 6. Vehicular Impact Loads: Design spandrel beams acting as vehicular barriers for passenger cars to resist a single [**6000 lb (26.7 kN)**] load applied horizontally in any direction to the spandrel beam, with anchorages or attachments capable of transferring this load to the structure. Design spandrel beams assuming the load to act at a height of **18 or 27 inches (457 or 686 mm)** above the floor or ramp surface, whichever is more severe, on an area not to exceed **1 sq. ft. (0.0929 sq. m)**.

2.2 PRECAST ARCHITECTURAL CONCRETE UNITS

- A. Provide unit types as indicated on Drawings, including [**wall panels**][**insulated wall panels**][**window panels**][**trim units**].
- B. Fabricators: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available fabricators offering products that may be incorporated into the Work include, but are not limited to, the following**]:
- C. Source Limitations: Obtain precast architectural concrete units from single fabricator.

2.3 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, nonabsorptive material, warp and buckle free, that provides continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
- B. Form Liners: Units of face design, texture, arrangement, and configuration **[indicated][to match those used for precast concrete design reference sample]**. Provide solid backing and supports to keep form liners in place during concrete placement.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Architectural Polymers, Inc.]**
 - b. **[Fitzgerald Formliners]**
 - c. **[Sika Corporation]**
 - d. **[Spec Formliners, Inc.]**
 - 2. Face Pattern: **[Smooth][Ribbed][Stone][Brick][Wood]**.
- C. Form-Release Agent: Commercially produced form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.
- D. Surface Retarder: Chemical-set retarder, capable of temporarily delaying final hardening of newly placed concrete mixture to depth of reveal specified.

2.4 REINFORCING MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25][60]** percent.
- B. Reinforcing Bars: ASTM A615/A615M, **Grade 60 (Grade 420)**, deformed.
- C. Low-Alloy-Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- D. Galvanized Reinforcing Bars: **[ASTM A615/A615M, Grade 60 (Grade 420)][ASTM A706/A706M]**, deformed bars, with ASTM A767/A767M, Class II zinc coating and chromate treatment. **[Galvanize after fabrication and bending.]**
- E. Epoxy-Coated Reinforcing Bars: **[ASTM A615/A615M, Grade 60 (Grade 420)][ASTM A706/A706M]**, deformed bars, **[ASTM A775/A775M][or][ASTM A934/A934M]** epoxy coated.
- F. Steel Bar Mats: ASTM A184/A184M, fabricated from **[ASTM A615/A615M, Grade 60 (Grade 420)][ASTM A706/A706M]**, deformed bars, assembled with clips.
- G. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from **[as-drawn][galvanized-]** steel wire into flat sheets.
- H. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

- I. Epoxy-Coated-Steel Wire: ASTM A884/A884M, Class A coated, **[plain][deformed]**, flat sheet, **[Type 1 bendable][Type 2 nonbendable]** coating.
- J. Supports: Suspend reinforcement from back of mold. Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place may only be used if they are not visible in the finished face.

2.5 PRESTRESSING TENDONS

- A. Prestressing Strand: ASTM A416/A416M, **Grade 270 (Grade 1860)**, uncoated, seven-wire, low-relaxation strand.
 - 1. Coat unbonded post-tensioning strand with post-tensioning coating and sheath with polypropylene tendon sheathing in compliance with ACI 423.7. Include anchorage devices and coupler assemblies.
- B. Post-Tensioning Bars: ASTM A722/A722M, uncoated high-strength steel bars.

2.6 CONCRETE MATERIALS

- A. Regional Materials: Concrete shall be manufactured within **500 miles (800 km)** of Project site from aggregates[**and cementitious materials**] that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- B. Regional Materials: Concrete shall be manufactured within **500 miles (800 km)** of Project site.
- C. Regional Materials: Concrete shall be manufactured within **100 miles (160 km)** of Project site from aggregates[**and cementitious materials**] that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- D. Indigenous Materials: Concrete shall be manufactured within **500 miles (800 km)** of Project site from aggregates[**and cementitious materials**] that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- E. Regional Materials: Concrete shall be manufactured within **500 miles (800 km)** of Project site from aggregates[**and cementitious materials**] that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- F. Portland Cement: ASTM C150/C150M, Type I or Type III.
 - 1. For surfaces exposed to view in finished structure, use **[gray][and][white]** cement, of same type, brand, and mill source.
 - a. Standard gray cement is acceptable for use where not exposed to view.
- G. Supplementary Cementitious Materials:
 - 1. Fly Ash: ASTM C618, Class C or F, with maximum loss on ignition of 3 percent.
 - 2. Metakaolin: ASTM C618, Class N.
 - 3. Silica Fume: ASTM C1240, with optional chemical and physical requirement[, **white**].

4. Ground Granulated Blast-Furnace Slag: ASTM C989/C989M, Grade 100 or 120.
 5. Blended Hydraulic Cement: ASTM C595/C595M, [Type IS, portland blast-furnace slag][Type IP, portland-pozzolan][Type I (PM), pozzolan-modified portland][Type I (SM), slag-modified portland] cement.
- H. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C33/C33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match approved finish sample.
 - a. Gradation: [Uniformly graded][Gap graded][To match design reference sample].
 2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand compatible with coarse aggregate; to match approved finish sample.
- I. Lightweight Aggregates: Except as modified by PCI MNL 117, ASTM C330/C330M, with absorption of less than 11 percent.
- J. Coloring Admixture: ASTM C979/C979M, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading[.].
- K. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117 [and ASTM C1602/C1602M].
- L. Air-Entraining Admixture: ASTM C260/C260M, certified by manufacturer to be compatible with other required admixtures.
- M. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
1. Water-Reducing Admixtures: ASTM C494/C494M, Type A.
 2. Retarding Admixture: ASTM C494/C494M, Type B.
 3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
 4. Water-Reducing and -Accelerating Admixture: ASTM C494/C494M, Type E.
 5. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 6. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
 7. Plasticizing Admixture: ASTM C1017/C1017M, Type I.
 8. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
 9. Corrosion-Inhibiting Admixture: ASTM C1582/C1582M.

2.7 STEEL CONNECTION MATERIALS

- A. Carbon Steel Shapes and Plates: ASTM A36/A36M.
- B. Carbon Steel-Headed Studs: ASTM A108, Grades 1010 through 1020, cold finished, AWS D1.1/D1.1M, Type A or Type B, with arc shields and with minimum mechanical properties of PCI MNL 117, Table 3.2.3.
- C. Carbon Steel Plate: ASTM A283/A283M, Grade C.
- D. Malleable Iron Castings: ASTM A47/A47M, Grade 32510 or Grade 35028.

- E. Carbon Steel Castings: ASTM A27/A27M, **Grade 60-30 (Grade 415-205)**.
- F. High-Strength, Low-Alloy Structural Steel: ASTM A572/A572M.
- G. Carbon Steel Structural Tubing: ASTM A500/A500M, Grade B or Grade C.
- H. Wrought Carbon Steel Bars: ASTM A675/A675M, **Grade 65 (Grade 450)**.
- I. Deformed-Steel Wire or Bar Anchors: ASTM A1064/A1064M or ASTM A706/A706M.
- J. Carbon Steel Bolts and Studs: ASTM A307, Grade A, or ASTM F1554, Grade 36; carbon steel, hex-head bolts and studs; carbon steel nuts, **ASTM A563 (ASTM A563M)**; and flat, unhardened steel washers, ASTM F844.
- K. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, **Grade A325 (Grade A325M)**, Type 1, heavy-hex steel structural bolts; **ASTM A563, Grade DH, (ASTM A563M, Class 10S)** heavy-hex carbon steel nuts; and ASTM F436/F436M, Type 1, hardened carbon steel washers.
- L. Zinc-Coated Finish: For exterior steel items[, **steel in exterior walls,**] and items indicated for galvanizing, apply zinc coating by [**hot-dip process in accordance with ASTM A123/A123M or ASTM A153/A153M**][**electrodeposition in accordance with ASTM B633, SC 3, Types 1 and 2**].
 - 1. For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent, or limit sum of silicon and 2.5 times phosphorous content to 0.09 percent.
 - 2. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with MIL-P-21035B or SSPC-Paint 20.
- M. Shop-Primed Finish: Prepare surfaces of nongalvanized-steel items, except those surfaces to be embedded in concrete, in accordance with requirements in SSPC-SP 3, and shop-apply [**lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in MPI 79**][**SSPC-Paint 23**] in accordance with SSPC-PA 1.
- N. Welding Electrodes: Comply with AWS standards.

2.8 STAINLESS STEEL CONNECTION MATERIALS

- A. Stainless Steel Plate: ASTM A240/A240M or ASTM A666, Type 304, Type 316, or Type 201.
- B. Stainless Steel Bolts and Studs: ASTM F593, Alloy Group 1 or 2) hex-head bolts and studs; **ASTM F594, Alloy Group 1 or 2 (ASTM F836M, Grade A1 or A4)** stainless steel nuts; and flat, stainless steel washers.
 - 1. Lubricate threaded parts of stainless steel bolts with an antiseize thread lubricant during assembly.
- C. Stainless Steel-Headed Studs: ASTM A276/A276M, Alloy 304 or Alloy 316, with minimum mechanical properties of PCI MNL 117, Table 3.2.3.

2.9 ACCESSORIES

- A. Bearing Pads: Provide one of the following for architectural precast concrete units[**as recommended**

by precast fabricator for application]:

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, Type A durometer hardness of 50 to 70, ASTM D2240, minimum tensile strength **2250 psi (15.5 MPa)**, ASTM D412.
 2. Random-Oriented-Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer; Type A durometer hardness of 70 to 90, ASTM D2240; capable of supporting a compressive stress of **3000 psi (20.7 MPa)** with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
 3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer; Type A durometer hardness of 80 to 100, ASTM D2240; in compliance with AASHTO LRFD BDS, Division II, Section 18.10.2; or with MIL-C-882E.
 4. Frictionless Pads: PTFE, glass-fiber reinforced, bonded to stainless or mild-steel plate, or random-oriented-fiber-reinforced elastomeric pads; of type required for in-service stress.
 5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.
- B. Reglets Specified Elsewhere: Specified in Section 076200 "Sheet Metal Flashing and Trim."
- C. Reglets: **[PVC extrusions,][Stainless steel, Type 302 or Type 304,][Copper,]** felt or fiber filled, or with face opening of slots covered.
- D. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install architectural precast concrete units.

2.10 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C150/C150M, Type I, and clean, natural sand, ASTM C144 or ASTM C404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content is to be less than 0.06 percent by weight of cement when tested in accordance with ASTM C1218/C1218M.
- B. Nonmetallic, Nonshrink Grout: Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107/C1107M, Grade A for dry pack and Grades B and C for flowable grout, and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content is to be less than 0.06 percent by weight of cement when tested in accordance with ASTM C1218/C1218M.
- C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C881/C881M, of type, grade, and class to suit requirements.

2.11 CLAY FACING MATERIALS

- A. Thin Brick: Not less than **1/2 inch (13 mm)** or more than **1 inch (25 mm)** thick, and as follows:
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Acme Brick Company]**
 - b. **[Belden Brick Company (The)]**
 - c. **[Endicott Clay Products Co]**

- d. **[General Shale, Inc.]**
- e. **[Glen-Gery Corporation]**
- f. **[Meridian Brick]**

2. Dimensional Tolerances: Plus **0 inch (0 mm)** or minus **1/16 inch (1.6 mm)** for any dimension **8 inches (203 mm)** or less and plus **0 inch (0 mm)** or minus **3/32 inch (2.4 mm)** for any dimension of more than **8 inches (203 mm)**.
 3. Out-of-Square Tolerance: Plus or minus **1/16 inch (1.6 mm)**.
 4. Warpage Tolerance: Not more than **1/16 inch (1.6 mm)** either concave or convex from consistent plane.
 5. Variation of Shape from Specified Angle: Plus or minus one degree.
 6. Modulus of Rupture: Not less than **250 psi (1.7 MPa)** when tested in accordance with ASTM C67/C67M.
 7. Tensile Bond Strength: Not less than **150 psi (1.0 MPa)** when tested before and after freeze-thaw test in accordance with ASTM E488/E488M as modified: Adhere a steel plate with a welded rod on a single thin-brick face with epoxy for each test.
 8. 24-Hour Cold-Water Absorption: Not more than **[6 percent when tested in accordance with ASTM C67/C67M][5 percent when tested in accordance with ASTM C373]**.
 9. Freeze-Thaw Resistance: No detectable disintegration or separation after 300 cycles when tested in accordance with ASTM C666/C666M, Method A or B.
 10. Chemical Resistance: Tested in accordance with ASTM C650 and rated "not affected."
 11. Efflorescence: Tested in accordance with ASTM C67/C67M and rated "not effloresced."
 12. Surface Coating: Thin brick with colors or textures applied as coatings to withstand 50 cycles of freezing and thawing; ASTM C67/C67M, with no observable difference in applied finish when viewed from **10 ft. (3 m)**.
 13. Back Surface Texture: Scored, combed, wire roughened, ribbed, keybacked, or dovetailed.
 14. Face Size: **[2-1/4 inches (57 mm) high by 7-5/8 inches (194 mm) long][2-1/4 inches (57 mm) high by 11-5/8 inches (295 mm) long][3-5/8 inches (92 mm) high by 7-5/8 inches (194 mm) long][3-5/8 inches (92 mm) high by 11-5/8 inches (295 mm) long]**.
 15. Special Shapes: Include corners, edge corners, and end edge corners.
 16. **[Where indicated to "match existing,"]**provide thin brick matching color, texture, and face size of existing adjacent brick work, as directed by the Owner.
17. Face Color and Texture: **[Match Architect's samples][Match color, texture, and face size of adjacent existing brick]** as directed by the Owner.

- B. Regional Materials: Brick shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- C. Regional Materials: Brick shall be manufactured within **500 miles (800 km)** of Project site.
- D. Regional Materials: Brick shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- E. Indigenous Materials: Brick shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- F. Regional Materials: Brick shall be manufactured within **500 miles (800 km)** of Project site from materials

that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.

- G. Architectural Terra Cotta: Not less than **3/4 inch (19 mm)** or more than **1-1/2 inch (38 mm)** thick, and as follows:
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Boston Valley Terra Cotta]**
 - b. **[Gladding, McBean; PABCO Clay Products, LLC; PABCO Building Products, LLC]**
 2. Dimensional Tolerances:
 - a. Height: Plus or minus **1/16 inch (1.6 mm)** up to **10 inches (250 mm)**; **3/32 inch (2.4 mm)** up to **15 inches (380 mm)**; **1/8 inch (3 mm)** up to **20 inches (500 mm)**; **5/32 inch (4 mm)** up to **24 inches (600 mm)**.
 - b. Thickness: Plus or minus **1/16 inch (1.6 mm)**.
 - c. Width: Plus or minus **0.039 inch (1 mm)** for lengths up to **60 inches (1524 mm)**.
 3. Out-of-Square Tolerance: Plus or minus **1/16 inch (1.6 mm)**.
 4. Warpage Tolerance:
 - a. Straightness (Sweep): Plus or minus 0.25 percent of length.
 - b. Diagonal Flatness: Plus or minus 0.25 percent of diagonal.
 - c. Vertical Flatness: Plus or minus one percent of height.
 5. Variation of Shape from Specified Angle: Plus or minus one degree.
 6. Modulus of Rupture: Not less than **1400 psi (9.7 MPa)** when tested in accordance with ASTM C67/C67M.
 7. Compressive strength: Not less than **6000 psi (41.4 MPa)** when tested in accordance with ASTM C67/C67M.
 8. Tensile Bond Strength: Not less than **150 psi (1.0 MPa)** when tested before and after freeze-thaw test in accordance with ASTM E488/E488M as modified: Adhere a steel plate with a welded rod on a single terra cotta unit face with epoxy for each test.
 9. 24-Hour Cold-Water Absorption: Not more than 7.5 percent when tested in accordance with ASTM C67/C67M.
 10. Freeze-Thaw Resistance: No detectable disintegration or separation after 300 cycles when tested in accordance with ASTM C666/C666M, Method A or B.
 11. Chemical Resistance: Tested in accordance with ASTM C126 and rated "not affected."
 12. Efflorescence: Tested in accordance with ASTM C67/C67M and rated "not effloresced."
 13. Glaze Resistance to Crazeing: Tested in accordance with ASTM C126 and rated "not affected."
 14. Back Surface Texture: Dovetailed.
 15. Special Shapes: Include corners, edge corners, and end edge corners.
 16. **[Where indicated to "match existing,"]provide terra cotta matching color, texture, and face size of existing adjacent brick work, as directed by the Owner.**
 17. Face Color and Texture: **[Match Architect's samples][Match color, texture, and face size of adjacent existing terra cotta]** as directed by the Owner.
- H. Sand-Cement Mortar: Portland cement, ASTM C150/C150M, Type I, and clean, natural sand, ASTM C144. Mix at ratio of 1 part cement to 4 parts sand, by volume, with minimum water required for placement.

- I. Pointing Grout: Packaged, polymer-modified, sanded grout complying with ANSI A118.7.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Bostik; Arkema]**
 - b. **[C-Cure]**
 - c. **[Custom Building Products]**
 - d. **[DAP Products Inc.]**
 - e. **[H.B. Fuller Construction Products Inc. / TEC]**
 - f. **[Jamo Inc]**
 - g. **[Laticrete International, Inc.]**
 - h. **[MAPEI Corporation]**
 - i. **[Parex, a Sika brand]**
 - j. **[ProSpec; H.B. Fuller Construction Products Inc.]**
 - k. **[Southern Grouts & Mortars, Inc]**
 - l. **[Summitville Tiles, Inc.]**
 - m. **[Thermomass]**
 2. Polymer Type: Acrylic resin in **[dry, redispersible form, packaged with other dry ingredients][liquid-latex form for adding packaged dry-grout mix]**.
 3. Colors: **[As indicated by manufacturer's designations][as directed by the Owner]**.

2.12 STONE FACING MATERIALS

- A. Stone facing for architectural precast concrete is specified in Section 044200 "Exterior Stone Cladding."
- B. Anchors: Stainless steel, ASTM A276/A276M, Type 304 or Type 316, of temper and diameter required to support loads without exceeding allowable design stresses.
 1. Fit each anchor leg with neoprene grommet collar of width at least twice the diameter and of length at least 5 times the diameter of anchor.
- C. Silicone Sealant Filler: Single-component, nonsag, neutral-curing, silicone sealant; Class 25, Use NT (nontraffic), and Use M (masonry) that complies with applicable requirements in Section 079200 "Joint Sealants" and that does not stain stone:
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[GE Construction Sealants; Momenive Performance Materials Inc.]**
 - b. **[Master Builders Solutions]**
 - c. **[The Dow Chemical Company]**
 - d. **[Tremco Incorporated]**
- D. Urethane Sealant Filler: Single-component, nonsag, urethane sealant; Class 25, Use T (traffic), and Use M (masonry) that complies with applicable requirements in Section 079200 "Joint Sealants" and that does not stain stone:

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Master Builders Solutions]**
 - b. **[Sika Corporation]**
 - c. **[Tremco Incorporated]**

- E. Epoxy Filler: ASTM C881/C881M, 100 percent solids, sand-filled nonshrinking, nonstaining of type, class, and grade to suit application.

1. Elastomeric Anchor Sleeve: **1/2 inch (13 mm)** long, Type A durometer hardness of 60, ASTM D2240.

- F. Bond Breaker: **[Preformed, compressible, resilient, nonstaining, nonwaxing, closed-cell polyethylene foam pad, nonabsorbent to liquid and gas, 1/8 inch (3 mm) thick][Polyethylene sheet, ASTM D4397, 6 to 10 mils (0.15 to 0.25 mm) thick].**

2.13 INSULATED PANEL MATERIALS

- A. Provide board insulation with regularly spaced **[holes][markings]** at connector placement locations.
- B. Molded-Polystyrene (EPS) Board Insulation: ASTM C578, **[Type XI, 0.70 lb/cu. ft. (12 kg/cu. m)][Type I, 0.90 lb/cu. ft. (15 kg/cu. m)][Type VIII, 1.15 lb/cu. ft. (18 kg/cu. m)][Type II, 1.35 lb/cu. ft. (22 kg/cu. m)][Type IX, 1.80 lb/cu. ft. (29 kg/cu. m)]**; **[square][ship-lap]** edges; thickness as directed by the Owner.
- C. Extruded-Polystyrene (XPS) Board Insulation: ASTM C578, **[Type X, 1.30 lb/cu. ft. (21 kg/cu. m)][Type IV, 1.55 lb/cu. ft. (25 kg/cu. m)][Type VI, 1.80 lb/cu. ft. (29 kg/cu. m)][Type VII, 2.20 lb/cu. ft. (35 kg/cu. m)][Type V, 3.00 lb/cu. ft. (48 kg/cu. m)]**; **[square][ship-lap]** edges; thickness as directed by the Owner.
- D. Polyisocyanurate Board Insulation: ASTM C591, **[Type I, 1.8 lb/cu. ft. (29 kg/cu. m)][Type II, 2.5 lb/cu. ft. (40 kg/cu. m)][Type III, 3.0 lb/cu. ft. (48 kg/cu. m)]** unfaced, thickness as directed by the Owner.
- E. Wythe Connectors: **[Glass-fiber-reinforced vinylester connectors][Polypropylene pin connectors][Stainless steel pin connectors][Bent galvanized reinforcing bars or galvanized welded-wire trusses][Epoxy-coated carbon-fiber grid][Fiberglass trusses]** manufactured to connect wythes of precast concrete panels.

2.14 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
 1. Use a single design mixture for units with more than one major face or edge exposed.
 2. Where only one face of unit is exposed, use either a single design mixture or separate mixtures for face and backup.
- B. Limit use of fly ash and ground granulated blast-furnace slag to 20 percent of portland cement by weight; limit metakaolin and silica fume to 10 percent of portland cement by weight.

- C. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.
- D. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 117 when tested in accordance with ASTM C1218/C1218M.
- E. Normal-Weight Concrete Mixtures: Proportion ~~[face mixtures]~~**[face and backup mixtures]**~~[full-depth mixture]~~**[face and backup mixtures or full-depth mixtures, at fabricator's option]** by either laboratory trial batch or field test data methods in accordance with ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): **5000 psi (34.5 MPa)** minimum.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- F. Water Absorption: Six percent by weight or 14 percent by volume, tested in accordance with ASTM C642, except for boiling requirement.
- G. Lightweight Concrete Backup Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods in accordance with ACI 213R, with materials to be used on Project, to provide lightweight concrete with the following properties:
 - 1. Compressive Strength (28 Days): **5000 psi (34.5 MPa)**.
 - 2. Unit Weight: Calculated equilibrium unit weight of **115 lb/cu. ft. (1842 kg/cu. m)**, plus or minus **3 lb/cu. ft. (48 kg/cu. m)**, in accordance with ASTM C567/C567M.
- H. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.
- I. When included in design mixtures, add other admixtures to concrete mixtures in accordance with manufacturer's written instructions.

2.15 FABRICATION OF MOLDS

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
 - 1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.
- B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
 - 1. Form joints are not permitted on faces exposed to view in the finished Project.
 - 2. Edge and Corner Treatment: Uniformly **[chamfered]**~~[radiused]~~.

2.16 FABRICATION OF CLAY FACING

- A. Place form liner templates accurately to provide grid for thin-brick facings. Provide solid backing and supports to maintain stability of liners while placing thin bricks and during concrete placement.

- B. Securely place thin-brick units face down into form liner pockets, and place concrete backing mixture.
- C. Completely fill joint cavities between thin-brick units with sand-cement mortar, and place precast concrete backing mixture while sand-cement mortar is still fluid enough to ensure bond.
- D. Mix and install pointing grout in accordance with ANSI A108.10. Completely fill joint cavities between thin-brick units with pointing grout, and compress into place without spreading grout onto faces of thin-brick units. Remove excess grout immediately to prevent staining of thin brick.
 - 1. Tool joints to a **[slightly concave][V-]**shape when pointing grout is thumbprint hard.
- E. Clean faces and joints of thin-brick facing.

2.17 FABRICATION OF STONE FACING

- A. Accurately position stone facings to comply with requirements and in locations indicated on Shop Drawings. Install anchors, supports, and other attachments indicated or necessary to secure stone in place. Keep concrete reinforcement a minimum of **3/4 inch (19 mm)** from the back surface of stone. Use continuous spacers to obtain uniform joints of widths indicated and with edges and faces aligned in accordance with established relationships and indicated tolerances.
 - 1. Stone to Precast Anchorages: Provide anchors in numbers, types, and locations required to satisfy specified performance criteria, but not more than **24 inches (600 mm)** o.c. around perimeter of stone facing panels with a minimum of four anchors per panel.
- B. Fill anchor holes with **[sealant filler and install anchors][epoxy filler and install anchors with elastomeric anchor sleeve at back surface of stone]**.
 - 1. Install minimum **0.006-inch- (0.15-mm-)** thick polyethylene sheet to prevent bond between back of stone facing and concrete substrate and to ensure no passage of precast matrix to stone surface.
 - 2. Install **1/8-inch (3-mm)** polyethylene-foam bond breaker to prevent bond between back of stone facing and concrete substrate and to ensure no passage of precast matrix to stone surface. Maintain minimum projection requirements of stone anchors into concrete substrate.

2.18 FABRICATION OF PRECAST ARCHITECTURAL CONCRETE

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
 - 1. Weld-headed studs and deformed bar anchors used for anchorage in accordance with AWS D1.1/D1.1M and AWS C5.4.
- B. Furnish loose hardware items, including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units, as indicated on the Drawings.
- D. Cast-in openings larger than **10 inches (250 mm)** in any dimension. Do not drill or cut openings or

prestressing strand without the Owner approval.

- E. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.
 - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A775/A775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
 - 2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 - 3. Place reinforcing steel and prestressing strands to maintain at least **3/4-inch (19-mm)** minimum concrete cover. Increase cover requirements for reinforcing steel to **1-1/2 inches (38 mm)** when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 - 4. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
- F. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses and specified in-place loads.
- G. Prestress tendons for architectural precast concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 117.
 - 1. Delay detensioning or post-tensioning of precast, prestressed architectural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete unit.
 - 2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat-cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
 - 3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
 - 4. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.
- H. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- I. Place face mixture to a minimum thickness after consolidation of the greater of **1 inch (25 mm)** or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.
- J. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.
 - 1. Place backup concrete mixture to ensure bond with face-mixture concrete.
- K. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.
 - 1. Place self-consolidating concrete without vibration in accordance with PCI TR-6. Ensure adequate bond between face and backup concrete, if used.

- L. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.
- M. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that does not show in finished structure.
- N. Cure concrete, in accordance with PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
- O. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs comply with requirements in PCI MNL 117, as directed by the Owner.

2.19 FABRICATION OF INSULATED PANELS

- A. Cast, screed, and consolidate bottom concrete wythe supported by mold.
- B. Place insulation boards abutting edges and ends of adjacent boards. Insert wythe connectors through insulation holes, and consolidate concrete around connectors in accordance with connector manufacturer's written instructions.
- C. Ensure bottom wythe and insulation layer are not disturbed after bottom wythe reaches initial set.
- D. Cast, screed, and consolidate top wythe to meet required finish.
- E. Maintain temperature below **150 deg F (65 deg C)** in bottom concrete wythe.

2.20 FABRICATION TOLERANCES

- A. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with **[PCI MNL 117][PCI MNL 116][PCI MNL 135]** product tolerances as well as position tolerances for cast-in items.
- B. Fabricate architectural precast concrete units to shapes, lines, and dimensions indicated so each finished unit complies with the following product tolerances:
 - 1. Overall Height and Width of Units, Measured at the Face Exposed to View: As follows:
 - a. **10 ft. (3 m)** or under, plus or minus **1/8 inch (3 mm)**.
 - b. **10 to 20 ft. (3 to 6 m)**, plus **1/8 inch (3 mm)**, minus **3/16 inch (5 mm)**.
 - c. **20 to 40 ft. (6 to 12 m)**, plus or minus **1/4 inch (6 mm)**.
 - d. Greater Than 20 ft. (6 m): Each additional **10 ft. (3 m)**, plus or minus **1/16 inch (1.6 mm)**.
 - e. Greater Than 40 ft. (12 m): Each additional **10 ft. (3 m)**, plus or minus **1/16 inch (1.6 mm)**.
 - 2. Overall Height and Width of Units, Measured at the Face Not Exposed to View: As follows:
 - a. **10 ft. (3 m)** or under, plus or minus **1/4 inch (6 mm)**.
 - b. **10 to 20 ft. (3 to 6 m)**, plus **1/4 inch (6 mm)**, minus **3/8 inch (10 mm)**.
 - c. **20 to 40 ft. (6 to 12 m)**, plus or minus **3/8 inch (10 mm)**.
 - d. Greater Than 20 ft. (6 m): Each additional **10 ft. (3 m)**, plus or minus **1/8 inch (3 mm)**.
 - e. Greater Than 40 ft. (12 m): Each additional **10 ft. (3 m)**, plus or minus **1/8 inch (3 mm)**.

3. Total Thickness or Flange Thickness: **[Exposed edge plus or minus 1/8 inch (3 mm); Unexposed edge]** plus 1/4 inch (6 mm), minus 1/8 inch (3 mm).
 4. Rib Thickness: Plus or minus 1/8 inch (3 mm).
 5. Rib to Edge of Flange: Plus or minus 1/8 inch (3 mm).
 6. Distance between Ribs: Plus or minus 1/8 inch (3 mm).
 7. Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or minus 1/8 inch/72 inches (3 mm/1830 mm) or 1/2 inch (13 mm) total, whichever is greater.
 8. Length and Width of Block-outs and Openings within One Unit: **[Plus or minus 1/8 inch (3 mm) for maximum opening dimensions less than 10 ft. (3 m) and plus 3/16 inch (5 mm), minus 1/8 inch (3 mm) for maximum opening dimensions greater than 10 ft. (3 m)][Plus or minus 1/4 inch (6 mm)]**.
 9. Location and Dimension of Block-outs Hidden from View and Used for HVAC and Utility Penetrations: Plus or minus 3/4 inch (19 mm).
 10. Dimensions of Haunches: Plus or minus 1/4 inch (6 mm).
 11. Haunch Bearing Surface Deviation from Specified Plane: Plus or minus 1/8 inch (3 mm).
 12. Difference in Relative Position of Adjacent Haunch Bearing Surfaces from Specified Relative Position: Plus or minus 1/4 inch (6 mm).
 13. Bowing: Plus or minus L/360, maximum 1 inch (25 mm).
 14. Local Smoothness: 1/4 inch/10 ft. (6 mm/3 m).
 15. Warping: 1/16 inch/12 inches (1.6 mm/300 mm) from nearest adjacent corner.
- C. Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
1. Weld Plates: Plus or minus 1 inch (25 mm).
 2. Tipping and Flushness of Plates: Plus or minus 1/4 inch (6 mm).
 3. Dimensions of Architectural Features and Rustications: Plus or minus 1/8 inch (3 mm).
 4. Inserts: Plus or minus 1/2 inch (13 mm).
 5. Handling Devices: Plus or minus 3 inches (75 mm).
 6. Reinforcing Steel and Welded-Wire Reinforcement: Plus or minus 1/4 inch (6 mm) where position has structural implications or affects concrete cover; otherwise, plus or minus 1/2 inch (13 mm).
 7. Reinforcing Steel Extending out of Member: Plus or minus 1/2 inch (13 mm).
 8. Prestressing Reinforcement: Plus or minus 1/4 inch (6 mm), perpendicular to panel; plus or minus 1 inch (25 mm), parallel to panel.
 9. Location of Rustication Joints: Plus or minus 1/8 inch (3 mm).
 10. Location of Opening within Panel: Plus or minus 1/4 inch (6 mm).
 11. Location of Flashing Reglets: Plus or minus 1/4 inch (6 mm).
 12. Location of Flashing Reglets at Edge of Panel: Plus or minus 1/8 inch (3 mm).
 13. Reglets for Glazing Gaskets: Plus or minus 1/8 inch (3 mm).
 14. Electrical Outlets, Hose Bibs: Plus or minus 1/2 inch (13 mm).
 15. Location of Bearing Surface from End of Member: Plus or minus 1/4 inch (6 mm).
 16. Allowable Rotation of Plate, Channel Inserts, and Electrical Boxes: Two-degree rotation or 1/4 inch (6 mm) maximum, measured at perimeter of insert.
 17. Position of Sleeve: Plus or minus 1/2 inch (13 mm).
 18. Location of Window-Washer Track or Buttons: Plus or minus 1/8 inch (3 mm).
- D. Thin-Brick-Faced Architectural Precast Concrete Units: Restrict the following misalignments to 2 percent of number of thin bricks in a unit.
1. Alignment of Mortar Joints:
 - a. Jog in Alignment: 1/8 inch (3 mm).
 - b. Alignment with Panel Centerline: Plus or minus 1/8 inch (3 mm).

2. Variation in Width of Exposed Mortar Joints: Plus or minus **1/8 inch (3 mm)**.
3. Tipping of Individual Thin Bricks from Panel Plane of Exposed Thin-Brick Surface: Plus **0 inch (0 mm)**; minus **1/4 inch (6 mm)** less than or equal to depth of form liner joint.
4. Exposed Thin-Brick Surface Parallel to Primary Control Surface of Panel: Plus **1/4 inch (6 mm)**; minus **1/8 inch (3 mm)**.
5. Individual Thin-Brick Step in Face from Panel Plane of Exposed Thin-Brick Surface: Plus **0 inch (0 mm)**; minus **1/4 inch (6 mm)** less than or equal to depth of form liner joint.

E. Stone Veneer-Faced Architectural Precast Concrete Units:

1. Variation in Cross-Sectional Dimensions: For thickness of walls from dimensions indicated: Plus or minus **1/4 inch (6 mm)**.
2. Variation in Joint Width: **1/8 inch in 36 inches (3 mm in 900 mm)** or a quarter of nominal joint width, whichever is less.
3. Variation in Plane between Adjacent Stone Units (Lipping): **1/16-inch (1.6-mm)** difference between planes of adjacent units.

2.21 FINISHES

- A. Exposed faces to be free of joint marks, grain, and other obvious defects. Corners, including false joints to be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved **[design reference sample][sample panels][mockups]** and as follows:
1. PCI's "Architectural Precast Concrete - Color and Texture Selection Guide," of plate numbers indicated.
 2. As-Cast Surface Finish: Provide surfaces to match approved sample for acceptable surface, air voids, sand streaks, and honeycomb.
 3. Textured-Surface Finish: Impart by form liners or inserts.
 4. Bushhammer Finish: Use power or hand tools to remove matrix and fracture coarse aggregates.
 5. Exposed-Aggregate Finish: Use chemical retarding agents applied to concrete forms and washing and brushing procedures to expose aggregate and surrounding matrix surfaces after form removal.
 6. Abrasive-Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
 7. Acid-Etched Finish: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces. Protect hardware, connections, and insulation from acid attach.
 8. Honed Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.
 9. Polished Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.
 10. Sand-Embedment Finish: Use selected stones placed in a sand bed in bottom of mold, with sand removed after curing.
 11. Thin-Brick or Terra Cotta Facing: See "Clay Facing Materials" Article.
 12. Stone Facing: See "Stone Facing Materials" Article.
- B. Finish exposed **[top][back]** surfaces of architectural precast concrete units **[to match face-surface finish][with smooth, steel-trowel finish]**.
- C. Finish unexposed surfaces of architectural precast concrete units with as-cast finish.

2.22 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Test and inspect precast concrete in accordance with PCI MNL 117

requirements. If using self-consolidating concrete, also test and inspect in accordance with PCI TR-6, ASTM C1610/C1610M, ASTM C1611/C1611M, ASTM C1621/C1621M, and ASTM C1712.

- B. The Owner will employ an independent testing agency to evaluate architectural precast concrete fabricator's quality-control and testing methods.
 - 1. Allow the Owner testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with the Owner testing agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.
- C. Strength of precast concrete units is considered deficient if units fail to comply with ACI 318 requirements for concrete strength.
- D. Testing: Fabricator will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength in accordance with ASTM C42/C42M and ACI 318.
 - 1. A minimum of three representative cores to be taken from units of suspect strength, from locations, as directed by the Owner.
 - 2. Test cores in an air-dry condition.
 - 3. Strength of concrete for each series of three cores is considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
 - 4. Report test results in writing on same day that tests are performed, with copies to the Owner, Contractor, and precast concrete fabricator, as directed by the Owner.
- E. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.
- F. Defective Units: Discard and replace recast architectural concrete units that do not comply with acceptability requirements in PCI MNL 117, including concrete strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to the Owner approval, as directed by the Owner. The Owner reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.
- B. Do not install precast concrete units until supporting cast-in-place concrete has attained minimum allowable design compressive strength and supporting steel or other structure is structurally ready to receive loads from precast concrete units.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF PRECAST ARCHITECTURAL CONCRETE UNITS

- A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.
- B. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.
 - 1. Install temporary steel or plastic spacing shims as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
 - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
 - 4. Unless otherwise indicated, maintain uniform joint widths of **3/4 inch (19 mm)**.
- C. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
 - 1. Do not permit connections to disrupt continuity of roof flashing.
- D. Welding: Comply with applicable requirements in AWS D1.1/D1.1M and AWS D1.4/D1.4M for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
 - 1. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
 - 2. Welds not specified to be continuous fillet welds use no less than the minimum fillet as specified by AWS.
 - 3. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and **[apply a minimum 4.0-mil- (0.1-mm-) thick coat of galvanized repair paint to galvanized surfaces in accordance with ASTM A780/A780M][re-priming damaged painted surfaces]**.
 - 4. Visually inspect welds and remove, reweld, or repair incomplete and defective welds.
- E. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
 - 1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
 - 2. For slip-critical connections, use one of the following methods to assure proper bolt pretension:
 - a. Turn-of-Nut: In accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 - b. Calibrated Wrench: In accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 - c. Twist-off Tension Control Bolt: ASTM F3125/F3125M, Grade 1852.
 - d. Direct-Tension Control Bolt: ASTM F3125/F3125M, Grade 1852.
 - 3. For slip-critical connections, use method and inspection procedure approved by the Owner and coordinated with inspection agency, as directed by the Owner.
- F. Grouting or Dry Packing Connections and Joints: Grout connections where required or indicated. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry pack grout material, tamping until voids are completely filled. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Keep grouted joints damp for not less than 24 hours after initial set.

3.3 ERECTION TOLERANCES

- A. Erect architectural precast concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.
- B. Erect architectural precast concrete units level, plumb, square, and in alignment, without exceeding the following noncumulative erection tolerances:
 - 1. Plan Location from Building Grid Datum: Plus or minus **1/2 inch (13 mm)**.
 - 2. Plan Location from Centerline of Steel: Plus or minus **1/2 inch (13 mm)**.
 - 3. Top Elevation from Nominal Top Elevation: As follows:
 - a. Exposed Individual Panel: Plus or minus **1/4 inch (6 mm)**.
 - b. Nonexposed Individual Panel: Plus or minus **1/2 inch (13 mm)**.
 - 4. Support Elevation from Nominal Support Elevation: As follows:
 - a. Maximum Low: **1/2 inch (13 mm)**.
 - b. Maximum High: **1/4 inch (6 mm)**.
 - 5. Maximum Plumb Variation over the Lesser of Height of Structure or 100 ft. (30 m): **1 inch (25 mm)**.
 - 6. Plumb in Any 10 ft. (3 m) of Unit Height: **1/4 inch (6 mm)**, **additionally a maximum of 1/2 inch (13 mm) over total height of the unit**.
 - 7. Maximum Jog in Alignment of Matching Edges: **1/4 inch (6 mm)**.
 - a. Exposed Panel Relative to Adjacent Panel: **1/4 inch (6 mm)**.
 - b. Nonexposed Panel Relative to Adjacent Panel: **1/2 inch (13 mm)**.
 - c. Add **1/8-inch (3-mm)** additional tolerance in the maximum jog for panels larger than **20 ft. (6 m)** per **10 ft. (3 m)** of additional height, up to a maximum tolerance of **1/2 inch (13 mm)**.
 - 8. Joint Width (Governs over Joint Taper): **[Plus or minus 3/16 inch (5 mm) for joints 10 ft. (3 m) or less in length, plus or minus 1/4 inch (6 mm) for joints over 10 ft. (3 m) in length][Plus or minus 1/4 inch (6 mm)]**.
 - 9. Maximum Joint Taper: **[Plus or minus 3/16 inch (5 mm) for joints 10 ft. (3 m) or less in length; plus or minus 1/4 inch (6 mm) for joints over 10 ft. (3 m) in length][Plus or minus 3/8 inch (10 mm) but not more than 1/4 inch (6 mm) in 10 ft. (3 m) length]**.
 - 10. Joint Taper in 10 ft. (3 m): **1/4 inch (6 mm)**.
 - 11. Maximum Jog in Alignment of Matching Faces: **1/4 inch (6 mm)**.
 - 12. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: **1/4 inch (6 mm)**.
 - 13. Opening Height between Spandrels: Plus or minus **1/4 inch (6 mm)**.

3.4 REPAIR

- A. Repair architectural precast concrete units as directed by the Owner. The Owner reserves the right to reject repaired units that do not comply with requirements.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of **20 ft. (6 m)**.
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint in accordance with ASTM A780/A780M.

- D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- E. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: **[the Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
 - 1. Erection of loadbearing precast concrete members.
 - 2. Visually inspect field welds and test in accordance with ASTM E165/E165M or to ASTM E709 and ASTM E1444/E1444M.
 - 3. High-strength bolted connections are subject to inspections.
- C. Prepare test and inspection reports.
- D. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, to be performed to determine compliance of replaced or additional work with specified requirements.

3.6 CLEANING

- A. Clean surfaces of precast concrete units exposed to view.
- B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
- C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, in accordance with precast concrete fabricator's recommendations. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

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SECTION 04 72 00 00A - CAST STONE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall panels[**with engraved inscriptions**].
2. Trim units.
3. Decorative elements.
4. Mortar materials.
5. Accessories.

B. Related Requirements:

1. Section 034500 "Precast Architectural Concrete."

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For cast stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Sustainable Design Submittals:

1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
2. Environmental Product Declaration (EPD): For each product.
3. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
4. Environmental Product Declaration: For each product.
5. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
6. Environmental Product Declaration: For each product.
7. Environmental Product Declaration: For each product.
8. Third-Party Certifications: For each product.
9. Third-Party Certified Life Cycle Assessment: For each product.

C. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

1. Include building elevations showing layout of units and locations of joints and anchors.

D. Samples for Initial Selection: For colored mortar.

E. Samples for Verification:

1. For each color and texture of cast stone required, **[4 inches (100 mm) square]<Insert dimension>** in size.
2. For each trim shape required, **[4 inches (100 mm)]<Insert dimension>** in length.
3. For colored mortar, make Samples using same sand and mortar ingredients to be used on Project. **[Label Samples to indicate types and amounts of pigments used.]**

F. Full-Size Samples: For each **[color][texture][engraving][and][shape]** of cast stone unit required.

1. Make available for Architect's review at Project site **[or at manufacturing plant, if acceptable to Architect]**.
2. Make Samples from materials to be used for units used on Project **[immediately before beginning production of units for Project]**.
3. Approved Samples may be installed in the Work.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For **[manufacturer][and][testing agency]**.

1. Include copies of material test reports, indicating compliance of cast stone with ASTM C1364.

B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C1364.

1. Provide test reports based on testing within previous six months.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by **[CSI][or][APA][or][PCI for Group A, Category AT]**.

B. Furnish cast stone for installation in mockups specified in **[Section 042000 "Unit Masonry."][Section 042613 "Masonry Veneer."]**

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects **[and to set quality standards for materials and execution]**.

1. Build mockup for **<Insert description>** installation **[including accessories]**.
 - a. Size: **<Insert dimension>****[As indicated on Drawings]**.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of cast stone **[with unit masonry work]** to avoid delaying the Work **[and to minimize the need for on-site storage]**.

- B. Pack, handle, and ship cast stone units in suitable packs or pallets.
 - 1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units if required, using dollies with wood supports.
 - 2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.6 PROJECT CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is **40 deg F (4 deg C)** and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements in TMS 602.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Source Limitations for Cast Stone: Obtain cast stone units from single source from single manufacturer.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

2.2 CAST STONE MATERIALS

- A. General: Comply with ASTM C1364.
- B. Portland Cement: ASTM C150/C150M, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C114. Provide natural color or white cement as required to produce cast stone color indicated.
- C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C33/C33M; gradation and colors as needed to produce required cast stone textures and colors.
- D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C33/C33M, gradation and colors as needed to produce required cast stone textures and colors.
- E. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, [**free of carbon black,**] nonfading, and resistant to lime and other alkalis.

- F. Admixtures: Use only admixtures specified or approved in writing by Architect.
1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
 2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
 3. Air-Entraining Admixture: ASTM C260/C260M. **[Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.]**
 4. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 5. Water-Reducing, Retarding Admixture: ASTM C494/C494M, Type D.
 6. Water-Reducing, Accelerating Admixture: ASTM C494/C494M, Type E.
- G. Reinforcement:
1. Deformed steel bars complying with ASTM A615/A615M, **Grade 40 (Grade 280)**. Use galvanized or epoxy-coated reinforcement when covered with less than **1-1/2 inches (38 mm)** of cast stone material.
 - a. Epoxy Coating: ASTM A775/A775M.
 - b. Galvanized Coating: ASTM A767/A767M.
 2. Plain-Steel, Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.
 3. Galvanized-Steel, Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from galvanized-steel wire into flat sheets.
 4. Fiber Reinforcement: ASTM C1116/C1116M.
- H. Embedded Anchors and Other Inserts: Fabricated from **[stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666, Type 304][stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666, Type 316][steel complying with ASTM A36/A36M and hot-dip galvanized to comply with ASTM A123/A123M]**.

2.3 CAST STONE UNITS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **<Insert manufacturer's name>**
- B. Regional Materials: Cast stone units shall be manufactured within **500 miles (800 km)** of Project site from aggregates **[and cement]** that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- C. Regional Materials: Cast stone units shall be manufactured within **500 miles (800 km)** of Project site.
- D. Regional Materials: Cast stone units shall be manufactured within **100 miles (160 km)** of Project site from aggregates **[and cement]** that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- E. Indigenous Materials: Cast stone units shall be manufactured within **500 miles (800 km)** of Project site from aggregates **[and cement]** that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the

distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.

- F. Regional Materials: Cast stone units shall be manufactured within **500 miles (800 km)** of Project site from aggregates[**and cement**] that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- G. Cast Stone Units: Comply with ASTM C1364.
1. Units are manufactured using the [manufacturer's selected][vibrant dry tamp][wet-cast][machine-made] method.
 2. Wall Panels: [Sizes as indicated on Drawings]<Insert dimension(s)>.
 - a. Engravings: As indicated on Drawings.
 3. Trim units including [window sills][lintels][surrounds][mullions][copings][cornices][wall caps][belt courses][water tables][quoins][keystones][items as indicated on Drawings].
 4. Decorative elements including [pilasters][column covers][medallions][balustrades][steps][steps and risers][bollards][benches][curbing][fountains][items as indicated on Drawings].
- H. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
 2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
 3. Provide drips on projecting elements unless otherwise indicated.
- I. Fabrication Tolerances:
1. Variation in Cross Section: Do not vary from indicated dimensions by more than **1/8 inch (3 mm)**.
 2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or **1/8 inch (3 mm)**, whichever is greater, but in no case by more than **1/4 inch (6 mm)**.
 3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or **1/8 inch (3 mm)**, whichever is greater.
 4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than **1/8 inch (3 mm)** on formed surfaces of units and **3/8 inch (10 mm)** on unformed surfaces.
- J. Cure Units as Follows:
1. Cure units in enclosed, moist curing room at 95 percent relative humidity and temperature of **100 deg F (38 deg C)** for 12 hours or **70 deg F (21 deg C)** for 16 hours.
 2. Keep units damp and continue curing to comply with one of the following:
 - a. No fewer than five days at mean daily temperature of **70 deg F (21 deg C)** or above.
 - b. No fewer than seven days at mean daily temperature of **50 deg F (10 deg C)** or above.
- K. Acid etch units after curing to remove cement film from surfaces to be exposed to view.
- L. Colors and Textures: [Match Architect's samples][Match existing units][As selected by Architect from manufacturer's full range]<Insert description>.

2.4 MORTAR MATERIALS

- A. Provide mortar materials that comply with **[Section 042000 "Unit Masonry."][Section 042613 "Masonry Veneer."]**
 - B. Regional Materials: Aggregate for mortar and grout[, **cement, and lime**] shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
 - C. Regional Materials: Aggregate for mortar and grout[, **cement, and lime**] shall be manufactured within **500 miles (800 km)** of Project site.
 - D. Regional Materials: Aggregate for mortar and grout[, **cement, and lime**] shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
 - E. Indigenous Materials: Aggregate for mortar and grout[, **cement, and lime**] shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 - F. Regional Materials: Aggregate for mortar and grout[, **cement, and lime**] shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 - G. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 - H. Hydrated Lime: ASTM C207, Type S.
 - I. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
 - J. Masonry Cement: ASTM C91/C91M.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
- a. **[Argos USA LLC]**
 - b. **[Cemex S.A.B. de C.V.]**
 - c. **[Fairborn Cement Company]**
 - d. **[Federal White Cement, Ltd.]**
 - e. **[Heidelberg Materials]**
 - f. **[Holcim (US) Inc]**
 - g. **[Lafarge North America Inc.]**
 - h. **[Lehigh White Cement Company]**
 - i. **[Quikrete; The QUIKRETE Companies, LLC]**
 - j. **[Sakrete; CRH Americas, Oldcastle APG]**
 - k. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Argos USA LLC]**
 - b. **[Cemex S.A.B. de C.V.]**
 - c. **[Fairborn Cement Company]**
 - d. **[Federal White Cement, Ltd.]**
 - e. **[Heidelberg Materials]**
 - f. **[Holcim (US) Inc]**
 - g. **[Lafarge North America Inc.]**
 - h. **[Lehigh White Cement Company]**
 - i. **[Quikrete; The QUIKRETE Companies, LLC]**
 - j. **[Sakrete; CRH Americas, Oldcastle APG]**
 - k. **<Insert manufacturer's name>**
- K. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Davis Colors]**
 - b. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - c. **[Lanxess Corporation]**
 - d. **[Solomon Colors Inc.]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Davis Colors]**
 - b. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - c. **[Lanxess Corporation]**
 - d. **[Solomon Colors Inc.]**
 - e. **<Insert manufacturer's name>**
- L. Colored Cement Products: Packaged blend made from **[portland cement and hydrated lime][masonry cement][or][mortar cement]** and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 1. Colored Portland Cement-Lime Mix:
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - 1) **[Argos USA LLC]**
 - 2) **[Heidelberg Materials]**
 - 3) **[Holcim (US) Inc]**
 - 4) **<Insert manufacturer's name>**

- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- 1) [Argos USA LLC]
- 2) [Heidelberg Materials]
- 3) [Holcim (US) Inc]
- 4) **<Insert manufacturer's name>**

2. Colored Masonry Cement:

- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- 1) [Argos USA LLC]
- 2) [Cemex S.A.B. de C.V.]
- 3) [Fairborn Cement Company]
- 4) [Heidelberg Materials]
- 5) [Holcim (US) Inc]
- 6) [Lafarge North America Inc.]
- 7) **<Insert manufacturer's name>**

- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- 1) [Argos USA LLC]
- 2) [Cemex S.A.B. de C.V.]
- 3) [Fairborn Cement Company]
- 4) [Heidelberg Materials]
- 5) [Holcim (US) Inc]
- 6) [Lafarge North America Inc.]
- 7) **<Insert manufacturer's name>**

3. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
4. Pigments do not exceed 10 percent of portland cement by weight.
5. Pigments do not exceed 5 percent of **[masonry cement][or][mortar cement]** by weight.

- M. Preblended Dry Mortar Mix: Packaged blend made from **[portland cement and hydrated lime][masonry cement][or][mortar cement]**, sand, **[mortar pigments,][water repellents,]** and admixtures and complying with ASTM C1714/C1714M.

1. Preblended Dry Portland Cement Mortar Mix:

- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- 1) [Amerimix is a trademark of Bonsal American, an Oldcastle company]
- 2) [Quikrete; The QUIKRETE Companies, LLC]
- 3) [Sakrete; CRH Americas, Oldcastle APG]

- 4) **[SPEC MIX, LLC]**
 - 5) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[Amerimix is a trademark of Bonsal American, an Oldcastle company]**
 - 2) **[Quikrete; The QUIKRETE Companies, LLC]**
 - 3) **[Sakrete; CRH Americas, Oldcastle APG]**
 - 4) **[SPEC MIX, LLC]**
 - 5) **<Insert manufacturer's name>**
 2. Preblended Dry Masonry Cement Mortar Mix:
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - 1) **[Amerimix is a trademark of Bonsal American, an Oldcastle company]**
 - 2) **[SPEC MIX, LLC]**
 - 3) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[Amerimix is a trademark of Bonsal American, an Oldcastle company]**
 - 2) **[SPEC MIX, LLC]**
 - 3) **<Insert manufacturer's name>**
 - N. Aggregate for Mortar: ASTM C144.
 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 2. For joints less than **1/4 inch (6 mm)** thick, use aggregate graded with 100 percent passing the **No. 16 (1.18-mm)** sieve.
 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 4. Colored Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
 - O. Water: Potable.
- 2.5 ACCESSORIES
- A. Anchors: Type and size indicated, fabricated from **[Type 304 stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666][Type 316 stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666][steel complying with ASTM A36/A36M and hot-dip galvanized to comply with ASTM A123/A123M]**.
 - B. Dowels: **1/2-inch- (12-mm-)** diameter round bars, fabricated from **[Type 304 stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666][Type 316 stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666][steel complying with ASTM A36/A36M and hot-dip galvanized to comply with ASTM A123/A123M]**.

- C. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cast stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Diedrich Technologies, Inc.; a Hohmann & Barnard company]**
 - b. **[EaCo Chem, Inc.]**
 - c. **[PROSOCO, Inc]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Diedrich Technologies, Inc.; a Hohmann & Barnard company]**
 - b. **[EaCo Chem, Inc.]**
 - c. **[PROSOCO, Inc]**
 - d. **<Insert manufacturer's name>**

2.6 MORTAR MIXES

- A. Comply with requirements in **[Section 042000 "Unit Masonry"]****[Section 042613 "Masonry Veneer"]** for mortar mixes.
- B. Do not use admixtures including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
 2. Use **[portland cement-lime][masonry cement][or][mortar cement]** mortar unless otherwise indicated.
- C. Comply with ASTM C270, Proportion Specification.
 1. For setting mortar, use **[Type S][Type N]**.
 2. For pointing mortar, use **[Type N][Type O]**.
- D. Preblended dry mortar mix complying with ASTM C1714/C1714M and capable of producing mortar strength as indicated in ASTM C270.
 1. For setting mortar, use **[Type S][Type N]**.
 2. For pointing mortar, use **[Type N][Type O]**.
- E. Pigmented Mortar: Use colored cement product **[or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products]**.
 1. Pigments do not exceed 10 percent of portland cement by weight.
 2. Pigments do not exceed 5 percent of **[masonry cement][or][mortar cement]** by weight.
 3. Mix to match Architect's sample.

4. Application: Use pigmented mortar for exposed mortar joints.
- F. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 1. Mix to match Architect's sample.
 2. Application: Use colored-aggregate mortar for exposed mortar joints.

2.7 SOURCE QUALITY CONTROL

- A. Engage a qualified independent testing agency to sample and test cast stone units according to ASTM C1364.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SETTING CAST STONE IN MORTAR

- A. Set cast stone as indicated in TMS 604.
- B. Install cast stone units to comply with requirements in **[Section 042000 "Unit Masonry."][Section 042613 "Masonry Veneer."]**
- C. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.
 1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
 2. Coordinate installation of cast stone with installation of flashing specified in other Sections.
- D. Wet joint surfaces thoroughly before applying mortar or setting in mortar.
- E. Set units in full bed of mortar with full head joints unless otherwise indicated.
 1. Set units with joints **[1/4 to 3/8 inch (6 to 10 mm)][3/8 to 1/2 inch (10 to 13 mm)]<Insert dimension>** wide unless otherwise indicated.
 2. Build anchors and ties into mortar joints as units are set.
 3. Fill dowel holes and anchor slots with mortar.
 4. Fill collar joints solid as units are set.
 5. Build concealed flashing into mortar joints as units are set.
 6. Keep head joints in copings and between other units with exposed horizontal surfaces open to receive sealant.
 7. Keep joints at shelf angles open to receive sealant.
- F. Rake out joints for pointing with mortar to depths of not less than **3/4 inch (19 mm)**. Rake joints to

uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

- G. Point mortar joints by placing and compacting mortar in layers not greater than **3/8 inch (10 mm)**. Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
- H. Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness.
- I. Rake out joints for pointing with sealant to depths of not less than **3/4 inch (19 mm)**. Scrub faces of units to remove excess mortar as joints are raked.
- J. Point joints with sealant to comply with applicable requirements in Section 079200 "Joint Sealants."
 - 1. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
- K. Provide sealant joints at head joints of copings and other horizontal surfaces; at expansion, control, and pressure-relieving joints; and at locations indicated.
 - 1. Keep joints free of mortar and other rigid materials.
 - 2. Build in compressible foam-plastic joint fillers where indicated.
 - 3. Form joint of width indicated, but not less than **[3/8 inch (10 mm)][1/2 inch (13 mm)]<Insert dimension>**.
 - 4. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
 - 5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.3 SETTING ANCHORED CAST STONE WITH SEALANT-FILLED JOINTS

- A. Set cast stone as indicated in TMS 604.
- B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.
 - 1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
 - 2. Shim and adjust anchors, supports, and accessories to set cast stone in locations indicated with uniform joints.
- C. Keep cavities open where unfilled space is indicated between back of cast stone units and backup wall; do not fill cavities with mortar or grout.
- D. Fill anchor holes with sealant.
 - 1. Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.
- E. Set cast stone supported on clip or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths. Hold shims back from face of cast stone a distance at least equal to width of joint.

- F. Keep joints free of mortar and other rigid materials. Remove temporary shims and spacers from joints after anchors and supports are secured in place and cast stone units are anchored. Do not begin sealant installation until temporary shims and spacers are removed.
 - 1. Form open joint of width indicated, but not less than **[3/8 inch (10 mm)][1/2 inch (13 mm)]<Insert dimension>**.
- G. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
- H. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

3.4 INSTALLATION TOLERANCES

- A. Variation from Plumb: Do not exceed **[1/4 inch in 10 ft. (6 mm in 3 m)][1/8 inch in 10 ft. (3 mm in 3 m)], [3/8 inch in 20 ft. (10 mm in 6 m)][1/4 inch in 20 ft. (6 mm in 6 m)], or 1/2 inch (12 mm) maximum.**
- B. Variation from Level: Do not exceed **[1/4 inch in 10 ft. (6 mm in 3 m)][1/8 inch in 10 ft. (3 mm in 3 m)], [3/8 inch in 20 ft. (10 mm in 6 m)][1/4 inch in 20 ft. (6 mm in 6 m)], or 1/2 inch (12 mm) maximum.**
- C. Variation in Joint Width: Do not vary joint thickness more than **1/8 inch in 36 inches (3 mm in 900 mm)** or one-fourth of nominal joint width, whichever is less.
- D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than **1/16 inch (1.5 mm)**, except where variation is due to warpage of units within tolerances specified.

3.5 ADJUSTING AND CLEANING

- A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.
- B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean cast stone as work progresses.
 - 1. Remove mortar fins and smears before tooling joints.
 - 2. Remove excess sealant immediately, including spills, smears, and spatter.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
 - 3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
 - 5. Clean cast stone by methods described in Cast Stone Institute Technical Bulletin #39.

-
6. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 04 72 00 00A



Task	Specification	Specification Description
04 72 00 00	03 41 00 00	Precast Structural Concrete
04 72 00 00	04 20 00 00	Unit Masonry



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SECTION 05 01 70 51 - DECORATIVE METAL CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes decorative metal cleaning as follows:

1. Cleaning metal.
2. Removing paint
3. Removing corrosion.
4. Priming for repainting.

B. Related Requirements:

1. Section 013516 "Alteration Project Procedures" for general remodeling, renovation, repair, and maintenance requirements.

1.2 ALLOWANCES

A. Allowances for decorative metal cleaning are specified in Section 012100 "Allowances."

1. Perform decorative metal cleaning under quantity allowances and only as authorized. Authorized work includes **[work required by Drawings and Specifications and][only]** work as directed in writing by Architect.
2. Notify Architect **[weekly]<Insert time interval>** of extent of work performed that is attributable to quantity allowances.
3. Perform work that exceeds quantity allowances only as authorized by Change Orders.

B. Preconstruction testing is part of testing and inspecting allowance.

C. Cleaning and removing paint from **<Insert item description>** is part of **<Insert name of allowance>**.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices specified in Section 012200 "Unit Prices."

1. Unit prices apply to authorized work covered by **[quantity allowances][estimated quantities]**.
2. Unit prices apply to authorized additions to and deletions from the Work as authorized by Change Orders.

1.4 DEFINITIONS

A. Low-Pressure Spray: **[100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s)]<Insert range of values>**.

B. Medium-Pressure Spray: **[400 to 800 psi (2750 to 5510 kPa); 4 to 6 gpm (0.25 to 0.4 L/s)]<Insert range of values>**.

- C. High-Pressure Spray: [800 to 1200 psi (5510 to 8250 kPa); 4 to 6 gpm (0.25 to 0.4 L/s)]<Insert range of values>.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at [Project site]<Insert location>.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include recommendations for product application and use.
 - 2. Include test data substantiating that products comply with requirements.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For decorative metal refinishing specialist.
- B. Preconstruction Test Reports: For [chemical cleaning of][and][paint removal from] decorative metal.

1.8 QUALITY ASSURANCE

- A. Decorative Metal Cleaning Specialist Qualifications: A qualified decorative metal cleaning specialist. Cleaning specialist shall be experienced in using mechanical and chemical methods on the types of metal surfaces indicated.
 - 1. Single Specialist: Subject to compliance with requirements, engage the same specialist firm to perform the work of [Section 050170.61 "Decorative Metal Repair"] [Section 050170.63 "Decorative Metal Refinishing"] and the work of this Section.
- B. Mockups: Prepare mockups of decorative metal cleaning processes[on existing surfaces] to demonstrate aesthetic effects and to set quality standards for materials and execution. Prepare mockups so they are inconspicuous.
 - 1. Cleaning: Prepare an area [approximately 2 sq. ft. (0.2 sq. m)][as indicated on Drawings]<Insert dimension> for each process on each type of metal indicated for treatment.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency or one or more [chemical-cleaner][and][paint-remover] manufacturers to perform preconstruction testing on each type of metal.
 - 1. Use test areas as indicated and representative of proposed materials and existing construction.
 - 2. Propose changes to materials and methods to suit Project.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with decorative metal cleaning only when existing and forecasted weather conditions are within the environmental limits set by each manufacturer's written instructions and specified requirements.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

- A. Water: Potable.
- B. Hot Water: Water heated to a temperature of **140 to 160 deg F (60 to 71 deg C)**.
- C. Detergent Solution, Job Mixed: Solution prepared by mixing **2 cups (0.5 L)** of tetrasodium pyrophosphate (TSPP), **1/2 cup (125 mL)** of laundry detergent, and **20 quarts (20 L)** of hot water for every **5 gal. (20 L)** of solution required.
- D. Nonacidic Liquid Chemical Cleaner: Manufacturer's standard mildly alkaline liquid cleaner, formulated for removing organic soiling from ordinary building materials, including polished stone, brick, copper, brass, bronze, aluminum, stainless steel, plastics, wood, and glass.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
- a. **[American Building Restoration Products, Inc.]**
 - b. **[Cathedral Stone Products, Inc.]**
 - c. **[Dumond Chemicals, Inc]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[American Building Restoration Products, Inc.]**
 - b. **[Cathedral Stone Products, Inc.]**
 - c. **[Dumond Chemicals, Inc]**
 - d. **<Insert manufacturer's name>**
- E. Abrasive Materials:
- 1. Abrasive Pads for Copper-Alloy Cleaning: Extra-fine bronze wool or plastic abrasive pads.
 - 2. Blasting Abrasive: **[Pulverized walnut shells][Powdered aluminum silicate]<Insert material>**.
 - 3. Abrasives for Ferrous Metal Cleaning: Aluminum oxide paper, emery paper, fine steel wool, steel scrapers, and steel-wire brushes of various sizes.
- F. Rust Remover: Manufacturer's standard phosphoric acid-based gel formulation, also called "naval jelly," for removing corrosion from iron and steel.

2.2 PAINT REMOVERS

- A. Alkaline-Paste Paint Remover: Manufacturer's standard alkaline paste or gel formulation for removing paint from metals, and containing no methylene chloride.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[American Building Restoration Products, Inc.]**
 - b. **[Diedrich Technologies, Inc.; a Hohmann & Barnard company]**
 - c. **[EaCo Chem, Inc.]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[American Building Restoration Products, Inc.]**
 - b. **[Diedrich Technologies, Inc.; a Hohmann & Barnard company]**
 - c. **[EaCo Chem, Inc.]**
 - d. **<Insert manufacturer's name>**
- B. Covered or Skin-Forming Alkaline Paint Remover: Manufacturer's standard covered or skin-forming alkaline paste or gel formulation for removing paint from metal, and containing no methylene chloride.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[American Building Restoration Products, Inc.]**
 - b. **[Dumond Chemicals, Inc.]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[American Building Restoration Products, Inc.]**
 - b. **[Dumond Chemicals, Inc.]**
 - c. **<Insert manufacturer's name>**
- C. Solvent-Type-Paste Paint Remover: Manufacturer's standard water-rinsable, solvent-type paste or gel formulation for removing paint from metals.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Diedrich Technologies, Inc.; a Hohmann & Barnard company]**
 - b. **[Shore Corporation]**
 - c. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Diedrich Technologies, Inc.; a Hohmann & Barnard company]**
 - b. **[Shore Corporation]**
 - c. **<Insert manufacturer's name>**
- D. Low-Odor, Solvent-Type-Paste Paint Remover: Manufacturer's standard low-odor, water-rinsable solvent-type paste, gel, or foamed emulsion formulation for removing paint from metals; and containing no methanol or methylene chloride.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[American Building Restoration Products, Inc.]**
 - b. **[Cathedral Stone Products, Inc.]**
 - c. **[Diedrich Technologies, Inc.; a Hohmann & Barnard company]**
 - d. **[Dumond Chemicals, Inc.]**
 - e. **[EaCo Chem, Inc.]**
 - f. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[American Building Restoration Products, Inc.]**
 - b. **[Cathedral Stone Products, Inc.]**
 - c. **[Diedrich Technologies, Inc.; a Hohmann & Barnard company]**
 - d. **[Dumond Chemicals, Inc.]**
 - e. **[EaCo Chem, Inc.]**
 - f. **<Insert manufacturer's name>**
- E. Covered, Solvent-Type-Paste Paint Remover: Manufacturer's standard, low-odor, covered, water-rinsable, solvent-type paste or gel formulation for removing paint from masonry; and containing no methanol or methylene chloride.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Dumond Chemicals, Inc.]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Dumond Chemicals, Inc.]**
 - b. **<Insert manufacturer's name>**

2.3 MISCELLANEOUS MATERIALS

- A. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, glazed masonry, and polished stone surfaces from damaging effects of acidic and alkaline cleaners.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[American Building Restoration Products, Inc.]**
 - b. **[Price Research, Ltd. dba Charles Paint Research]**
 - c. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[American Building Restoration Products, Inc.]**
 - b. **[Price Research, Ltd. dba Charles Paint Research]**
 - c. **<Insert manufacturer's name>**
- B. Masking Tape: Nonstaining, nonabsorbent material; compatible with chemical solutions being used and substrate surfaces; and that will easily come off entirely, including adhesive.
- C. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:
 - 1. Previous effectiveness in performing the work involved.
 - 2. Little possibility of damaging exposed surfaces.
 - 3. Consistency of each application.
 - 4. Uniformity of the resulting overall appearance.
 - 5. Do not use products or tools that could do the following:
 - a. Remove, alter, or in any way harm the present or future condition of existing surfaces, including surrounding surfaces not in the Contract.
 - b. Leave an unintended residue on surfaces.

2.4 FERROUS METAL PRIMERS

- A. Repair Primer: Manufacturer's standard, rust-inhibiting, fast-curing, lead- and chromate-free, universal primer, compatible with **[firmly adhered existing paint and]** applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry-film thickness.
- B. Finish Primer: Primer complying with applicable requirements in **[Section 090190.52 "Maintenance Repainting"]<Insert Section number and title>** for finish painting of primed metal.

PART 3 - EXECUTION

3.1 DECORATIVE METAL CLEANING SPECIALIST

- A. Decorative Metal Cleaning Specialist Firms: Subject to compliance with requirements, **[provide decorative metal cleaning by one of the following][firms that may provide decorative metal cleaning include, but are not limited to, the following]**:
1. **<Insert, in separate subparagraphs, names of decorative metal cleaning specialist firms>.**

3.2 PROTECTION

- A. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
1. Cover adjacent surfaces with materials that are proven to resist chemical solutions being used unless products being used will not damage adjacent surfaces. Use protective materials that are waterproof and UV resistant. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
 2. Do not apply chemical solutions during winds of sufficient force to spread them to unprotected surfaces.
 3. Neutralize alkaline and acid wastes before disposal.
 4. Dispose of runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

3.3 DECORATIVE METAL CLEANING, GENERAL

- A. Execution of the Work: In cleaning items, disturb them as minimally as possible and as follows:
1. Remove deteriorated coatings and corrosion.
 2. Sequence work to minimize time before protective coatings are reapplied.
 3. Clean items in place unless otherwise indicated.
- B. Mechanical Coating Removal: Use gentle methods, such as scraping and wire brushing, that will not abrade metal substrate.
- C. Repaint: Where indicated, prepare painted decorative metal by **[cleaning surface, removing less than firmly adhered existing paint, sanding edges smooth,][removing existing paint]** and priming for painting as specified.

3.4 CLEANING

- A. General: Use those methods indicated for each type of decorative metal and its location.
1. Brushes: If using wire brushes, use brushes of same base metal composition as metal being treated. Use brushes that are resistant to chemicals being used.
 2. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that spray

methods do not damage surfaces.

- a. Equip units with pressure gages.
 - b. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with nozzle having a cone-shaped spray.
 - c. For water-spray application, use fan-shaped spray that disperses water at an angle of 25 to 50 degrees.
 - d. For high-pressure water-spray application, use fan-shaped spray that disperses water at an angle of at least 40 degrees.
 - e. For heated water-spray application, use equipment capable of maintaining temperature between **140 and 160 deg F (60 and 71 deg C)** at flow rates indicated.
3. Uniformity: Perform each cleaning method in a manner that results in uniform coverage of all surfaces, including corners, contours, and interstices, and that produces an even effect without streaks or damaging surfaces.
 4. Protection: After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.
- B. Water Cleaning: Clean with **[cold][hot]** water applied by **[low][medium][high]**-pressure spray. Supplement with **[natural-fiber][or][plastic]**-bristle brush. Use small brushes to remove soil from joints and crevices.
- C. Detergent Cleaning:
1. Wet surface with **[cold][hot]** water applied by low-pressure spray.
 2. Scrub surface with detergent solution and **[natural-fiber][or][plastic]**-bristle brush until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet.
 3. Rinse with **[cold][hot]** water applied by **[low][medium][high]**-pressure spray to remove detergent solution and soil.
 4. Repeat cleaning procedure where needed to produce cleaning effect established by mockup.
- D. Nonacidic Liquid Chemical Cleaning: Apply chemical cleaner to surfaces according to chemical-cleaner manufacturer's written instructions.
1. Wet surface with **[cold][hot]** water applied by low-pressure spray.
 2. Apply cleaner to surface **[in two applications]** by brush **[or low-pressure spray]**.
 3. Let cleaner remain on surface for period **[recommended in writing by chemical-cleaner manufacturer][established by mockup][of two to three minutes]<Insert requirement>**.
 4. Nonferrous Metals: Rinse with **[cold][hot]** water applied by **[low][medium][high]**-pressure spray to remove chemicals and soil.
 5. Ferrous Metals: Do not rinse ferrous metals with water; neutralize chemical cleaner on ferrous metals as recommended in writing by manufacturer. Dry immediately with clean soft cloths. Follow direction of grain in metal.
 6. Repeat cleaning procedure where needed to produce cleaning effect established by mockup. Do not repeat more than once.
- E. Cleaning with Abrasive Pads: Clean surfaces to remove dirt[, **leaving uniform patina intact,**] by light rubbing with abrasive pads and water. **[Rinse with cold water to remove residue. Apply rinse by low-pressure spray][Do not rinse ferrous metals with water; wipe with damp cloths to remove residue]<Insert requirement>**.
- F. Cleaning by Abrasive Blasting: Clean surfaces to remove dirt[, **leaving uniform patina intact,**] by dry blasting with specified blasting abrasive at pressure and distance from surface indicated below. **[Rinse**

with cold-water, low-pressure spray to remove residue][Do not rinse ferrous metals with water; wipe with damp cloths to remove residue]<Insert requirement>.

1. Pressure and Distance from Surface: Maximum pressure of **[60 psi (415 kPa)][100 psi (690 kPa)][200 psi (1375 kPa)]<Insert value>** with specified blasting abrasive propelled from a distance of **[6 to 12 inches (152 to 305 mm)][12 to 18 inches (305 to 457 mm)]<Insert dimension>** from surface.
2. Pressure and distance from surface as established by mockup.

G. Chemical Rust Removal:

1. Remove loose rust scale with approved abrasives for ferrous metal cleaning.
2. Apply rust remover with brushes or as recommended in writing by manufacturer.
3. Allow rust remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing. Do not allow extended dwell time.
4. Wipe off residue with mineral spirits and either steel wool or soft rags, or clean with method recommended in writing by manufacturer to remove residue.
5. Dry immediately with clean, soft cloths. Follow direction of grain in metal.
6. Prime immediately to prevent rust. Do not touch cleaned metal surface until primed.

H. Mechanical Rust Removal:

1. Remove rust with approved abrasives for ferrous metal cleaning.
2. Wipe off residue with mineral spirits and either steel wool or soft rags.
3. Dry immediately with clean, soft cloths. Follow direction of grain in metal.
4. Prime immediately to prevent rust. Do not touch cleaned metal surface until primed.

3.5 PAINT REMOVAL

A. General: Use only those paint-removal methods indicated for each type of decorative metal.

1. Application: Apply paint removers according to paint-remover manufacturer's written instructions. Do not allow paint removers to remain on surface for periods longer than those indicated or recommended in writing by manufacturer.
 - a. Apply materials to all surfaces, corners, contours, and interstices, to provide a uniform final appearance without streaks.
 - b. After work is complete, remove protection no longer required. Remove tape and adhesive marks.
2. Brushes: If using wire brushes, use brushes of same base metal composition as metal being treated. Use brushes that are resistant to chemicals being used.
3. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that spray methods do not damage surfaces.
 - a. Equip units with pressure gages.
 - b. Unless otherwise indicated, hold spray nozzle at least **6 inches (152 mm)** from surface and apply material in horizontal, back-and-forth sweeping motion, overlapping previous strokes to produce uniform coverage.
 - c. For chemical spray application, use low-pressure tank or chemical pump suitable for chemical indicated, equipped with cone-shaped spray.
 - d. For water-spray application, use fan-shaped spray that disperses water at an angle of 25 to 50 degrees.
 - e. For high-pressure water-spray application, use fan-shaped spray tip that disperses water at

an angle of at least 40 degrees.

- f. For heated water-spray application, use equipment capable of maintaining temperature between **140 and 160 deg F (60 and 71 deg C)** at flow rates indicated.

B. Paint Removal with Alkaline-Paste Paint Remover:

1. Remove loose and peeling paint using water, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply paint remover to dry, painted metal with brushes.
3. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
4. Rinse with **[cold][hot]** water applied by **[low][medium][high]**-pressure spray to remove chemicals and paint residue.
5. Use mechanical methods recommended in writing by manufacturer to remove chemicals and paint residue.
6. Repeat process if necessary to remove all paint.

C. Paint Removal with Covered or Skin-Forming Alkaline Paint Remover:

1. Remove loose and peeling paint using water, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply paint remover to dry, painted metal with brushes or as recommended in writing by manufacturer.
3. Apply cover according to manufacturer's written instructions.
4. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
5. Scrape off paint and remover.
6. Rinse with **[cold][hot]** water applied by **[low][medium][high]**-pressure spray to remove chemicals and paint residue.
7. Use mechanical methods recommended in writing by manufacturer to remove chemicals and paint residue.
8. For spots of remaining paint, apply alkaline-paste paint remover according to "Paint Removal with Alkaline-Paste Paint Remover" Paragraph above.

D. Paint Removal with Solvent-Type-Paste Paint Remover:

1. Remove loose and peeling paint using water, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply thick coating of paint remover to painted decorative metal with natural-fiber cleaning brush, deep-nap roller, or large paint brush. Apply in one or two coats according to manufacturer's written instructions.
3. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
4. Rinse with **[cold][hot]** water applied by **[low][medium][high]**-pressure spray to remove chemicals and paint residue.
5. Use mechanical methods recommended in writing by manufacturer to remove chemicals and paint residue.
6. Repeat process if necessary to remove all paint.

E. Paint Removal with Covered, Solvent-Type-Paste Paint Remover:

1. Remove loose and peeling paint using water, scrapers, stiff brushes, or a combination of these. Let surface dry thoroughly.
2. Apply paint remover to dry, painted decorative metal with natural-fiber cleaning brush, deep-nap roller, or large paint brush or as recommended in writing by manufacturer.

3. Apply cover according to manufacturer's written instructions.
4. Allow paint remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing.
5. Scrape off paint and remover.
6. Rinse with **[cold][hot]** water applied by **[low][medium][high]**-pressure spray to remove chemicals and paint residue.
7. Use mechanical methods recommended in writing by manufacturer to remove remaining chemicals and paint residue.

3.6 PRIMING

- A. Repair Primer: Apply immediately after completing a repair.
- B. Finish Primer: Apply as soon after cleaning as possible.

3.7 DECORATIVE METAL CLEANING SCHEDULE

- A. Treatment for Decorative Railing **[DMR-1]<Insert drawing designation>**: Wrought-iron railing and gate.
 1. General: Perform work **[in the shop][or][in the field]**.
 2. Paint Removal: **[Alkaline-paste paint remover][Covered or skin-forming alkaline paint remover][Solvent-type-paste paint remover][Low-odor, solvent-type-paste paint remover][Covered, solvent-type paint remover]<Insert method>**.
 3. Repairs: As specified in Section 050170.61 "Decorative Metal Repair."
 4. Painted Finish: As specified in **[Section 090190.52 "Maintenance Repainting."]<Insert Section number and title>**.
- B. Treatment of Decorative Railing **[DMR-2]<Insert drawing designation>**: Cast-iron balustrade.
 1. General: Perform work **[in the shop][or][in the field]**.
 2. Paint Removal: **[Alkaline-paste paint remover][Covered or skin-forming alkaline paint remover][Solvent-type-paste paint remover][Low-odor, solvent-type-paste paint remover][Covered, solvent-type-paste paint remover]<Insert method>**.
 3. Rust Removal: **[Chemical][Mechanical]<Insert method>**.
 4. Repair: As specified in Section 050170.61 "Decorative Metal Repair."
 5. Painted Finish: As specified in **[Section 090190.52 "Maintenance Repainting."]<Insert Section number and title>**.
- C. Treatment of Decorative Railing **[DMR-3]<Insert drawing designation>**: Bronze railing with bronze handrail.
 1. General: Perform work **[in the shop][or][in the field]**.
 2. Cleaning: **[Water cleaning][Detergent cleaning][Chemical cleaning][Abrasive blasting]<Insert description>**.
 3. Repair: As specified in Section 050170.61 "Decorative Metal Repair."
 4. Bronze Finish: **[Satin finish with statuary conversion coating on railing; satin hand-rubbed finish, lacquered, on handrail]<Insert requirement>**.
- D. Treatment for Bronze Grille **[DMG-#]<Insert drawing designation>**: Strip paint and coat grille.
 1. General: Perform work **[in the shop][or][in the field]**.
 2. Paint Removal: **[Solvent-type-paste paint remover][Low-odor, solvent-type-paste paint remover][Covered, solvent-type-paste paint remover]<Insert method>**.
 3. Protective Coating: As specified in **[Section 050170.63 "Decorative Metal Refinishing."]<Insert**



05 - Metals

Section number and title.>

END OF SECTION 05 01 70 51

SECTION 05 01 70 61 - DECORATIVE METAL REPAIR

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Decorative metal repairs as follows:
 - a. Repairing metal and replacing damaged and missing components in place.
 - b. Removing metal for shop repair and replacement of components; reinstalling repaired metal.
 - c. Painting steel uncovered during the Work.
 - d. Installing wood rails supported by or attached to decorative metal railings or brackets.

B. Related Requirements:

1. Section 013516 "Alteration Project Procedures" for general remodeling, renovation, repair, and maintenance requirements.
2. Section 057000 "Decorative Metal" for new decorative metal construction.
3. Section 057300 "Decorative Metal Railings" for new decorative handrails and railings.

1.2 ALLOWANCES

A. Allowances for decorative metal repairs are specified in Section 012100 "Allowances."

1. Perform decorative metal repairs under quantity allowances and only as authorized. Authorized work includes **[work required by Drawings and Specifications and][only]** work as directed in writing by Architect.
2. Notify Architect **[weekly]<Insert time interval>** of extent of work performed that is attributable to quantity allowances.
3. Perform work that exceeds quantity allowances only as authorized by Change Orders.

B. Repairing **<Insert item description>** is part of **<Insert name of allowance>**.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices specified in Section 012200 "Unit Prices."

1. Unit prices apply to authorized work covered by **[quantity allowances][estimated quantities]**.
2. Unit prices apply to authorized additions to and deletions from the Work as authorized by Change Orders.

1.4 DEFINITIONS

- A. Low-Pressure Spray: **[100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s)]<Insert range of values>**.

- B. Medium-Pressure Spray: [400 to 800 psi (2750 to 5510 kPa); 4 to 6 gpm (0.25 to 0.4 L/s)]<Insert range of values>.
- C. High-Pressure Spray: [800 to 1200 psi (5510 to 8250 kPa); 4 to 6 gpm (0.25 to 0.4 L/s)]<Insert range of values>.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at [Project site]<Insert location>.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include recommendations for product application and use.
 - 2. Include test data substantiating that products comply with requirements.
- B. Shop Drawings:
 - 1. Include plans, elevations, and sections showing locations and extent of repair and replacement work, with enlarged details of replacement parts indicating materials, profiles, methods of attachment, accessory items, and finishes.
 - 2. Include field-verified dimensions and the following:
 - a. Identification of each new metal item and component and its location on the structure in annotated plans and elevations.
 - b. Provisions for expansion, weep holes, and conduits as required for each location and exposure.
 - c. Provisions for sealant joints if required.
- C. Samples for Initial Selection: For the following:
 - 1. Each type of decorative metal item and component with applied finishes.
 - 2. Sealant materials.
 - 3. Accessories to verify color selection.
- D. Samples for Verification: For the following products in manufacturer's standard sizes unless otherwise indicated, finished as required for use in the Work:
 - 1. Each type of new material to be used for replacing existing or missing decorative metal; **6 inches (150 mm)** long in least dimension or whole item.
 - 2. Fittings and brackets.
 - 3. Each type of exposed connection between components. Show method of finishing components at connections.
 - 4. Each type of exposed finish prepared on metal of the same alloy to be used for the Work of this Section; **6 inches (150 mm)** long in least dimension.
 - 5. Sealant materials.
 - 6. Accessories: Each type of anchor, accessory, and miscellaneous support in required finishes.
- E. Delegated-Design Submittal: For [structural performance of repaired railings, handrails, and anchors]<Insert item>, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For decorative metal repair specialist.
- B. Evaluation Reports: For post-installed structural anchors, from ICC-ES.

1.8 QUALITY ASSURANCE

- A. Decorative Metal Repair Specialist Qualifications: A qualified decorative metal fabrication and repair specialist. Experience installing and finishing new decorative metalwork is insufficient experience for repairing decorative metal.
 - 1. Single Specialist: Subject to compliance with requirements, engage the same specialist firm to perform the work of [Section 050170.51 "Decorative Metal Cleaning"] [Section 050170.63 "Decorative Metal Refinishing"] and the work of this Section.
- B. Mockups: Prepare mockups of decorative metal repair processes[on existing surfaces] to demonstrate aesthetic effects and to set quality standards for materials and execution and for fabrication and installation. Prepare mockups so they are inconspicuous.
 - 1. Replacing Cast-Metal Components: [Two]<Insert number> cast-iron [handrail brackets][and][grilles]<Insert item description> replaced with exact duplicates.
 - 2. Replacing Cut-Out Metal Items: [Two]<Insert number> cut-out bronze-plate [wall registers]<Insert item description> replaced with exact duplicates.
 - 3. Repairing Wrought Handrail and Railing: [3 feet (1 m)]<Insert dimension> of wrought-iron handrail and railing. [Patch indentations and reconnect fractures by filling, welding, brazing, or applying new metal material]<Insert description>.
 - 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Pack, deliver, and store decorative metal items in suitable packs, heavy-duty cartons, or wooden crates; surround with sufficient packing material to ensure that products are not deformed, cracked, or otherwise damaged.
- B. Store decorative metal inside a well-ventilated area, away from uncured concrete and masonry and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.
- C. Protect strippable protective covering on decorative metal from exposure to sunlight and high humidity, except to the extent necessary for the period of decorative metal installation.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with decorative metal repairs only when existing and forecasted weather conditions are within the environmental limits set by each manufacturer's written instructions and specified requirements.

PART 2 - PRODUCTS
2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design post-installed structural anchors.
- B. Structural Performance: **[Railings][and][handrails]<Insert item>**, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform load of **50 lbf/ft. (0.73 kN/m)** applied in any direction.
 - 2. Concentrated load of **200 lbf (0.89 kN)** applied in any direction.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.

2.2 METAL MATERIALS

- A. General: Provide decorative metal materials made of the alloys, forms, and types that match existing metals and have the ability to receive finishes matching existing finishes unless otherwise indicated. Exposed-to-view surfaces exhibiting imperfections inconsistent with existing materials are unacceptable.
- B. Source Limitation for Replacement Cast Materials: Obtain castings for decorative metal repair from single source from single manufacturer with resources to provide materials of consistent quality in appearance and physical properties.
- C. Aluminum: Alloy and temper recommended in writing by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required:
 - 1. Extruded Bars and Shapes: **ASTM B221 (ASTM B221M)**, Alloy 6063-T6.
 - 2. Extruded Structural Pipe and Tubes: ASTM B429/B429M, Alloy 6063-T6.
 - 3. Drawn General-Purpose Seamless Tubes: **ASTM B210 (ASTM B210M)**, Alloy 6063-T832.
 - 4. Plate and Sheet: **ASTM B209 (ASTM B209M)**, Alloy 6061-T6.
 - 5. Die and Hand Forgings: **ASTM B247 (ASTM B247M)**, Alloy 6061-T6.
 - 6. Castings: ASTM B26/B26M, Alloy A356-T6.
- D. Copper Alloys, Bronze: Copper alloy designated below for each form required:
 - 1. Extruded Shapes: ASTM B455, Alloy UNS No. C38500 (extruded architectural bronze, 57 percent copper and 40 percent zinc).
 - 2. Plate, Sheet, Strip, and Bars: ASTM B36/B36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper and 40 percent zinc).
 - 3. Seamless Pipe: ASTM B43, Alloy UNS No. C23000 (red brass, 85 percent copper and 15 percent zinc).
 - 4. Seamless Tubes: **ASTM B135 (ASTM B135M)**, Alloy UNS No. C23000 (red brass, 85 percent copper and 15 percent zinc).
 - 5. Composition Bronze Castings: ASTM B62, Alloy UNS No. C83600 ("85-5-5-5" is the common trade name; 85 percent copper and 5 percent each of tin, lead, and zinc).
 - 6. Sand Castings: ASTM B584, Alloy UNS No. C86500 (No. 1 manganese bronze, 58 percent copper, 39 percent zinc, 1 percent manganese, and small amounts of other metals).
- E. Copper Alloys, Brass: Copper alloy designated below for each form required:

1. Extruded Shapes: ASTM B249/B249M, Alloy UNS No. C36000 (free-cutting brass, 60 percent copper, 36 percent zinc, and small amounts of other metals).
2. Plate, Sheet, Strip, and Bars: ASTM B36/B36M, Alloy UNS No. C26000 (cartridge brass, 70 percent copper and 30 percent zinc).
3. Seamless Tubes: **ASTM B135 (ASTM B135M)**, Alloy UNS No. C26000 (cartridge brass, 70 percent copper and 30 percent zinc).
4. Sand Castings: ASTM B584, Alloy UNS No. C85200 (high-copper yellow brass, 72 percent copper, 24 percent zinc, and small amounts of other metals).

F. Stainless Steel: Grade designated below for each form required:

1. Tubing: ASTM A554, **[Grade MT-304][Grade MT-316]**.
2. Pipe: ASTM A312/A312M, **[Grade TP304][Grade TP316]**.
3. Castings: ASTM A743/A743M, **[Grade CF8 or CF20][Grade CF8M]**.
4. Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, **[Type 304][Type 316]**.
5. Flat Bar: ASTM A666, **[Type 304][Type 316]**.
6. Bars and Shapes: ASTM A276, **[Type 304][Type 316]**.

G. Steel: Standard and grade designated below for each form required:

1. Tubing: Cold formed, ASTM A500/A500M.
2. Steel Plate, Shapes, and Bars: ASTM A36/A36M.
3. Steel Bars: Mild steel; ASTM A29/A29M, Grade 1010.
4. Steel Sheet: ASTM A1008/A1008M, cold-rolled commercial steel sheet; matte finish; suitable for exposed applications.

H. Cast Iron: Standard designated below for each type of casting:

1. Gray-Iron Castings: ASTM A48/A48M, Class 30.
2. Malleable-Iron Castings: ASTM A47/A47M, grade as recommended in writing by fabricator for type of use indicated.

I. Wrought Iron: **[Mild steel; ASTM A29/A29M, Grade 1010]**<Insert requirement>; hand worked or machine forged to the form indicated.

2.3 PREPARATORY CLEANING MATERIALS

- A. Water: Potable.
- B. Hot Water: Water heated to a temperature of **140 to 160 deg F (60 to 71 deg C)**.
- C. Detergent Solution, Job Mixed: Solution prepared by mixing **2 cups (0.5 L)** of tetrasodium pyrophosphate (TSPP), **1/2 cup (125 mL)** of laundry detergent, and **20 quarts (20 L)** of hot water for every **5 gal. (20 L)** of solution required.
- D. Abrasive Materials:
 1. Abrasive Pads for Copper-Alloy Cleaning: Extra-fine bronze wool or plastic abrasive pads.
 2. Blasting Abrasive: **[Pulverized walnut shells][Powdered aluminum silicate]**<Insert material>.
 3. Abrasives for Ferrous Metal Cleaning: Aluminum oxide paper, emery paper, fine steel wool, steel scrapers, and steel-wire brushes of various sizes.
- E. Rust Remover: Manufacturer's standard phosphoric acid-based gel formulation, also called "naval jelly," for removing corrosion from iron and steel.

- F. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer according to **[MPI #23 (surface-tolerant, anticorrosive metal primer)][or][SSPC-Paint 20 or SSPC-Paint 29]<Insert requirement>**.
1. Surface Preparation: Use coating requiring no better than **[SSPC-SP 2, "Hand Tool Cleaning"]****[SSPC-SP 3, "Power Tool Cleaning"]****[or][SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning"]****<Insert surface preparation standard>** surface preparation according to manufacturer's literature or certified statement.
 2. VOC Limit: Use coating with a VOC content of **[400 g/L (3.3 lb/gal.)]<Insert VOC limit>** or less.

2.4 FASTENERS

- A. Fasteners: Fasteners of the same basic metal as fastened metal unless otherwise indicated. Use metals that are noncorrosive and compatible with each metal joined.
1. Match existing fasteners in material and in type of fastener unless otherwise indicated.
 2. Use concealed fasteners for interconnecting decorative metal components and for attaching them to other work unless exposed fasteners are **[unavoidable][or][the existing fastening method]**.
 3. For exposed fasteners, use Phillips-type machine screws of head profile flush with metal surface unless otherwise indicated.
 4. Finish heads of exposed fasteners to match finish of metal fastened unless otherwise indicated.
- B. Anchors, General: Use bolt heads of same basic metal as fastened metal unless otherwise indicated. Use metals that are noncorrosive and compatible with each metal anchored.
- C. Post-Installed Structural Anchors: Fastener systems; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES **[AC01][AC193][AC58][or][AC308]** as appropriate for the substrate.
1. Uses: Securing **[railings][and][handrails]<Insert item>** to concrete.
 2. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or **ASTM F1941 (ASTM F1941M)**, Class Fe/Zn 5, unless otherwise indicated.
 3. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy **[Group 1 (A1)][Group 2 (A4)]** stainless steel bolts, **ASTM F593 (ASTM F738M)**, and nuts, **ASTM F594 (ASTM F836M)**.
- D. Post-Installed Nonstructural Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES **[AC01][AC193][AC58][or][AC308]** as appropriate for the substrate.
1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or **ASTM F1941 (ASTM F1941M)**, Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy **[Group 1 (A1)][Group 2 (A4)]** stainless steel bolts, **ASTM F593 (ASTM F738M)**, and nuts, **ASTM F594 (ASTM F836M)**.

2.5 MISCELLANEOUS MATERIALS

- A. Wood Rails: Hardwood rails of species and profile **[matching design reference sample][matching existing][as indicated on Drawings]<Insert description>**, complying with **[Section 064013 "Exterior Architectural Woodwork."][Section 064023 "Interior Architectural Woodwork."][.]<Insert Section number and title.>**

- B. Welding Electrodes and Filler Metal: Select according to AWS specifications for metal alloy welded; use metal type and alloy as recommended in writing by producer of metal to be welded or filled and as required for color match, strength, and compatibility in fabricated items.
- C. Brazing Rods for Copper-Alloy Components: Type and alloy as recommended in writing by producer of metal to be brazed and as required for color match, strength, and compatibility in fabricated items.
- D. Brazing Rods for Cast-Iron Components: Type and alloy as recommended in writing by brazing-rod manufacturer and as required for strength and compatibility in fabricated items.
- E. Metal-Patching Compound: Two-part, polyester-resin metal-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of metal repair indicated, tooling time required for the detail of work, and site conditions. Compound shall be produced for filling metal that has deteriorated because of corrosion. Filler shall be capable of filling deep holes and spreading to feather edge.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended in writing by manufacturer for interior and exterior applications.
- G. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 1. Water-Resistant Product: **[At exterior locations][and][where indicated]**, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer for exterior use.
- H. Sealant Materials:
 1. Provide manufacturer's standard, elastomeric **[single-component, nonsag, neutral-curing silicone][single-component, nonsag urethane]<Insert type>** sealant complying with applicable requirements in Section 079200 "Joint Sealants."
 2. Colors: Provide colors of exposed sealants to match colors of metals in which sealant is placed unless otherwise indicated.
- I. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, glazed masonry, and polished stone surfaces from damaging effects of acidic and alkaline cleaners.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[American Building Restoration Products, Inc.]**
 - b. **[Price Research, Ltd. dba Charles Paint Research]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[American Building Restoration Products, Inc.]**
 - b. **[Price Research, Ltd. dba Charles Paint Research]**
 - c. **<Insert manufacturer's name>**

- J. Masking Tape: Nonstaining, nonabsorbent material; compatible with chemical solutions being used and substrate surfaces, and that will easily come off entirely, including adhesive.
- K. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:
 - 1. Previous effectiveness in performing the work involved.
 - 2. Little possibility of damaging exposed surfaces.
 - 3. Consistency of each application.
 - 4. Uniformity of the resulting overall appearance.
 - 5. Do not use products or tools that could do the following:
 - a. Remove, alter, or in any way harm the present or future condition of existing surfaces, including surrounding surfaces not in the Contract.
 - b. Leave an unintended residue on surfaces.

2.6 METAL FABRICATION

A. Metal Fabricators:

- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Allen Architectural Metals, Inc]**
 - b. **[Alloy Casting Co., Inc.]**
 - c. **[Antique Cast Iron, LLC]**
 - d. **[Architectural Iron Company, Inc.]**
 - e. **[Brandywine Forge]**
 - f. **[f2 Industries]**
 - g. **[Heritage Cast Iron USA]**
 - h. **[Historical Arts & Casting, Inc]**
 - i. **[King Architectural Metals]**
 - j. **[Olek Lejbzon & Co.]**
 - k. **[Postville Blacksmith Shop]**
 - l. **[Robinson Iron]**
 - m. **[Schiff Architectural Detail]**
 - n. **[Wiemann Metalcraft]**
 - o. **<Insert manufacturer's name>**
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Allen Architectural Metals, Inc]**
 - b. **[Alloy Casting Co., Inc.]**
 - c. **[Antique Cast Iron, LLC]**
 - d. **[Architectural Iron Company, Inc.]**
 - e. **[Brandywine Forge]**
 - f. **[f2 Industries]**
 - g. **[Heritage Cast Iron USA]**
 - h. **[Historical Arts & Casting, Inc]**
 - i. **[King Architectural Metals]**

- j. [Olek Lejbzon & Co.]
- k. [Postville Blacksmith Shop]
- l. [Robinson Iron]
- m. [Schiff Architectural Detail]
- n. [Wiemann Metalcraft]
- o. <Insert manufacturer's name>

- B. Fabricate repairs of decorative metal items and components in sizes and profiles to match existing decorative metal, with accurate curves, lines, and angles. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
- C. Provide uniform, neat seams with minimum exposure of welds, brazing, solder, and sealant.
- D. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for fasteners. Use concealed fasteners where possible; use exposed fasteners to match existing work.
- E. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed joints of flux, and dress exposed and contact surfaces.
 - 1. Use materials and methods that match color of base metal, minimize distortion, and develop maximum strength and corrosion resistance.
 - 2. Remove flux immediately.
 - 3. At exposed connections, match contours of adjoining surfaces, and finish exposed surfaces smooth and blended so no roughness shows after finishing.
- F. Castings: Fabricate castings free of warp, cracks, blowholes, or other defects that impair strength or appearance. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks.
 - 1. Finish castings to match existing decorative metalwork.
 - 2. Replacement Casting for Handrail Bracket: Duplicate existing handrail bracket on the cast-iron railing of first-floor stairs in the lobby. Make molds from this bracket to create new cast-iron brackets.

2.7 FINISHES, GENERAL

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

- A. Mill finish.
- B. Clear Anodic Finish: AAMA 611, [Class I, 0.018 mm][Class II, 0.010 mm] or thicker over a [satin (directionally textured)][polished (buffed)][nonspecular as fabricated]<Insert requirement> mechanical finish.
- C. Color Anodic Finish: AAMA 611, [Class I, 0.018 mm][Class II, 0.010 mm] or thicker over a [satin

(directionally textured)][polished (buffed)][nonspecular as fabricated]<Insert requirement> mechanical finish.

- D. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.

2.9 COPPER-ALLOY FINISHES

- A. General: Finish designations for copper alloys comply with the system defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)."
- B. Buffed Finish: **[M21 (Mechanical Finish: buffed, smooth specular)][M22 (Mechanical Finish: buffed, specular)]<Insert description>**.
- C. Buffed Finish, Lacquered: **[M22 (Mechanical Finish: buffed, specular; specified clear organic coating)]<Insert description>**.
- D. Satin Hand-Rubbed Finish: **[M32-M34 (Mechanical Finish: directionally textured, medium satin and hand rubbed)]<Insert description>**.
- E. Satin Hand-Rubbed Finish, Lacquered: **[M32-M34-06x (Mechanical Finish: directionally textured, medium satin and hand rubbed; specified clear organic coating)]<Insert description>**.
- F. Satin Finish with Statuary Conversion Coating: **[M32-C55 (directionally textured, medium satin; sulfide conversion coating)]<Insert description>**.
 - 1. Color: **[Match design reference sample][Match existing][Match Architect's sample]<Insert color>**.
- G. Brushed Finish with Patina Conversion Coating: M35-C12-C52 (directionally textured, rotary brushed and buff polished, nonetched cleaned; ammonium sulfate conversion coating).
 - 1. Texture and Color: **[Match design reference sample][Match existing][Match Architect's sample]<Insert description>**.
- H. Bright-Relieved Statuary Conversion Coating, Lacquered: M12-C55-M2x-06x (matte finish as cast; sulfide conversion coating; buffed to brighten high spots; specified clear organic coating):
 - 1. Color and Buffing: **[Match design reference sample][Match existing][Match Architect's sample]<Insert description>**.
- I. **<Insert name>** Patina Finish: **<Insert description>**.

2.10 FERROUS METAL FINISHES

- A. Repair Primer: Manufacturer's standard, rust-inhibiting, fast-curing, lead- and chromate-free universal primer, compatible with **[firmly adhered existing paint and]** applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
- B. Finish Primer: Primer complying with applicable requirements in **[Section 090190.52 "Maintenance**

Repainting"]<Insert Section number and title> for finish painting of primed existing metal.

- C. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
- D. Patina Finish: **<Insert description>**.

2.11 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines from new replacement stainless steel, or blend into finish.
- B. Restored Finish: Grind and polish surfaces to produce uniform, directionally textured, polished finish to match **[existing finish][Architect's sample]**, free of cross scratches.
 - 1. Run grain to match existing metal.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- C. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3. Directional Satin Finish: ASTM A480/A480M, No. 4.
 - 4. Dull Satin Finish: ASTM A480/A480M, No. 6.
 - 5. Reflective, Directional Polish: ASTM A480/A480M, No. 7.
 - 6. Mirrorlike Reflective, Nondirectional Polish: ASTM A480/A480M, No. 8.
- D. Bright, Cold-Rolled, Unpolished Finish: ASTM A480/A480M, No. 2B.

PART 3 - EXECUTION

3.1 DECORATIVE METAL REPAIR SPECIALIST

- A. Decorative Metal Repair Specialist Firms: Subject to compliance with requirements, **[provide decorative metal repair by one of the following][firms that may provide decorative metal repair include, but are not limited to, the following]**:
 - 1. **<Insert, in separate subparagraphs, names of decorative metal repair specialist firms>**.

3.2 PROTECTION

- A. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
 - 1. Cover adjacent surfaces with materials that are proved to resist chemical solutions being used unless products being used will not damage adjacent surfaces. Use protective materials that are waterproof and UV resistant. Apply masking agents to comply with manufacturer's written

instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.

2. Do not apply chemical solutions during winds of enough force to spread them to unprotected surfaces.
3. Neutralize alkaline and acid wastes before disposal.
4. Dispose of runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

3.3 DECORATIVE METAL REPAIR, GENERAL

- A. Repair Appearance Standard: Repaired surfaces are to have a uniform appearance as viewed from [20 feet (6 m)][50 feet (15 m)]<Insert distance> away by Architect.
- B. Execution of the Work: In repairing items, disturb remaining existing work as minimally as possible and as follows:
 1. Stabilize decorative metal to reestablish structural integrity and weather resistance while maintaining the existing form of each item.
 2. Remove deteriorated coatings and corrosion.
 3. Sequence work to minimize time before protective coatings are reapplied.
 4. Repair items where stabilization is insufficient to stop progress of deterioration.
 5. Repair items in place where possible.
 6. Replace or reproduce items where indicated or scheduled.
 7. Install temporary protective measures to stabilize decorative metal that is indicated to be repaired later.
- C. Mechanical Coating Removal: Use gentle methods, such as scraping and wire brushing, that will not abrade metal substrate.
- D. Repair Decorative Metal Item: Match existing materials and features.
 1. Repair decorative metals by patching, piecing-in, splicing, or otherwise reinforcing metals with new metal matching existing metal.
- E. Replace Decorative Metal Component: Where indicated, duplicate and replace items with new metal matching existing metal.
 1. Replace heavily deteriorated or missing parts or features of decorative metal with compatible materials, using surviving prototypes to create patterns or molds for duplicate replacements.

3.4 PREPARATORY CLEANING

- A. General: Use those methods indicated for each type of decorative metal and its location.
 1. Brushes: If using wire brushes, use brushes of same base metal composition as metal being cleaned. Use brushes that are resistant to chemicals being used.
 2. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that spray methods do not damage surfaces.
 - a. Equip units with pressure gages.
 - b. For water-spray application, use fan-shaped spray that disperses water at an angle of 25 to

- 50 degrees.
- c. For high-pressure water-spray application, use fan-shaped spray that disperses water at an angle of at least 40 degrees.
- d. For heated water-spray application, use equipment capable of maintaining temperature between **140 and 160 deg F (60 and 71 deg C)** at flow rates indicated.
- 3. Uniformity: Perform each cleaning method in a manner that results in uniform coverage of all surfaces, including corners, contours, and interstices, and that produces an even effect without streaks or damaging surfaces.
- 4. Protection: After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.
- B. Water Cleaning: Clean with **[cold][hot]** water applied by **[low][medium][high]**-pressure spray. Supplement with **[natural-fiber][or][plastic]**-bristle brush. Use small brushes to remove soil from joints and crevices.
- C. Detergent Cleaning:
 - 1. Wet surface with **[cold][hot]** water applied by low-pressure spray.
 - 2. Scrub surface with detergent solution and **[natural-fiber][or][plastic]**-bristle brush until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet.
 - 3. Rinse with **[cold][hot]** water applied by **[low][medium][high]**-pressure spray to remove detergent solution and soil.
- D. Cleaning with Abrasive Pads: Clean surfaces to remove dirt[, **leaving uniform patina intact,**] by light rubbing with abrasive pads and water. **[Rinse with cold water to remove residue. Apply rinse by low-pressure spray][Do not rinse ferrous metals with water; wipe with damp cloths to remove residue]<Insert requirement>.**
- E. Cleaning by Abrasive Blasting: Clean surfaces to remove dirt[, **leaving uniform patina intact,**] by dry blasting with specified blasting abrasive at pressure and distance from surface indicated below. **[Rinse with cold-water, low-pressure spray to remove residue][Do not rinse ferrous metals with water; wipe with damp cloths to remove residue]<Insert requirement>.**
 - 1. Pressure and Distance from Surface: Maximum pressure of **[60 psi (415 kPa)][100 psi (690 kPa)][200 psi (1375 kPa)]<Insert value>** with specified blasting abrasive propelled from a distance of **[6 to 12 inches (152 to 305 mm)][12 to 18 inches (305 to 457 mm)]<Insert dimension>** from surface.
 - 2. Pressure and distance from surface as established by mockup.
- F. Chemical Rust Removal:
 - 1. Remove loose rust scale with approved abrasives for ferrous metal cleaning.
 - 2. Apply rust remover with brushes or as recommended in writing by manufacturer.
 - 3. Allow rust remover to remain on surface for period recommended in writing by manufacturer or as determined by preconstruction testing. Do not allow extended dwell time.
 - 4. Wipe off residue with mineral spirits and either steel wool or soft rags, or clean with method recommended in writing by manufacturer to remove residue.
 - 5. Dry immediately with clean, soft cloths. Follow direction of grain in metal.
 - 6. Prime immediately to prevent rust. Do not touch cleaned metal surface until primed.
- G. Mechanical Rust Removal:
 - 1. Remove rust with approved abrasives for ferrous metal cleaning.

2. Wipe off residue with mineral spirits and either steel wool or soft rags.
3. Dry immediately with clean, soft cloths. Follow direction of grain in metal.
4. Prime immediately to prevent rust. Do not touch cleaned metal surface until primed.

3.5 REMOVAL, REPAIR, AND REINSTALLATION

- A. General: Perform removal work as required in Section 024119 "Selective Demolition" for specific requirements relating to selectively demolishing construction, including decorative metal removal for repair or reinstallation elsewhere.
- B. Defects in Painted Metal Surfaces: Repair nonload-bearing defects in existing metal surfaces, including dents and gouges more than **[1/16 inch (1.6 mm)][1/8 inch (3 mm)]<Insert dimension>** deep or **[1/2 inch (13 mm)][1 inch (25 mm)]<Insert dimension>** across, and all holes and cracks by filling with metal-patching compound and sanding smooth. Remove burrs and protruding fasteners. Prime iron and steel surfaces immediately after repair to prevent flash rusting.
- C. Reinstalling **[Railing][and][Fence]** Posts: After posts have been inserted into sleeves, fill annular space between post and sleeve with **[nonshrink, nonmetallic grout][or][anchoring cement]**, mixed and placed to comply with anchoring material manufacturer's written instructions. Leave anchorage joint exposed, wipe off surplus anchoring material, and leave **1/8-inch (3-mm)** buildup sloped away from post.
- D. Anchoring Wood Rails: Secure wood rails to metal subrail or brackets from bottom of wood rail as indicated on Drawings. Make fastener heads flush to metal surface.
- E. Installing Sealant:
 1. After metal reinstallation, keep joints to receive sealant dry and free of debris.
 2. Clean and prepare joint surfaces according to Section 079200 "Joint Sealants." **[Prime joint surfaces unless sealant manufacturer recommends against priming.]** Do not allow primer to spill or migrate onto adjoining surfaces.
 3. Fill sealant joints with specified joint sealant as recommended in writing by sealant manufacturer and according to Section 079200 "Joint Sealants" and the following:
 - a. Install sealant using only proved installation methods that ensure sealant is deposited in a uniform, continuous ribbon, without gaps or air pockets, and with complete wetting of the joint bond surfaces equally on both sides. Fill joint flush with surrounding metal.
 - b. Do not allow sealant to overflow or spill onto adjoining surfaces or to migrate into the voids of adjoining surfaces, particularly rough or sculptural textures. Promptly remove excess and spillage of sealant as the work progresses. Clean adjoining surfaces by means necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes, as demonstrated in an approved mockup.
 4. Cure sealant according to Section 079200 "Joint Sealants."

3.6 PRIMING

- A. Repair Primer: Apply immediately after completing a repair.
- B. Finish Primer: Apply as soon after cleaning as possible.

3.7 PAINTING STEEL UNCOVERED DURING THE WORK

- A. Notify Architect if steel is exposed during metal removal. Where Architect determines that the steel is structural, or for other reasons cannot be totally removed, prepare and paint it as follows:
 - 1. Surface Preparation: Remove paint, rust, and other contaminants according to [SSPC-SP 2, "Hand Tool Cleaning,"][SSPC-SP 3, "Power Tool Cleaning,"][or][SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning,"]<Insert surface preparation standard> as applicable to comply with paint manufacturer's recommended preparation.
 - 2. Antirust Coating: Immediately paint exposed steel with two coats of antirust coating, following coating manufacturer's written instructions and without exceeding manufacturer's recommended rate of application (dry film thickness per coat).
- B. If on inspection and rust removal, the thickness of a steel member is found to be reduced from rust by more than [1/16 inch (1.6 mm)]<Insert dimension>, notify Architect before proceeding.

3.8 DECORATIVE METAL REPAIR SCHEDULE

- A. Treatment for Decorative Railing [DMR-1]<Insert drawing designation>: Wrought-iron railing and gate.
 - 1. General: Perform work [in the shop][or][in the field].
 - 2. Paint Removal: As specified in Section 050170.51 "Decorative Metal Cleaning."
 - 3. Repairs: Repair railing and replace missing components with hand-worked [steel bars][wrought iron].
 - a. Apply repair primer immediately after repair.
 - 4. Painted Finish: As specified in [Section 090190.52 "Maintenance Repainting."]<Insert Section number and title.>
 - 5. Baked-Enamel or Powder-Coat Finish: [Color as indicated by manufacturer's designations][Color matching design reference sample][Color matching Architect's sample][Color as selected by Architect from manufacturer's full range]<Insert color and gloss>.
- B. Treatment of Decorative Railing [DMR-2]<Insert drawing designation>: Cast-iron balustrade.
 - 1. General: Perform work [in the shop][or][in the field].
 - 2. Paint Removal: As specified in Section 050170.51 "Decorative Metal Cleaning."
 - 3. Rust Removal: [Chemical][Mechanical]<Insert method>.
 - 4. Repair: [Patch with new material by filling, welding, brazing, or applying new metal material with fasteners]<Insert description>.
 - a. Apply repair primer immediately after repair.
 - 5. Painted Finish: As specified in [Section 090190.52 "Maintenance Repainting."]<Insert Section number and title.>
- C. Treatment of Decorative Railing [DMR-3]<Insert drawing designation>: Bronze railing with bronze handrail.
 - 1. General: Perform work [in the shop][or][in the field].
 - 2. Cleaning: As specified in Section 050170.51 "Decorative Metal Cleaning."
 - 3. Repair: [Splice new material into deteriorated section]<Insert description>.
 - 4. Bronze Finish: [Satin finish with statuary conversion coating on railing; satin hand-rubbed finish, lacquered, on handrail]<Insert requirement>.

- D. Treatment of Decorative Railing and Handrail **[DMRH-1]<Insert drawing designation>**: Deteriorated bronze handrail on cast-iron railing.
1. Repair: Replace broken cast-iron railing components and repaint railing. Replace entire, deteriorated bronze handrail with shop-fabricated aluminum handrail.
 2. Paint Removal: As specified in Section 050170.51 "Decorative Metal Cleaning."
 3. Railing Finish: Paint as specified in **[Section 090190.52 "Maintenance Repainting."]<Insert Section number and title.>**
 - a. Color: **[As indicated by manufacturer's designations][Matching design reference sample][Matching Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
 4. Handrail Finish:
 - a. Aluminum Finish: **[Light bronze anodized][Medium bronze anodized][Dark bronze anodized][Anodized color matching design reference sample][Anodized color matching Architect's sample][Anodized color as selected by Architect from full range of industry colors and color densities]<Insert color>**.
 - b. Baked-Enamel or Powder-Coat Finish: **[Color as indicated by manufacturer's designations][Color matching design reference sample][Color matching Architect's sample][Color as selected by Architect from manufacturer's full range]<Insert color and gloss>**.
 5. Finish Treatment:
 - a. Protective Coating: As specified in Section 050170.63 "Decorative Metal Refinishing."
 - b. Painted Finish: As specified in **[Section 090190.52 "Maintenance Repainting."]<Insert Section number and title.>**

END OF SECTION 05 01 70 61

SECTION 05 01 70 63 - DECORATIVE METAL REFINISHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes refinishing bare decorative metal surfaces as follows:
 - 1. Refinishing metal in place.
 - 2. Removing metal for shop refinishing; reinstalling refinished metal.
 - 3. Integral metal finishes.
 - 4. Clear protective coatings.
- B. Related Requirements:
 - 1. Section 013516 "Alteration Project Procedures" for general remodeling, renovation, repair, and maintenance requirements.
 - 2. Section 099423 "Gilding" for gilding on metalwork.

1.2 ALLOWANCES

- A. Allowances for decorative metal refinishing are specified in Section 012100 "Allowances."
 - 1. Perform decorative metal refinishing under quantity allowances and only as authorized. Authorized work includes **[work required by Drawings and Specifications and][only]** work as directed in writing by Architect.
 - 2. Notify Architect **[weekly]<Insert time interval>** of extent of work performed that is attributable to quantity allowances.
 - 3. Perform work that exceeds quantity allowances only as authorized by Change Orders.
- B. Refinishing **<Insert item description>** is part of **<Insert name of allowance>**.

1.3 UNIT PRICES

- A. Work of this Section is affected by unit prices specified in Section 012200 "Unit Prices."
 - 1. Unit prices apply to authorized work covered by **[quantity allowances][estimated quantities]**.
 - 2. Unit prices apply to authorized additions to and deletions from the Work as authorized by Change Orders.

1.4 DEFINITIONS

- A. Low-Pressure Spray: **[100 to 400 psi (690 to 2750 kPa); 4 to 6 gpm (0.25 to 0.4 L/s)]<Insert range of values>**.
- B. Medium-Pressure Spray: **[400 to 800 psi (2750 to 5510 kPa); 4 to 6 gpm (0.25 to 0.4 L/s)]<Insert range of values>**.
- C. High-Pressure Spray: **[800 to 1200 psi (5510 to 8250 kPa); 4 to 6 gpm (0.25 to 0.4 L/s)]<Insert range of values>**.

of values>.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include recommendations for product application and use.
 - 2. Include test data substantiating that products comply with requirements.
- B. Shop Drawings:
 - 1. Include plans, elevations, and sections showing locations and extent of refinishing work.
 - 2. Include field-verified dimensions.
- C. Samples for Initial Selection: For the following:
 - 1. A range of each type of exposed finish prepared on metal of the same alloy matching existing metal.
- D. Samples for Verification: For the following products in manufacturer's standard sizes unless otherwise indicated, finished as required for use in the Work:
 - 1. Each type of exposed finish prepared on metal of the same alloy matching existing metal; **6 inches (150 mm)** long in least dimension.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For decorative metal refinishing specialist.

1.8 QUALITY ASSURANCE

- A. Decorative Metal Refinishing Specialist Qualifications: A qualified decorative metal refinishing specialist.
 - 1. Single Specialist: Subject to compliance with requirements, engage the same specialist firm to perform the work of **[Section 050170.51 "Decorative Metal Cleaning"]****[Section 050170.61 "Decorative Metal Repair"]** and the work of this Section.
- B. Mockups: Prepare mockups of decorative metal refinishing processes[**on existing surfaces**] to demonstrate aesthetic effects and to set quality standards for materials and execution. Prepare mockups so they are inconspicuous.
 - 1. Waxing Bronze: Wax a cleaned area **[approximately 2 sq. ft. (0.2 sq. m)]****[as indicated on Drawings]<Insert dimension>** of **[each type of]** bronze **[sculpture][paneling][and][hardware]<Insert item description>**.
 - 2. Refinishing Decorative Metal: Refinish **[one]<Insert number>** decorative **<Insert item description>** for each type of metal indicated to be refinished.

3. Repairing Decorative Metal Finish: Repair finish of **[one]<Insert number>** decorative **<Insert item description>** for each type of metal finish indicated to be repaired.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Pack, deliver, and store decorative metal items in suitable packs, heavy-duty cartons, or wooden crates; surround with sufficient packing material to ensure that products are not deformed, cracked, or otherwise damaged.
- B. Store decorative metal inside a well-ventilated area, away from uncured concrete and masonry and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.
- C. Protect strippable protective covering on decorative metal from exposure to sunlight and high humidity, except to the extent necessary for the period of decorative metal installation.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with decorative metal refinishing only when existing and forecasted weather conditions are within the environmental limits set by each manufacturer's written instructions and specified requirements.

PART 2 - PRODUCTS

2.1 PREPARATORY CLEANING MATERIALS

- A. Water: Potable.
- B. Hot Water: Water heated to a temperature of **140 to 160 deg F (60 to 71 deg C)**.
- C. Detergent Solution, Job Mixed: Solution prepared by mixing **2 cups (0.5 L)** of tetrasodium pyrophosphate (TSPP), **1/2 cup (125 mL)** of laundry detergent, and **20 quarts (20 L)** of hot water for every **5 gal. (20 L)** of solution required.
- D. Nonacidic Liquid Chemical Cleaner: Manufacturer's standard mildly alkaline liquid cleaner, formulated for removing organic soiling from ordinary building materials, including polished stone, brick, copper, brass, bronze, aluminum, stainless steel, plastics, wood, and glass.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[American Building Restoration Products, Inc.]**
 - b. **[Cathedral Stone Products, Inc.]**
 - c. **[Dumond Chemicals, Inc]**
 - d. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[American Building Restoration Products, Inc.]**
- b. **[Cathedral Stone Products, Inc.]**
- c. **[Dumond Chemicals, Inc]**
- d. **<Insert manufacturer's name>**

E. Abrasive Materials:

1. Abrasive Pads for Copper-Alloy Cleaning: Extra-fine bronze wool or plastic abrasive pads.
2. Blasting Abrasive: **[Pulverized walnut shells][Powdered aluminum silicate]<Insert material>**.
3. Abrasives for Ferrous Metal Cleaning: Aluminum oxide paper, emery paper, fine steel wool, steel scrapers, and steel-wire brushes of various sizes.

2.2 PROTECTIVE COATING MATERIALS

- A. Wax Coating: Inert, high-melting-point wax or wax blend, consisting primarily of **[carnauba][or][microcrystalline petroleum] wax[and no solvents]**.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[BWC Company, Inc. (The)]**
 - b. **[Fisher Scientific; part of Thermo Fisher Scientific]**
 - c. **[Real Milk Paint Co.]**
 - d. **[TALAS]**
 - e. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[BWC Company, Inc. (The)]**
 - b. **[Fisher Scientific; part of Thermo Fisher Scientific]**
 - c. **[Real Milk Paint Co.]**
 - d. **[TALAS]**
 - e. **<Insert manufacturer's name>**

- B. Organic Coating: Clear, waterborne, air-drying, acrylic lacquer called "Incralac"; specially developed for coating copper-alloy products; consisting of a solution of methyl methacrylate copolymer with benzotriazole UV inhibitor.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[StanChem, Inc.]**
 - b. **[TALAS]**
 - c. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[StanChem, Inc.]**
 - b. **[TALAS]**
 - c. **<Insert manufacturer's name>**
- C. Copper-Alloy Corrosion Inhibitor: Solution of **[1][to][3]<Insert number>** percent benzotriazole in water.

2.3 MISCELLANEOUS MATERIALS

- A. Liquid Strippable Masking Agent: Manufacturer's standard liquid, film-forming, strippable masking material for protecting glass, metal, glazed masonry, and polished stone surfaces from damaging effects of acidic and alkaline cleaners.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[American Building Restoration Products, Inc.]**
 - b. **[Price Research, Ltd. dba Charles Paint Research]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[American Building Restoration Products, Inc.]**
 - b. **[Price Research, Ltd. dba Charles Paint Research]**
 - c. **<Insert manufacturer's name>**
- B. Masking Tape: Nonstaining, nonabsorbent material; compatible with chemical solutions being used and substrate surfaces, and that will easily come off entirely, including adhesive.
- C. Other Products: Select materials and methods of use based on the following, subject to approval of a mockup:
 1. Previous effectiveness in performing the work involved.
 2. Little possibility of damaging exposed surfaces.
 3. Consistency of each application.
 4. Uniformity of the resulting overall appearance.
 5. Do not use products or tools that could do the following:
 - a. Remove, alter, or in any way harm the present or future condition of existing surfaces, including surrounding surfaces not in the Contract.
 - b. Leave an unintended residue on surfaces.

2.4 FINISHES, GENERAL

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 ALUMINUM FINISHES

- A. Unfinished: No applied finish; only preparatory cleaning.
- B. Clear Anodic Finish: AAMA 611, **[Class I, 0.018 mm][Class II, 0.010 mm]** or thicker over a **[satin (directionally textured)][polished (buffed)][nonspecular as fabricated]<Insert requirement>** mechanical finish.
- C. Color Anodic Finish: AAMA 611, **[Class I, 0.018 mm][Class II, 0.010 mm]** or thicker over a **[satin (directionally textured)][polished (buffed)][nonspecular as fabricated]<Insert requirement>** mechanical finish.

2.6 COPPER-ALLOY FINISHES

- A. General: Finish designations for copper alloys comply with the system defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)."
- B. Buffed Finish: **[M21 (Mechanical Finish: buffed, smooth specular)][M22 (Mechanical Finish: buffed, specular)]<Insert description>**.
- C. Buffed Finish, Lacquered: **[M22 (Mechanical Finish: buffed, specular; specified clear organic coating)]<Insert description>**.
- D. Satin Hand-Rubbed Finish: **[M32-M34 (Mechanical Finish: directionally textured, medium satin and hand rubbed)]<Insert description>**.
- E. Satin Hand-Rubbed Finish, Lacquered: **[M32-M34-06x (Mechanical Finish: directionally textured, medium satin and hand rubbed; specified clear organic coating)]<Insert description>**.
- F. Satin Finish with Statuary Conversion Coating: **[M32-C55 (directionally textured, medium satin; sulfide conversion coating)]<Insert description>**.
1. Color: **[Match design reference sample][Match existing][Match Architect's sample]<Insert color>**.
- G. Brushed Finish with Patina Conversion Coating: M35-C12-C52 (directionally textured, rotary brushed and buff polished, nonetched cleaned; ammonium sulfate conversion coating).
1. Texture and Color: **[Match design reference sample][Match existing][Match Architect's sample]<Insert description>**.
- H. Bright-Relieved Statuary Conversion Coating, Lacquered: M12-C55-M2x-06x (matte finish as cast; sulfide conversion coating; buffed to brighten high spots; specified clear organic coating):
1. Color and Buffing: **[Match design reference sample][Match existing][Match Architect's sample]<Insert description>**.
- I. **<Insert name>** Patina Finish: **<Insert description>**.

2.7 FERROUS METAL FINISHES

- A. Patina Finish: **<Insert description>**.

2.8 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines from new replacement stainless steel, or blend into finish.
- B. Restored Finish: Grind and polish surfaces to produce uniform, directionally textured, polished finish to match **[existing finish][Architect's sample]**, free of cross scratches.
1. Run grain to match existing metal.
 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- C. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
1. Run grain of directional finishes with long dimension of each piece.
 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 3. Directional Satin Finish: ASTM A480/A480M, No. 4.
 4. Dull Satin Finish: ASTM A480/A480M, No. 6.
 5. Reflective, Directional Polish: ASTM A480/A480M, No. 7.
 6. Mirrorlike Reflective, Nondirectional Polish: ASTM A480/A480M, No. 8.

PART 3 - EXECUTION

3.1 DECORATIVE METAL REFINISHING SPECIALIST

- A. Decorative Metal Refinishing Specialist Firms: Subject to compliance with requirements, **[provide decorative metal refinishing by one of the following][firms that may provide decorative metal refinishing include, but are not limited to, the following]**:
1. **<Insert, in separate subparagraphs, names of decorative metal refinishing specialist firms>**.

3.2 PROTECTION

- A. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent chemical solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.
1. Cover adjacent surfaces with materials that are proved to resist chemical solutions being used unless products being used will not damage adjacent surfaces. Use protective materials that are waterproof and UV resistant. Apply masking agents to comply with manufacturer's written instructions. Do not apply liquid masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.
 2. Do not apply chemical solutions during winds of enough force to spread them to unprotected surfaces.
 3. Neutralize alkaline and acid wastes before disposal.

4. Dispose of runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

3.3 DECORATIVE METAL REFINISHING, GENERAL

- A. Refinishing Appearance Standard: Refinished surfaces are to have a uniform appearance as viewed from **[20 feet (6 m)][50 feet (15 m)]<Insert distance>** away by Architect.
- B. Execution of the Work: In refinishing items, disturb remaining existing work as minimally as possible and as follows:
 1. Remove dirt and corrosion.
 2. Sequence work to minimize time before protective coatings are reapplied.
 3. Refinish items in place where possible and according to required appearance.
- C. Refinish Decorative Metal Item: Remove existing metal finishes on item unless otherwise indicated[, **including integral polished and patinated finishes,**] and reapply them.
- D. Repair Finish of Decorative Metal Item: Restore areas of deteriorated or missing finish on item and blend restored finish with existing, adjacent finish[, **including integral polished and patinated finishes**].

3.4 PREPARATORY CLEANING

- A. General: Use those methods indicated for each type of decorative metal and its location.
 1. Brushes: If using wire brushes, use brushes of same base metal composition as metal being treated. Use brushes that are resistant to chemicals being used.
 2. Spray Equipment: Use spray equipment that provides controlled application at volume and pressure indicated, measured at nozzle. Adjust pressure and volume to ensure that spray methods do not damage surfaces.
 - a. Equip units with pressure gages.
 - b. For chemical-cleaner spray application, use low-pressure tank or chemical pump suitable for chemical cleaner indicated, equipped with nozzle having a cone-shaped spray.
 - c. For water-spray application, use fan-shaped spray that disperses water at an angle of 25 to 50 degrees.
 - d. For high-pressure water-spray application, use fan-shaped spray that disperses water at an angle of at least 40 degrees.
 - e. For heated water-spray application, use equipment capable of maintaining temperature between **140 and 160 deg F (60 and 71 deg C)** at flow rates indicated.
 3. Uniformity: Perform each cleaning method in a manner that results in uniform coverage of all surfaces, including corners, contours, and interstices, and that produces an even effect without streaks or damaging surfaces.
 4. Protection: After cleaning is complete, remove protection no longer required. Remove tape and adhesive marks.
- B. Water Cleaning: Clean with **[cold][hot]** water applied by **[low][medium][high]**-pressure spray. Supplement with **[natural-fiber][or][plastic]**-bristle brush. Use small brushes to remove soil from joints and crevices.

C. Detergent Cleaning:

1. Wet surface with [cold][hot] water applied by low-pressure spray.
2. Scrub surface with detergent solution and [natural-fiber][or][plastic]-bristle brush until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet.
3. Rinse with [cold][hot] water applied by [low][medium][high]-pressure spray to remove detergent solution and soil.

D. Nonacidic Liquid Chemical Cleaning: Apply chemical cleaner to surfaces according to chemical-cleaner manufacturer's written instructions.

1. Wet surface with [cold][hot] water applied by low-pressure spray.
2. Apply cleaner to surface[in two applications] by brush[or low-pressure spray].
3. Let cleaner remain on surface for period [recommended in writing by chemical-cleaner manufacturer][established by mockup][of two to three minutes]<Insert requirement>.
4. Nonferrous Metals: Rinse with [cold][hot] water applied by [low][medium][high]-pressure spray to remove chemicals and soil.
5. Ferrous Metals: Do not rinse ferrous metals with water; neutralize chemical cleaner on ferrous metals as recommended in writing by manufacturer. Dry immediately with clean soft cloths. Follow direction of grain in metal.

E. Cleaning with Abrasive Pads: Clean surfaces to remove dirt[, leaving uniform patina intact,] by light rubbing with abrasive pads and water. [Rinse with cold water to remove residue. Apply rinse by low-pressure spray][Do not rinse ferrous metals with water; wipe with damp cloths to remove residue]<Insert requirement>.

F. Cleaning by Abrasive Blasting: Clean surfaces to remove dirt[, leaving uniform patina intact,] by dry blasting with specified blasting abrasive at pressure and distance from surface indicated below. [Rinse with cold water, low-pressure spray to remove residue.][Do not rinse ferrous metals with water; wipe with damp cloths to remove residue]<Insert requirement>.

1. Pressure and Distance from Surface: Maximum pressure of [60 psi (415 kPa)][100 psi (690 kPa)][200 psi (1375 kPa)]<Insert value> with specified blasting abrasive propelled from a distance of [6 to 12 inches (152 to 305 mm)][12 to 18 inches (305 to 457 mm)]<Insert dimension> from the surface.
2. Pressure and distance from surface as established by mockup.

3.5 PROTECTIVE COATING

A. Protective Hot-Wax Coating:[Pretreat cleaned copper-alloy surfaces with copper-alloy corrosion inhibitor, wipe off excess with ethanol-saturated rag, and allow surface to dry. If fresh corrosion appears, repeat process.] Apply wax coating to produce uniform appearance without runs or other surface imperfections.

1. Clean and dry surface being waxed.
2. Preheat surface to about 212 deg F (100 deg C); hot enough to melt the wax and remove water vapor and other gases within metal surface, but not hot enough to boil the wax or ignite solvents if any.
3. Apply uniform wax coating to surface, ensuring that wax coverage is complete, including recesses.[Apply second wax coating following the same process.]
4. Inspect surface and repair holidays by reheating and applying more wax.
5. Buff waxed surface to a slight shine with a lint-free cloth after wax has cooled to a hazy appearance.

- B. Protective Organic Coating: [**Pretreat cleaned copper-alloy surfaces with copper-alloy corrosion inhibitor, wipe off excess with ethanol-saturated rag, and allow surface to dry. If fresh corrosion appears, repeat process.**] Apply organic coating to produce uniform appearance without runs or other surface imperfections.

1. Clean and dry surface being coated.
2. Apply two uniform coats by air-spray method according to manufacturer's written instructions, with interim drying between coats.
3. Apply coating to a total dry film thickness of **1 mil (0.025 mm)**.
4. Protect coated surface from contamination until fully cured.

3.6 REMOVAL, REPAIR, AND REINSTALLATION

- A. General: Perform removal, repair, and reinstallation work as required in Section 024119 "Selective Demolition" and Section 050170.61 "Decorative Metal Repair."

3.7 DECORATIVE METAL REFINISHING SCHEDULE

- A. Treatment of Decorative Handrail [DMR-#]<Insert drawing designation>: Tarnished bronze railing with bronze handrail.

1. General: Perform work [in the shop][or][in the field].
2. Cleaning: [Water cleaning][Detergent cleaning][Chemical cleaning][Abrasive blasting]<Insert description>.
3. Bronze Finish: [Satin finish with statuary conversion coating on railing; satin hand-rubbed finish, lacquered, on handrail]<Insert requirement>.

- B. Treatment for Bronze Statue Finish [DMS-#]<Insert drawing designation>: Clean, repair patina finish, and coat statue.

1. General: Perform work [in the shop][or][in the field].
2. Cleaning: [Water cleaning][Detergent cleaning][Chemical cleaning][Abrasive blasting]<Insert description>.
3. Finish Repair: Selectively patinate the [nose][foot][and][previous metal repairs]<Insert description> to match the rest of the statue.
4. Protective Coating: Protective [hot-wax][organic] coating.

END OF SECTION 05 01 70 63



Task	Specification	Specification Description
05 05 19 00	05 50 00 00	Metal Fabrications
05 05 21 00	05 12 00 00	Structural Steel Framing
05 05 23 00	01 11 19 00	No Specification Required
05 05 23 00	05 12 00 00	Structural Steel Framing
05 05 23 00	05 50 00 00	Metal Fabrications



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SECTION 05 12 00 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural-steel materials.
2. Shrinkage-resistant grout.
3. Prefabricated building columns.
4. Shear stud connectors.

B. Related Requirements:

1. Section 051213 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
2. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.
3. Section 055000 "Metal Fabrications" for **[steel lintels and shelf angles not attached to structural-steel frame][miscellaneous steel fabrications]** and other steel items not defined as structural steel.
4. **[Section 099113 "Exterior Painting" and Section 099123 "Interior Painting"]****[and][Section 099600 "High-Performance Coatings"]** for painting requirements.
5. Section 133419 "Metal Building Systems" for structural steel.

1.2 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.
- B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
- C. Heavy Sections: Rolled and built-up sections as follows:
1. Shapes included in ASTM A6/A6M with flanges thicker than **1-1/2 inches (38 mm)**.
 2. Welded built-up members with plates thicker than **2 inches (50 mm)**.
 3. Column base plates thicker than **2 inches (50 mm)**.
- D. Protected Zone: Structural members or portions of structural members indicated as "protected zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
- E. Demand-Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the seismic-load-resisting system and which are indicated as "demand critical" or "seismic critical" on Drawings.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are

compatible with one another.

- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.5 ACTION SUBMITTALS

- A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Shear stud connectors.
4. Anchor rods.
5. Threaded rods.
6. Forged-steel hardware.
7. Slide bearings.
8. Prefabricated building columns.
9. Shop primer.
10. Galvanized-steel primer.
11. Etching cleaner.
12. Galvanized repair paint.
13. Shrinkage-resistant grout.

- B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Environmental Product Declaration: For each product.
3. Health Product Declaration: For each product.
4. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
5. Environmental Product Declaration: For each product.
6. Environmental Product Declaration: For each product.
7. Environmental Product Declaration: For each product.
8. Third-Party Certifications: For each product.
9. Third-Party Certified Life Cycle Assessment: For each product.
10. Health Product Declaration (HPD): For each product.
11. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

- C. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. Identify members and connections of the seismic-load-resisting system.

6. Indicate locations and dimensions of protected zones.
 7. Identify demand-critical welds.
 8. Identify members not to be shop primed.
- D. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M for each welded joint **[whether prequalified or qualified by testing][qualified by testing]**, including the following:
1. Power source (constant current or constant voltage).
 2. Electrode manufacturer and trade name, for demand-critical welds.
- E. Delegated Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data **[signed and sealed by the qualified professional engineer responsible for their preparation]**.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[Installer][fabricator][shop-painting applicators][professional engineer][testing agency]**.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural-steel materials, including chemical and physical properties.
- E. Product Test Reports: For the following:
1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
 2. Direct-tension indicators.
 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 4. Shear stud connectors.
 5. **<Insert product>**.
- F. Survey of existing conditions.
- G. Source quality-control reports.
- H. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).
- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, **[Category ACSE][Category CSE]**.
- C. Shop-Painting Applicator Qualifications: Qualified in accordance with AISC's Sophisticated Paint **[Endorsement P1][Endorsement P2][Endorsement P3]** or to SSPC-QP 3.

- D. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.
1. Welders and welding operators performing work on bottom-flange, demand-critical welds are to pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G are to be considered separate processes for welding personnel qualification.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the following specifications and documents:
1. ANSI/AISC 303.
 2. ANSI/AISC 341.
 3. ANSI/AISC 360.
 4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- B. Connection Design Information:
1. Option 1: Connection designs have been completed and connections indicated on the Drawings.
 2. Option 2: Fabricator's experienced steel detailer selects or completes connections in accordance with ANSI/AISC 303.
 - a. Select and complete connections using **[schematic details indicated][and][ANSI/AISC 360]<Insert source>**.
 - b. Use **[Load and Resistance Factor Design; data are given at factored-load level][Allowable Stress Design; data are given at service-load level]**.
 3. Option 3 and 3A: Design connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer. Member reinforcement at connections is indicated on Drawings.
 - a. Use **[Load and Resistance Factor Design; data are given at factored-load level][Allowable Stress Design; data are given at service-load level]**.

4. Option 3 and 3B: Design connections and final configuration of member reinforcement at connections in accordance with ANSI/AISC 303 by fabricator's qualified professional engineer.

- a. Use **[Load and Resistance Factor Design; data are given at factored-load level][Allowable Stress Design; data are given at service-load level]**.

C. Moment Connections: **[Type PR, partially][Type FR, fully]** restrained.

D. Construction: **[Moment frame][Braced frame][Shear wall system][Combined system of moment frame and braced frame][Combined system of moment frame and shear walls][Combined system of braced frame and shear walls][Combined system of moment frame, braced frame, and shear walls]**.

2.2 STRUCTURAL-STEEL MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- B. W-Shapes: **[ASTM A992/A992M][ASTM A572/A572M, Grade 50 (Grade 345)][ASTM A529/A529M, Grade 50 (Grade 345)][ASTM A913/A913M, Grade 50 (Grade 345)]**.
- C. Channels, Angles, M-Shapes: **[ASTM A36/A36M][ASTM A572/A572M, Grade 50 (Grade 345)][ASTM A529/A529M, Grade 50 (Grade 345)][ASTM A913/A913M, Grade 50 (Grade 345)]**.
- D. Channels, Angles, S-Shapes: **[ASTM A36/A36M][ASTM A572/A572M, Grade 50 (Grade 345)][ASTM A529/A529M, Grade 50 (Grade 345)][ASTM A913/A913M, Grade 50 (Grade 345)]**.
- E. Plate and Bar: **[ASTM A36/A36M][ASTM A572/A572M, Grade 50 (Grade 345)][ASTM A529/A529M, Grade 50 (Grade 345)]**.
- F. Corrosion-Resisting (Weathering) Structural-Steel Shapes, Plates, and Bars: ASTM A588/A588M, **50 ksi (345 MPa)**.
- G. Cold-Formed Hollow Structural Sections: **[ASTM A500/A500M, Grade B][ASTM A500/A500M, Grade C][ASTM A1085/ASTMA1085M]** structural tubing.
- H. Corrosion-Resisting (Weathering), Cold-Formed Hollow Structural Sections: ASTM A847/A847M structural tubing.
- I. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.
 1. Weight Class: **[Standard][Extra strong][Double-extra strong]**.
 2. Finish: **[Black][Galvanized][Black except where indicated to be galvanized]**.
- J. Steel Castings: ASTM A216/A216M, Grade WCB, with supplementary requirement S11.
- K. Steel Forgings: ASTM A668/A668M.
- L. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

- A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, **Grade A325 (Grade A325M)**,

Type 1, heavy-hex steel structural bolts; **ASTM A563, Grade DH (ASTM A563M, Class 10S)**, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959/F959M, **Type 325-1 (Type 8.8-1)**, compressible-washer type with plain finish.

- B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125/F3125M, **Grade A490 (Grade A490M)**, Type 1, heavy-hex steel structural bolts[**or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends**]; **ASTM A563, Grade DH (ASTM A563M, Class 10S)**, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959/F959M, **Type 490-1 (Type 10.9-1)**, compressible-washer type with plain finish.

- C. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, **Grade A325 (Grade A325M)**, Type 1, heavy-hex steel structural bolts; **ASTM A563, Grade DH (ASTM A563M, Class 10S)**, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: **[Hot-dip zinc coating][Mechanically deposited zinc coating][Hot-dip or mechanically deposited zinc coating]**.
2. Direct-Tension Indicators: ASTM F959/F959M, **Type 325-1 (Type 8.8-1)**, compressible-washer type with **[mechanically deposited zinc coating][mechanically deposited zinc coating, baked epoxy-coated]** finish.

- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, **[heavy-hex][round]** head assemblies, consisting of steel structural bolts with splined ends; **ASTM A563, Grade DH (ASTM A563M, Class 10S)**, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: **[Plain][Mechanically deposited zinc coating]**.

- E. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

2.4 Prefabricated Structural Roof Frames

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

1. **<Insert manufacturer's name>**

2.5 RODS

- A. Unheaded Anchor Rods: **[ASTM F1554, Grade 36][ASTM F1554, Grade 55, weldable][ASTM A354][ASTM A449][ASTM A572/A572M, Grade 50 (Grade 345)][ASTM A36/A36M]**.

1. Configuration: **[Straight][Hooked]**.
2. Nuts: **ASTM A563 (ASTM A563M) [heavy-]hex carbon steel**.
3. Plate Washers: ASTM A36/A36M carbon steel.
4. Washers: **ASTM F436 (ASTM F436M)**, Type 1, hardened carbon steel.

5. Finish: **[Plain][Hot-dip zinc coating, ASTM A153/A153M, Class C][Mechanically deposited zinc coating, ASTM B695, Class 50]**.
- B. Headed Anchor Rods: **[ASTM F1554, Grade 36][ASTM F1554, Grade 55, weldable][ASTM A354][ASTM A449]**, straight.
1. Nuts: **ASTM A563 (ASTM A563M) [heavy-]**hex carbon steel.
 2. Plate Washers: ASTM A36/A36M carbon steel.
 3. Washers: **ASTM F436 (ASTM F436M)**, Type 1, hardened carbon steel.
 4. Finish: **[Plain][Hot-dip zinc coating, ASTM A153/A153M, Class C][Mechanically deposited zinc coating, ASTM B695, Class 50]**.
- C. Threaded Rods: **[ASTM A36/A36M][ASTM A193/A193M, Grade B7][ASTM A354, Grade BD][ASTM A449][ASTM A572/A572M, Grade 50 (Grade 345)]**.
1. Nuts: **ASTM A63 (ASTM A563M) [heavy-]**hex carbon steel.
 2. Washers: **[ASTM F436 (ASTM F436M), Type 1, hardened][ASTM A36/A36M]** carbon steel.
 3. Finish: **[Plain][Hot-dip zinc coating, ASTM A153/A153M, Class C][Mechanically deposited zinc coating, ASTM B695, Class 50]**.

2.6 FORGED-STEEL STRUCTURAL HARDWARE

- A. Clevises and Turnbuckles: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1035.
- B. Eye Bolts and Nuts: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1030.
- C. Sleeve Nuts: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1018.

2.7 SLIDE BEARINGS

- A. Structural Slide Bearings: Low-friction assemblies, of configuration indicated, that provide vertical transfer of loads and allow horizontal movement perpendicular to plane of expansion joint while resisting movement within plane of expansion joint.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Amscot Structural Products Corp.]**
 - b. **[Fluorocarbon Company Limited]**
 - c. **[GRM Custom Products]**
 - d. **[R.J. Watson Bridge & Structural Engineered Systems]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Amscot Structural Products Corp.]**
 - b. **[Fluorocarbon Company Limited]**
 - c. **[GRM Custom Products]**
 - d. **[R.J. Watson Bridge & Structural Engineered Systems]**
 - e. **<Insert manufacturer's name>**

3. Mating Surfaces: **[PTFE and PTFE][PTFE and mirror-finished stainless steel]**.
4. Coefficient of Friction: Not more than **[0.03][0.04][0.05][0.06][0.10][0.12]<Insert value>**.
5. Design Load: Not less than **[2,000 psi (13.7 MPa)][5,000 psi (34 MPa)][6,000 psi (41 MPa)]<Insert value>**.
6. Total Movement Capability: **[2 inches (50 mm)]<Insert dimension>**.

2.8 PRIMER

A. Steel Primer:

1. Comply with **[Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."][Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."]**
2. SSPC-Paint 23, latex primer.
3. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanized-Steel Primer: **[MPI#26][MPI#80,][MPI#134]**.

1. Etching Cleaner: MPI#25, for galvanized steel.
2. Galvanizing Repair Paint: **[MPI#18, MPI#19, or SSPC-Paint 20][ASTM A780/A780M]**.

2.9 SHRINKAGE-RESISTANT GROUT

- A. Metallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.10 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, **[mechanically thermal cut,]**or punch standard bolt holes perpendicular to metal surfaces.

- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with [SSPC-SP 1.][SSPC-SP 2.][SSPC-SP 3.]
- F. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.
- H. Welded-Steel Door Frames: Build up welded-steel doorframes attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than **10 inches (250 mm)** o.c. unless otherwise indicated on Drawings.
- I. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces.[**Do not thermally cut bolt holes or enlarge holes by burning.**]
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.11 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: [**Snug tightened**][**Pretensioned**][**Slip critical**].
- B. Weld Connections: Comply with AWS D1.1/D1.1M[**and AWS D1.8/D1.8M**] for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.12 PREFABRICATED BUILDING COLUMNS

- A. Prefabricated Building Columns: Prefabricated building columns, consisting of load-bearing structural-steel members protected by concrete fireproofing encased in an outer non-load-bearing steel shell.
 - 1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
 - a. [**Black Rock Fireproof Column, a division of United Steel**]
 - b. [**Dean Lally LLC / FireTrol Columns**]

- c. **<Insert manufacturer's name>**
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Black Rock Fireproof Column, a division of United Steel]**
 - b. **[Dean Lally LLC / FireTrol Columns]**
 - c. **<Insert manufacturer's name>**
- B. Fire-Resistance Ratings: Provide prefabricated building column listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for ratings indicated, based on testing in accordance with ASTM E119.
 - 1. Fire-Resistance Design: UL Design No. **<Insert designation>**.
 - 2. Fire-Resistance Rating: **[Four hours][Three hours][Two hours][As indicated on Drawings]**.

2.13 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.
 - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
 - 2. Galvanize **[lintels][shelf angles][and][welded door frames]** attached to structural-steel frame and located in exterior walls.

2.14 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of **2 inches (50 mm)**.
 - 2. Surfaces to be field welded.
 - 3. Surfaces of high-strength bolted, slip-critical connections.
 - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 - 5. Galvanized surfaces **[unless indicated to be painted]**.
 - 6. Corrosion-resisting (weathering) steel surfaces.
 - 7. Surfaces enclosed in interior construction.
- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
 - 1. SSPC-SP 2.
 - 2. SSPC-SP 3.
 - 3. SSPC-SP 7 (WAB)/NACE WAB-4.
 - 4. SSPC-SP 14 (WAB)/NACE WAB-8.
 - 5. SSPC-SP 11.
 - 6. SSPC-SP 6 (WAB)/NACE WAB-3.
 - 7. SSPC-SP 10 (WAB)/NACE WAB-2.
 - 8. SSPC-SP 5 (WAB)/NACE WAB-1.
 - 9. SSPC-SP 8.

- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner **[or in accordance with SSPC-SP 16]**.
- D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of **1.5 mils (0.038 mm)**. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.15 SOURCE QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform shop tests and inspections.
 - 1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
 - 2. Bolted Connections: Inspect **[and test]** shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 - 3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E165/E165M.
 - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E164.
 - d. Radiographic Inspection: ASTM E94/E94M.
 - 4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear stud connector.
 - b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear stud connectors if weld fracture occurs on shear stud connectors already tested.
 - 5. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.
 - 1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. **[Snug-tighten][Pretension]** anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. **[Comply with manufacturer's written installation instructions for grouting.]**
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection **[unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M].**
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: **[Snug tightened][Pretensioned][Slip critical]**.
- B. Weld Connections: Comply with AWS D1.1/D1.1M **[and AWS D1.8/D1.8M]** for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 2. Remove backing bars or runoff tabs **[where indicated]**, back gouge, and grind steel smooth.
 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.
- C. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

3.5 INSTALLATION OF PREFABRICATED BUILDING COLUMNS

- A. Install prefabricated building columns to comply with ANSI/AISC 360, manufacturer's written recommendations, and requirements of testing and inspecting agency that apply to the fire-resistance rating indicated.

3.6 REPAIR

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting:
 1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 2. Cleaning and touchup painting are specified in **[Section 099113 "Exterior Painting."][Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings.]**
- C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

3.7 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
 1. Verify structural-steel materials and inspect steel frame joint details.
 2. Verify weld materials and inspect welds.
 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.

1. Bolted Connections: Inspect[**and test**] bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
 - a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1) Liquid Penetrant Inspection: ASTM E165/E165M.
 - 2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - 3) Ultrasonic Inspection: ASTM E164.
 - 4) Radiographic Inspection: ASTM E94/E94M.
3. Shear Stud Connectors: In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - b. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

END OF SECTION 05 12 00 00

SECTION 05 12 00 00A - ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Architecturally exposed structural steel (AESS).
2. Section 051200 "Structural Steel Framing" requirements that also apply to AESS.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for **[steel lintels and shelf angles not attached to structural-steel frame][miscellaneous steel fabrications][and][other metal items]** not defined as structural steel.
2. **[Section 099113 "Exterior Painting"]****[Section 099123 "Interior Painting"]****[and]****[Section 099600 "High-Performance Coatings"]** for surface preparation and priming requirements.

1.2 DEFINITIONS

- A. AESS: Architecturally exposed structural steel.
- B. Category AESS 1: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 1 and may be designated AESS 1 or Category AESS 1 in the Contract Documents.
- C. Category AESS 2: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 2 and is designated as AESS 2 or Category AESS 2 in the Contract Documents.
- D. Category AESS 3: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 3 and is designated as AESS 3 or Category AESS 3 in the Contract Documents.
- E. Category AESS 4: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 4 and is designated as AESS 4 or Category AESS 4 in the Contract Documents.
- F. Category AESS C: Structural steel with custom characteristics that is categorized by ANSI/AISC 303, Section 10, as AESS C and is designated as AESS C or Category AESS C in the Contract Documents.
- G. SEAC/RMSCA Guide Specification: SEAC/RMSCA's "Sample Specification, Section 05 02 13: Architecturally Exposed Structural Steel."

1.3 COORDINATION

- A. Coordinate surface preparation requirements for shop-primed items.
- B. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.5 ACTION SUBMITTALS

- A. Product Data:

1. Tension-control, high-strength, bolt-nut-washer assemblies.
2. Corrosion-resisting (weathering steel), tension-control, high-strength, bolt-nut-washer assemblies.
3. Filler.
4. Primer.
5. Galvanized-steel primer.
6. Etching cleaner.
7. Galvanized repair paint.

- B. Sustainable Design Submittals:

1. Environmental Product Declaration: For each product.
2. Health Product Declaration: For each product.
3. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
4. Environmental Product Declaration: For each product.
5. Environmental Product Declaration: For each product.
6. Environmental Product Declaration: For each product.
7. Third-Party Certifications: For each product.
8. Third-Party Certified Life Cycle Assessment: For each product.
9. Health Product Declaration (HPD): For each product.
10. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

- C. Shop Drawings: Show fabrication of AESS components. **[Shop Drawings for structural steel may be used for AESS.]**

1. Identify AESS category for each steel member and connection, including transitions between AESS categories and between AESS and non-AESS.
2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
3. Include embedment Drawings.
4. Indicate orientation of mill marks and HSS seams.
5. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. **[Indicate grinding, finish, and profile of welds.]**
6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate orientation and location of bolt heads.
7. Indicate exposed surfaces and edges and surface preparation being used.
8. Indicate special tolerances and erection requirements.
9. Indicate weep holes for HSS **[and vent holes for galvanized HSS]**.
10. Indicate surface preparation, primer, and coating requirements, including systems specified in other Sections.

- D. Samples: Submit Samples to set quality standards for AESS.

1. Two steel plates, **3/8 by 8 by 4 inches (9.5 by 200 by 100 mm)**, with long edges joined by a groove weld **[and with weld ground smooth]**.
2. Steel plate, **3/8 by 8 by 8 inches (9.5 by 200 by 200 mm)**, with one end of a short length of

rectangular steel tube, **4 by 6 by 3/8 inches (100 by 150 by 9.5 mm)**, welded to plate with a continuous fillet weld[**and with weld ground smooth and blended**].

3. Round steel tube or pipe, minimum **8 inches (200 mm)** in diameter, with end of another round steel tube or pipe, approximately **4 inches (100 mm)** in diameter, welded to its side at a 45-degree angle with a continuous fillet weld[**and with weld ground smooth and blended**].

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For [Installer][fabricator][shop-painting applicator].
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172) and is experienced in fabricating AESS similar to that indicated on this Project.
- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program, is designated an AISC-Certified Erector, [**Category ACSE**][**Category CSE**], and is experienced in erecting AESS similar to that indicated on this Project.
- C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint [**Endorsement P1**][**Endorsement P2**][**Endorsement P3**] or SSPC-QP 3.
- D. Mockups: Build mockups of AESS to set quality standards for fabrication and installation.
 1. Build mockup of typical portion of AESS as shown on Drawings.
 2. Coordinate painting requirements with [**Section 099113 "Exterior Painting."**][**Section 099123 "Interior Painting."**]
 3. Coordinate high-performance coatings requirements with Section 099600 "High-Performance Coatings."
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Use special care in handling AESS to prevent twisting, warping, nicking, and other damage during fabrication, delivery, and erection. Store materials to permit easy access for inspection and identification. Keep AESS members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect AESS members and packaged materials from corrosion and deterioration.
 1. Do not store AESS materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.9 FIELD CONDITIONS

- A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions

by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with requirements of ANSI/AISC 303, Sections 1 through 9 and as modified in Section 10, "Architecturally Exposed Structural Steel."

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. Tension-Control, High-Strength, Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, round-head assemblies consisting of steel structural bolts with splined ends; **ASTM A563, Grade DH, (ASTMA563M, Class 10S)** heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 - 1. Finish: **[Plain][Mechanically deposited zinc coating]**.
- B. Corrosion-Resisting (Weathering) Steel, Tension-Control, High-Strength, Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 3, round-head assemblies consisting of steel structural bolts with splined ends; **ASTM A563, Grade DH3, (ASTM A563M, Class 10S3)** heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 3, hardened carbon-steel washers.

2.3 FILLER

- A. Polyester filler intended for use in repairing dents in automobile bodies.

2.4 PRIMER

- A. Steel Primer:
 - 1. Comply with **[Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."][Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."]**
 - 2. SSPC-Paint 23, latex primer.
 - 3. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Galvanized-Steel Primer: **[MPI#26][MPI#80][MPI#134]**.
 - 1. Etching Cleaner: MPI#25, for galvanized steel.
 - 2. Galvanizing Repair Paint: **[MPI#18, MPI#19, or SSPC-Paint 20][ASTM A780/A780M]**.

2.5 FABRICATION

- A. Shop fabricate and assemble AECS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.

1. Use special care handling and fabricating AESS before and after shop painting to minimize damage to shop finish.

B. Category AESS 1:

1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
4. Make intermittent welds appear continuous, using filler or additional welding.
5. Seal weld open ends of hollow structural sections with **3/8-inch (9.5-mm)** closure plates.
6. Limit butt and plug weld projections to **1/16 inch (1.6 mm)**.
7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
8. Remove weld spatter, slivers, and similar surface discontinuities.
9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
10. Grind tack welds smooth unless incorporated into final welds.
11. Remove backing and runoff tabs, and grind welds smooth.

C. Category AESS 2:

1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
4. Make intermittent welds appear continuous, using filler or additional welding.
5. Seal weld open ends of hollow structural sections with **3/8-inch (9.5-mm)** closure plates.
6. Limit butt and plug weld projections to **1/16 inch (1.6 mm)**.
7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
8. Remove weld spatter, slivers, and similar surface discontinuities.
9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
10. Grind tack welds smooth unless incorporated into final welds.
11. Remove backing and runoff tabs, and grind welds smooth.
12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.
13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.
14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
15. Conceal fabrication and erection markings from view in the completed structure.
16. Make welds uniform and smooth.

D. Category AESS 3:

1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.

2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
4. Make intermittent welds appear continuous, using filler or additional welding.
5. Seal weld open ends of hollow structural sections with **3/8-inch (9.5-mm)** closure plates.
6. Limit butt and plug weld projections to **1/16 inch (1.6 mm)**.
7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
8. Remove weld spatter, slivers, and similar surface discontinuities.
9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
10. Grind tack welds smooth unless incorporated into final welds.
11. Remove backing and runoff tabs, and grind welds smooth.
12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.
13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.
14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
15. Conceal fabrication and erection markings from view in the completed structure.
16. Make welds uniform and smooth.
17. Cut out mill marks from mill material or hide these markings from view in the completed structure. Where neither method is possible, remove mill marks by grinding and filling surfaces as approved by Architect.
18. Grind butt and plug welds smooth or fill, removing weld splatter exposed to view.
19. Orient HSS seams as indicated or away from view.
20. Align and match abutting member cross sections.
21. At visible open joints of copes, miters, and cuts, maintain uniform clear gaps of **1/8 inch (3.2 mm)**. At closed joints, maintain uniform contact within **1/16 inch (1.6 mm)**.
22. Fabricate with exposed surfaces smooth, square, and of surface quality approved by Architect.

E. Category AESS 4:

1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
4. Make intermittent welds appear continuous, using filler or additional welding.
5. Seal weld open ends of hollow structural sections with **3/8-inch (9.5-mm)** closure plates.
6. Limit butt and plug weld projections to **1/16 inch (1.6 mm)**.
7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
8. Remove weld spatter, slivers, and similar surface discontinuities.
9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
10. Grind tack welds smooth unless incorporated into final welds.
11. Remove backing and runoff tabs, and grind welds smooth.
12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.
13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.

14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
15. Conceal fabrication and erection markings from view in the completed structure.
16. Make welds uniform and smooth.
17. Cut out mill marks from mill material or hide these markings from view in the completed structure. Where neither method is possible, remove mill marks by grinding and filling surfaces as approved by Architect.
18. Grind butt and plug welds smooth or fill, removing weld splatter exposed to view.
19. Orient HSS seams as indicated or away from view.
20. Align and match abutting member cross sections.
21. At visible open joints of copes, miters, and cuts, maintain uniform clear gaps of **1/8 inch (3.2 mm)**. At closed joints, maintain uniform contact within **1/16 inch (1.6 mm)**.
22. Fabricate with exposed surfaces smooth, square, and of surface quality approved by Architect.
23. Treat HSS seams to appear seamless.
24. Contour and blend welds and weld transitions between members, removing splatter exposed to view.
25. Fill surface imperfections with filler and sand smooth to achieve surface quality approved by Architect.
26. Minimize weld show-through and distortion on the opposite side of exposed connections by grinding to a smooth profile aligned with adjacent material.

F. Erection marks, painted marks, and other marks are permitted on **[galvanized-][corrosion-resisting (weathering)]** steel surfaces of completed structure.

G. Cleaning Corrosion-Resisting (Weathering) AESS: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 6 (WAB)/NACE WAB-3.

2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 1. Joint Type: **[Snug tightened][Pretensioned][Slip critical]**.
- B. Weld Connections: Comply with AWS D1.1/D1.1M **[and AWS D1.8/D1.8M]** for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.7 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123/A123M.
 1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
 3. Galvanize AESS **[lintels]<Insert description>** attached to structural-steel frame and located in exterior walls.

2.8 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a

- depth of **2 inches (50 mm)**.
- 2. Surfaces to be field welded.
- 3. Surfaces to be high-strength bolted with slip-critical connections.
- 4. Corrosion-resisting (weathering) steel surfaces.
- 5. Galvanized surfaces [**unless indicated to be painted**].

B. Surface Preparation: Clean nongalvanized surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

- 1. SSPC-SP 2.
- 2. SSPC-SP 3.
- 3. SSPC-SP 7 (WAB)/NACE WAB-4.
- 4. SSPC-SP 14 (WAB)/NACE WAB-8.
- 5. SSPC-SP 11.
- 6. SSPC-SP 6 (WAB)/NACE WAB-3.
- 7. SSPC-SP 10 (WAB)/NACE WAB-2.
- 8. SSPC-SP 5 (WAB)/NACE WAB-1.
- 9. SSPC-SP 8.

C. Preparing Galvanized Steel for Shop Priming: After galvanizing, thoroughly clean steel of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner [**or according to SSPC-SP 16**].

D. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of **1.5 mils (0.038 mm)**. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

- 1. Stripe paint corners, crevices, bolts, welds, and eased edges.
- 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
 - 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments, showing dimensions, locations, angles, and elevations.
- B. Examine AECS for twists, kinks, warping, gouges, and other imperfections before erecting.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep AECS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in

place unless otherwise indicated.

3.3 ERECTION

- A. Take special care during erection to avoid marking or distorting the AESS and to minimize damage to shop painting. Set AESS accurately in locations and to elevations indicated and according to ANSI/AISC 303 and ANSI/AISC 360.
1. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Take care to avoid any blemishes, holes, or unsightly surfaces resulting from the use or removal of temporary elements.
 2. Grind tack welds smooth.
 3. Remove backing and runoff tabs, and grind welds smooth.
 4. Orient bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
 5. Remove erection bolts in **[Category AESS 4]<Insert category>** AESS, fill holes with weld metal or filler, and grind or sand smooth to achieve surface quality approved by Architect.
 6. Fill weld access holes in **[Category AESS 4]<Insert category>** AESS with weld metal or filler and grind, or sand smooth to achieve surface quality as approved by Architect.
 7. Conceal fabrication and erection markings from view in the completed structure.
- B. In addition to ANSI/AISC 303, Section 10 requirements, comply with the following.
1. Erection of **[Category AESS 1][and Category AESS 2]**:
 - a. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.
 - b. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
 - c. Remove weld spatter, slivers, and similar surface discontinuities.
 - d. Grind off butt and plug weld projections larger than **1/16 inch (1.6 mm)**.
 - e. Continuous welds are to be of uniform size and profile.
 - f. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
 - g. Splice members only where indicated on Drawings.
 - h. No torch cutting or field fabrication is permitted.
 2. Erection of Category AESS 3:
 - a. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.
 - b. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
 - c. Remove weld spatter, slivers, and similar surface discontinuities.
 - d. Grind off butt and plug weld projections larger than **1/16 inch (1.6 mm)**.
 - e. Continuous welds are to be of uniform size and profile.
 - f. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
 - g. Splice members only where indicated on Drawings.
 - h. No torch cutting or field fabrication is permitted.
 - i. Weld profiles, quality, and finish are to be as approved by Architect.
 - j. Make joint welds, including tack welds, appear continuous by filling intermittent welds.
 3. Erection of Category AESS 4:
 - a. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.
 - b. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain

- c. true alignment of members without warp exceeding specified tolerances.
 - d. Remove weld spatter, slivers, and similar surface discontinuities.
 - e. Grind off butt and plug weld projections larger than **1/16 inch (1.6 mm)**.
 - f. Continuous welds are to be of uniform size and profile.
 - g. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
 - h. Splice members only where indicated on Drawings.
 - i. No torch cutting or field fabrication is permitted.
 - j. Weld profiles, quality, and finish are to be as approved by Architect.
 - k. Make joint welds, including tack welds, appear continuous by filling intermittent welds.
 - l. Grind welds smooth.
 - m. Minimize weld show-through and distortion on the opposite side of exposed connections by grinding to a smooth profile aligned with adjacent material.
 - n. Oversize welds where ground, contoured, or blended, and grind to provide a smooth transition, matching profile approved by Architect.

4. Erection of Category AESS C:

- a. **<Insert requirements>**.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: **[Snug tightened][Pretensioned][Slip critical]**.
- B. Weld Connections: Comply with AWS D1.1/D1.1M **[and AWS D1.8/D1.8M]** for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

3.5 REPAIR

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and touchup galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting, to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 - 2. Cleaning and touchup painting are specified in **[Section 099113 "Exterior Painting."][Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings.]**
- C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."



3.6 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to inspect AECS as specified in Section 051200 "Structural Steel Framing." The testing agency is not responsible for enforcing requirements relating to aesthetic effect.
- B. Architect will observe AECS in place to determine acceptability relating to aesthetic effect.

END OF SECTION 05 12 00 00A

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Task	Specification	Specification Description
05 12 23 00	05 12 00 00	Structural Steel Framing
05 12 23 00	05 12 00 00a	Architecturally Exposed Structural Steel Framing
05 12 23 00	05 40 00 00	Cold-Formed Metal Framing
05 12 23 00	05 50 00 00	Metal Fabrications
05 12 33 00	05 12 00 00	Structural Steel Framing
05 12 33 00	05 12 00 00a	Architecturally Exposed Structural Steel Framing
05 13 00 00	05 12 00 00	Structural Steel Framing
05 13 00 00	05 50 00 00	Metal Fabrications
05 14 13 00	01 11 19 00	No Specification Required
05 15 16 00	05 50 00 00	Metal Fabrications
05 15 16 00	05 70 00 00	Decorative Metal
05 15 19 00	05 70 00 00	Decorative Metal



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SECTION 05 21 00 00 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel joists and joist girders.
2. Primers.
3. Steel joist accessories.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing bearing plates in concrete.
2. Section 042000 "Unit Masonry" for installing bearing plates in unit masonry.
3. Section 051200 "Structural Steel Framing" for field-welded shear connectors.

1.2 DEFINITIONS

- A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
3. Indicate locations and details of bearing plates to be embedded in other construction.

C. Delegated Design Submittals: For steel joist framing, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. **<Insert additional requirements if needed>.**

D. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for recycled content.>
2. <Double click to insert sustainable design text for EPDs and HPDs.>
3. <Double click here to insert sustainable design text for Health Product Declaration.>
4. <Double click here to insert sustainable design text for sourcing of raw materials.>



1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- C. Mill Certificates: For each type of bolt.
- D. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.
- E. Field quality control reports.
- F. Qualification Statements: For [manufacturer] [Erector] [testing agency].
- G. Delegated Design Engineer Qualifications: For steel joist framing.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications[.]" and **"Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice."**
 - 1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.
- B. Erector Qualifications: An experienced Erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- C. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in [state] <Insert jurisdiction> where Project is located and who is experienced in providing engineering services of the type indicated.
- D. Welding Qualifications: Qualify field-welding procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications[.]" and **"Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice."**
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.7 SEQUENCING

- A. Deliver steel bearing plates to be built into [cast-in-place concrete] [and] [masonry] construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design steel joist framing.
- B. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated on Drawings.
 - 1. Use **[ASD; data are given at service-load level]** **[LRFD; data are given at factored-load level]**.
 - 2. Design special joists to withstand design loads with live-load deflections no greater than the following:
 - a. Floor Joists: Vertical deflection of **[1/360]** **[1/240]** of the span.
 - b. Roof Joists: Vertical deflection of **[1/360]** **[1/240]** of the span.
- C. **<Insert requirements>**.
- D. <Double click to insert sustainable design text for recycled content.>

2.2 STEEL JOISTS AND JOIST GIRDERS

- A. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- B. K-Series Steel Joist: Manufactured steel joists of type indicated in accordance with "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
 - 1. Joist Type: **[K-series steel joists]** **[and] [KCS-type K-series steel joists]**.
 - 2. K-Series Steel Joist Substitutes: Manufactured in accordance with "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
 - 3. Provide holes in chord members for connecting and securing other construction to joists.
 - 4. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated on Drawings, complying with SJI's "Specifications."
 - 5. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends as indicated on Drawings, complying with SJI's "Specifications."
 - 6. Do not camber joists.
 - 7. Camber joists **[in accordance with SJI's "Specifications."]** **[as indicated on Drawings.]** **<Insert camber requirements>**.
 - 8. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).
- C. Long-Span Steel Joist: Manufactured in accordance with "Standard Specification for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements[**as follows:**]**[as indicated on Drawings.]**
 - 1. Joist Type: **[LH-series long-span steel joists]** **[and] [DLH-series long-span steel joists]**.
 - 2. End Arrangement: **[Underslung]** **[Square]**.
 - 3. Top-Chord Arrangement: **[Parallel]** **[Pitched 1/8 inch per 12 inches (1:96), one way]** **[Pitched 1/8 inch per 12 inches (1:96), two ways]** **<Insert pitch>**.
 - 4. Provide holes in chord members for connecting and securing other construction to joists.

5. Camber long-span steel joists [**in accordance with SJI's "Specifications."**] [**as indicated on Drawings.**] <Insert camber requirements>.
 6. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).
- D. Composite Steel Joist: Manufactured in accordance with "Standard Specifications for Composite Steel Joists, CJ-Series" in SJI's "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice," with steel-angle top- and bottom-chord members and parallel top chord, and with [**underslung**] [**square**] ends.
1. Camber composite steel joists [**as indicated on Drawings**] <Insert camber requirements>.
- E. Joist Girders: Manufactured in accordance with "Standard Specification for Joist Girders" in SJI's "Specifications," with steel-angle top- and bottom-chord members; with end and top-chord arrangements[**as follows:**][**as indicated on Drawings.**]
1. End Arrangement: [**Underslung**] [**Underslung with bottom-chord extensions**] [**Square**].
 2. Top-Chord Arrangement: [**Parallel**] [**Pitched 1/8 inch per 12 inches (1:96), one way**] [**Pitched 1/8 inch per 12 inches (1:96), two ways**] <Insert pitch>.
 3. Provide holes in chord members for connecting and securing other construction to joist girders.
 4. Camber joist girders [**in accordance with SJI's "Specifications."**] [**as indicated on Drawings.**] <Insert camber requirements>.
 5. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches (1:48).

2.3 PRIMERS

- A. Primer:
1. SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.
 2. Provide shop primer that complies with [**Section 099113 "Exterior Painting"**] and [**Section 099123 "Interior Painting."**] [**Section 099600 "High-Performance Coatings."**]

2.4 STEEL JOIST ACCESSORIES

- A. Bridging:
1. Provide bridging anchors and number of rows of [**horizontal**] [**or**] [**diagonal**] bridging of material, size, and type required by SJI's "Specifications"[**and "Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice"**] for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
 2. Detail and fabricate in accordance with SJI's "Specifications[.][" and "**Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice."**] Furnish additional erection bridging if required for stability.
 3. Fabricate as indicated on Drawings and in accordance with SJI's "Specifications[.][" and "**Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice."**] Furnish additional erection bridging if required for stability.

- B. Fabricate steel bearing plates from ASTM A36/A36M steel with integral anchorages of sizes and thicknesses indicated on Drawings. **[Shop prime paint] [Hot-dip zinc coat in accordance with ASTM A123/A123M].**
- C. Steel bearing plates with integral anchorages are specified in Section 055000 "Metal Fabrications."
- D. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction.
 - 1. Extend ends to within 1/2 inch (13 mm) of finished wall surface unless otherwise indicated on Drawings.
 - 2. Finish: **[Plain, uncoated] [Hot-dip zinc coating, ASTM A153/A153M, Class C] [Mechanically deposited zinc coating, ASTM B695, Class 50].**
- E. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563/A563M, Grade DH (Grade 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 - 1. Finish: **[Plain] [Hot-dip zinc coating, ASTM A153/A153M, Class C] [Mechanically deposited zinc coating, ASTM B695, Class 50].**
- F. Welding Electrodes: Comply with AWS standards.
- G. Galvanizing Repair Paint: **[MPI#18, MPI#19, or SSPC-Paint 20] [ASTM A780/A780M].**
- H. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.5 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by **[hand-tool cleaning, SSPC-SP 2] [or] [power-tool cleaning, SSPC-SP 3].**
- B. Do not prime paint joists and accessories **[to receive sprayed fire-resistive materials].**
- C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil (0.025 mm) thick.
- D. Shop priming of joists and joist accessories is specified in **[Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."]** **[Section 099600 "High-Performance Coatings."]**

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF STEEL JOISTS AND JOIST GIRDERS

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction in accordance with SJI's "Specifications,]" and **"Standard Specification for Composite Steel Joists, CJ-Series"** in **"Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice,]"** joist manufacturer's written instructions, and requirements in this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.
 - 2. Space, adjust, and align joists accurately in location before permanently fastening.
 - 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 - 4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.
- C. Field weld joists to supporting steel **[bearing plates] [and] [framework]**. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- D. Bolt joists to supporting steel framework using carbon-steel bolts.
- E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for high-strength structural bolt installation and tightening requirements.
- F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 REPAIRS

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.
- B. Touchup Painting:
 - 1. Immediately after installation, clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists[, **bearing plates,**] **[abutting structural steel,]** and accessories.
 - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 - b. Apply a compatible primer of same type as primer used on adjacent surfaces.
 - 2. Cleaning and touchup painting are specified in **[Section 099113 "Exterior Painting" and Section 099123 "Interior Painting.]" [Section 099600 "High-Performance Coatings.]"**

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage] [Engage]** a qualified testing agency to perform tests and inspections.



- B. Visually inspect field welds in accordance with AWS D1.1/D1.1M.
- C. Visually inspect bolted connections.
- D. Prepare test and inspection reports.

END OF SECTION 05 21 00 00



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Task	Specification	Specification Description
05 21 19 00	05 21 00 00	Steel Joist Framing



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SECTION 05 31 00 00 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.
2. Acoustical roof deck.
3. Composite floor deck.
4. Electrified cellular floor deck.
5. Noncomposite form deck.
6. Noncomposite vented form deck.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
2. Section 035216 "Lightweight Insulating Concrete" for lightweight insulating concrete fill over steel deck.
3. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
4. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Roof deck.
2. Acoustical roof deck.
3. Composite floor deck.
4. Electrified cellular floor deck.
5. Noncomposite form deck.
6. Noncomposite vented form deck.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

C. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Environmental Product Declaration (EPD): For each product.
4. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.

5. Environmental Product Declaration: For each product.
6. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
7. Environmental Product Declaration: For each product.
8. Environmental Product Declaration: For each product.
9. Third-Party Certifications: For each product.
10. Third-Party Certified Life Cycle Assessment: For each product.
11. Health Product Declaration (HPD): For each product.
12. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of steel deck.
- C. Test and Evaluation Reports:
 1. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - a. Power-actuated mechanical fasteners.
 - b. Acoustical roof deck.
 2. Research Reports: For steel deck, from ICC-ES showing compliance with the building code.
- D. Field Quality-Control Submittals:
 1. Field quality-control reports.
- E. Qualification Statements: For **[welding personnel][and][testing agency]**.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding codes:
 1. AWS D1.1/D1.1M.
 2. AWS D1.3/D1.3M.
- B. Electrical Raceway Units: Provide UL-labeled cellular floor-deck units complying with UL 209 and listed in UL's "Electrical Construction Equipment Directory" for use with standard header ducts and outlets for electrical distribution systems.
- C. FM Approvals' RoofNav Listing: Provide steel roof deck evaluated by FM Approvals and listed in its "RoofNav" for Class 1 fire rating and **[Class 1-60][Class 1-75][Class 1-90]** windstorm ratings. Identify materials with FM Approvals Certification markings.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck in accordance with AISI S100.
- B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.
- C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25]<Insert value> percent.

2.2 ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - 1. **[ASC Steel Deck; ASC Profiles, LLC]**
 - 2. **[Canam Buildings US Inc.; Canam Group Inc.]**
 - 3. **[Cordeck]**
 - 4. **[CSM Metal Deck]**
 - 5. **[DACS, Inc.]**
 - 6. **[Epic Metals Corporation]**
 - 7. **[Marlyn Steel Decks, Inc.]**
 - 8. **[Miami Metal Deck]**
 - 9. **[New Millennium Building Systems, LLC]**
 - 10. **[OEG Building Materials Inc]**
 - 11. **[Roof Deck, Inc]**
 - 12. **[Tristate Decking, Inc.]**
 - 13. **[Valley Joist]**
 - 14. **[Verco Decking, Inc.; a Nucor company]**
 - 15. **[Vulcraft Group; Division of Nucor Corp.]**
 - 16. **[Vulcraft/Verco Group; a division of Nucor Corp.]**
 - 17. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

1. [ASC Steel Deck; ASC Profiles, LLC]
2. [Canam Buildings US Inc.; Canam Group Inc.]
3. [Cordeck]
4. [CSM Metal Deck]
5. [DACS, Inc.]
6. [Epic Metals Corporation]
7. [Marlyn Steel Decks, Inc.]
8. [Miami Metal Deck]
9. [New Millennium Building Systems, LLC]
10. [OEG Building Materials Inc]
11. [Roof Deck, Inc]
12. [Tristate Decking, Inc.]
13. [Valley Joist]
14. [Verco Decking, Inc.; a Nucor company]
15. [Vulcraft Group; Division of Nucor Corp.]
16. [Vulcraft/Verco Group; a division of Nucor Corp.]
17. <Insert manufacturer's name>

C. Fabrication of Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:

1. Prime-Painted Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), [Grade 33 (230)][Grade 40 (275)][Grade 80 (550)] minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: [Manufacturer's standard][Gray][White][Gray top surface with white underside].
2. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), [Grade 33 (230)][Grade 40 (275)][Grade 80 (550)], [G60 (Z180)][G90 (Z275)] zinc coating.
3. Galvanized- and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), [Grade 33 (230)][Grade 40 (275)][Grade 80 (550)], G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: [Manufacturer's standard][Gray][White][Gray top surface with white underside].
4. Aluminum-Zinc-Alloy-Coated Steel Sheet: ASTM A792/A792M, Structural Steel (SS), Grade 33 (230) minimum, AZ50 (AZ150) aluminum-zinc-alloy coating.
5. Deck Profile: [As indicated][Type NR, narrow rib][Type IR, intermediate rib][Type WR, wide rib][Type 3DR, deep rib][Long span].
6. Cellular Deck Profile: [As indicated][Type WR, wide rib][Type 3DR, deep rib][Long span], with bottom plate.
7. Profile Depth: [As indicated][1-1/2 inches (38 mm)][2 inches (51 mm)][3 inches (76 mm)][4-1/2 inches (114 mm)][6 inches (152 mm)][7-1/2 inches (190 mm)].
8. Design Uncoated-Steel Thickness: [As indicated][0.0295 inch (0.75 mm)][0.0358 inch (0.91 mm)][0.0474 inch (1.20 mm)][0.0598 inch (1.52 mm)][0.0747 inch (1.90 mm)].
9. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: [As indicated][0.0358/0.0358 inch (0.91/0.91 mm)][0.0358/0.0474 inch (0.91/1.20 mm)][0.0474/0.0474 inch (1.20/1.20 mm)][0.0474/0.0598 inch (1.20/1.52 mm)][0.0598/0.0474 inch (1.52/1.20 mm)][0.0598/0.0598 inch (1.52/1.52 mm)].
10. Span Condition: [As indicated][Simple span][Double span][Triple span or more].
11. Side Laps: [Overlapped][Interlocking seam][Overlapped or interlocking seam at Contractor's option].

2.3 ACOUSTICAL ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
1. **[ASC Steel Deck; ASC Profiles, LLC]**
 2. **[Canam Buildings US Inc.; Canam Group Inc.]**
 3. **[Cordeck]**
 4. **[DACS, Inc.]**
 5. **[Epic Metals Corporation]**
 6. **[Marlyn Steel Decks, Inc.]**
 7. **[Miami Metal Deck]**
 8. **[Roof Deck, Inc]**
 9. **[Vulcraft Group; Division of Nucor Corp.]**
 10. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[ASC Steel Deck; ASC Profiles, LLC]**
 2. **[Canam Buildings US Inc.; Canam Group Inc.]**
 3. **[Cordeck]**
 4. **[DACS, Inc.]**
 5. **[Epic Metals Corporation]**
 6. **[Marlyn Steel Decks, Inc.]**
 7. **[Miami Metal Deck]**
 8. **[Roof Deck, Inc]**
 9. **[Vulcraft Group; Division of Nucor Corp.]**
 10. **<Insert manufacturer's name>**
- C. Fabrication of Acoustical Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:
1. Prime-Painted Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), **[Grade 33 (230)][Grade 40 (275)][Grade 80 (550)]** minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: **[Manufacturer's standard][Gray][White][Gray top surface with white underside].**
 2. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), **[Grade 33 (230)][Grade 40 (275)][Grade 80 (550)]**, **[G60 (Z180)][G90 (Z275)]** zinc coating.
 3. Galvanized- and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), **[Grade 33 (230)][Grade 40 (275)][Grade 80 (550)]**, **G60 (Z180)** zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: **[Manufacturer's standard][Gray][White][Gray top surface with white underside].**
 4. Aluminum-Zinc-Alloy-Coated Steel Sheet: ASTM A792/A792M, Structural Steel (SS), Grade **33 (230)** minimum, **AZ50 (AZ150)** aluminum-zinc-alloy coating.
 5. Deck Profile: **[As indicated][Type WR, wide rib][Type 3DR, deep rib][Long span].**
 6. Cellular Deck Profile: **[As indicated][Type WR, wide rib][Type 3DR, deep rib][Long span]**, with bottom plate.
 7. Profile Depth: **[As indicated][1-1/2 inches (38 mm)][2 inches (50 mm)][3 inches (76 mm)][4-1/2 inches (114 mm)][6 inches (152 mm)][7-1/2 inches (190 mm)].**
 8. Design Uncoated-Steel Thickness: **[As indicated][0.0295 inch (0.75 mm)][0.0358 inch (0.91**

- mm)][0.0474 inch (1.20 mm)][0.0598 inch (1.52 mm)].
9. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: **[As indicated][0.0358/0.0358 inch (0.91/0.91 mm)][0.0358/0.0474 inch (0.91/1.20 mm)][0.0474/0.0358 inch (1.20/0.91 mm)][0.0474/0.0474 inch (1.20/1.20 mm)][0.0474/0.0598 inch (1.20/1.52 mm)][0.0598/0.0474 inch (1.52/1.20 mm)][0.0598/0.0598 inch (1.52/1.52 mm)]**.
 10. Span Condition: **[As indicated][Simple span][Double span][Triple span or more]**.
 11. Side Laps: **[Overlapped][Interlocking seam][Overlapped or interlocking seam at Contractor's option]**.
 12. Acoustical Perforations: **[Deck units with manufacturer's standard perforated vertical webs][Cellular deck units with manufacturer's standard perforated flat-bottom plate welded to ribbed deck]**.
 13. Sound-Absorbing Insulation: Manufacturer's standard premolded roll or strip of glass or mineral fiber. **<Insert actual physical properties and thicknesses of insulation>**.
 - a. Factory install sound-absorbing insulation into cells of cellular deck.
 - b. Installation of sound-absorbing insulation is specified in **<Insert Section number and title>**.
 14. Acoustical Performance: NRC **[0.65][0.75][0.80][0.85][0.90]**, tested in accordance with ASTM C423.

2.4 COMPOSITE FLOOR DECK

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 1. **[ASC Steel Deck; ASC Profiles, LLC]**
 2. **[Canam Buildings US Inc.; Canam Group Inc.]**
 3. **[Cordeck]**
 4. **[CSM Metal Deck]**
 5. **[DACS, Inc.]**
 6. **[Epic Metals Corporation]**
 7. **[Marlyn Steel Decks, Inc.]**
 8. **[Miami Metal Deck]**
 9. **[New Millennium Building Systems, LLC]**
 10. **[OEG Building Materials Inc]**
 11. **[Roof Deck, Inc]**
 12. **[Tristate Decking, Inc.]**
 13. **[Verco Decking, Inc.; a Nucor company]**
 14. **[Vulcraft Group; Division of Nucor Corp.]**
 15. **[Vulcraft/Verco Group; a division of Nucor Corp.]**
 16. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 1. **[ASC Steel Deck; ASC Profiles, LLC]**
 2. **[Canam Buildings US Inc.; Canam Group Inc.]**
 3. **[Cordeck]**
 4. **[CSM Metal Deck]**
 5. **[DACS, Inc.]**
 6. **[Epic Metals Corporation]**
 7. **[Marlyn Steel Decks, Inc.]**

8. **[Miami Metal Deck]**
9. **[New Millennium Building Systems, LLC]**
10. **[OEG Building Materials Inc]**
11. **[Roof Deck, Inc]**
12. **[Tristate Decking, Inc.]**
13. **[Verco Decking, Inc.; a Nucor company]**
14. **[Vulcraft Group; Division of Nucor Corp.]**
15. **[Vulcraft/Verco Group; a division of Nucor Corp.]**
16. **<Insert manufacturer's name>**

- C. Fabrication of Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with SDI C, with the minimum section properties indicated, and with the following:

1. Prime-Painted Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), **[Grade 33 (230)][Grade 40 (275)][Grade 80 (550)]** minimum, with top surface phosphatized and unpainted and underside surface shop primed with manufacturers' standard **[gray][or][white]** baked-on, rust-inhibitive primer.
2. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade **33 (230)**, **[G30 (Z90)][G60 (Z180)][G90 (Z275)]** zinc coating.
3. Galvanized- and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade **33 (230)**, **[G30 (Z90)][G60 (Z180)]** zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard **[gray][white]** baked-on, rust-inhibitive primer.
4. Profile Depth: **[1-1/2 inches (38 mm)][2 inches (51 mm)][3 inches (76 mm)][As indicated]**.
5. Design Uncoated-Steel Thickness: **[0.0295 inch (0.75 mm)][0.0358 inch (0.91 mm)][0.0474 inch (1.20 mm)][0.0598 inch (1.52 mm)]**.
6. Span Condition: **[As indicated][Simple span][Double span][Triple span or more]**.

2.5 ELECTRIFIED CELLULAR FLOOR DECK

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[Cordeck]**
 2. **[HH Robertson]**
 3. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Cordeck]**
 2. **[HH Robertson]**
 3. **<Insert manufacturer's name>**
- C. Source Limitations for Electrified Cellular Floor Deck: Obtain cellular floor-deck units and compatible electrical components, such as preset inserts, activation kits, afterset inserts, service fittings, header ducts, and trench header ducts, from single manufacturer.
- D. Fabrication of Electrified Cellular Floor Deck: Fabricate steel sheet cellular floor-deck panels, consisting of a ribbed top section welded to a lower flat-bottom sheet with interlocking side laps, to comply with SDI C. Fabricate deck to the minimum section properties, width of panel, number, and area of cells per panel indicated.

1. Cellular Deck Type: **[Composite][Noncomposite]**.
2. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade **33 (230)**, **[G60 (Z180)][G90 (Z275)]** zinc coating.
3. Galvanized- and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade **33 (230)**, **G60 (Z180)** zinc coating; with underside surface cleaned, pretreated, and primed with manufacturer's standard **[gray][white]** baked-on, rust-inhibitive primer.
4. Profile Depth: **[1-1/2 inches (38 mm)][2 inches (51 mm)][3 inches (76 mm)][As indicated]**.
5. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: **[0.0358/0.0358 inch (0.91/0.91 mm)][0.0358/0.0474 inch (0.91/1.20 mm)][0.0358/0.0598 inch (0.91/1.52 mm)][0.0474/0.0358 inch (1.20/0.91 mm)][0.0474/0.0474 inch (1.20/1.20 mm)][0.0474/0.0598 inch (1.20/1.52 mm)][0.0598/0.0474 inch (1.52/1.20 mm)][0.0598/0.0598 inch (1.52/1.52 mm)]**.
6. Span Condition: **[As indicated][Simple span][Double span][Triple span or more]**.
7. Factory punch holes, of size and arrangement indicated, into each deck cell at preset inserts and header duct locations.

2.6 NONCOMPOSITE FORM DECK

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

1. **[ASC Steel Deck; ASC Profiles, LLC]**
2. **[Canam Buildings US Inc.; Canam Group Inc.]**
3. **[Cordeck]**
4. **[CSM Metal Deck]**
5. **[DACS, Inc.]**
6. **[Marlyn Steel Decks, Inc.]**
7. **[Miami Metal Deck]**
8. **[New Millennium Building Systems, LLC]**
9. **[OEG Building Materials Inc]**
10. **[Roof Deck, Inc]**
11. **[Valley Joist]**
12. **[Verco Decking, Inc.; a Nucor company]**
13. **[Vulcraft Group; Division of Nucor Corp.]**
14. **[Vulcraft/Verco Group; a division of Nucor Corp.]**
15. **<Insert manufacturer's name>**

- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

1. **[ASC Steel Deck; ASC Profiles, LLC]**
2. **[Canam Buildings US Inc.; Canam Group Inc.]**
3. **[Cordeck]**
4. **[CSM Metal Deck]**
5. **[DACS, Inc.]**
6. **[Marlyn Steel Decks, Inc.]**
7. **[Miami Metal Deck]**
8. **[New Millennium Building Systems, LLC]**
9. **[OEG Building Materials Inc]**
10. **[Roof Deck, Inc]**
11. **[Valley Joist]**
12. **[Verco Decking, Inc.; a Nucor company]**
13. **[Vulcraft Group; Division of Nucor Corp.]**
14. **[Vulcraft/Verco Group; a division of Nucor Corp.]**

15. <Insert manufacturer's name>

- C. Fabrication of Noncomposite Form Deck: Fabricate ribbed-steel sheet noncomposite deck panels used as a form to comply with SDI NC, with the minimum section properties indicated, and with the following:
1. Uncoated Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), [Grade 33 (230)][Grade 40 (275)][Grade 80 (550)] minimum.
 2. Prime-Painted Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), [Grade 33 (230)][Grade 40 (275)][Grade 80 (550)] minimum, with [top and] underside surface shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: [Manufacturer's standard][Gray][White][Gray top surface with white underside].
 3. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), [Grade 33 (230)][Grade 40 (275)][Grade 80 (550)], [G30 (Z90)][G60 (Z180)][G90 (Z275)] zinc coating.
 4. Galvanized- and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), [Grade 33 (230)][Grade 80 (550)], G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: [Manufacturer's standard][Gray][White][Gray top surface with white underside].
 5. Profile Depth: [9/16 inch (14 mm)][15/16 inch (24 mm)][1-5/16 inches (33 mm)][1-1/2 inches (38 mm)].
 6. Design Uncoated-Steel Thickness: [0.0149 inch (0.38 mm)][0.0179 inch (0.45 mm)][0.0239 inch (0.61 mm)][0.0295 inch (0.75 mm)][0.0358 inch (0.91 mm)][0.0474 inch (1.20 mm)][0.0598 inch (1.52 mm)].
 7. Span Condition: [As indicated][Simple span][Double span][Triple span or more].
 8. Side Laps: [Overlapped][Interlocking seam][Overlapped or interlocking seam at Contractor's option].

2.7 NONCOMPOSITE VENTED FORM DECK

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
1. [ASC Steel Deck; ASC Profiles, LLC]
 2. [Canam Buildings US Inc.; Canam Group Inc.]
 3. [Marlyn Steel Decks, Inc.]
 4. [Miami Metal Deck]
 5. [New Millennium Building Systems, LLC]
 6. [Roof Deck, Inc]
 7. [Verco Decking, Inc.; a Nucor company]
 8. [Vulcraft Group; Division of Nucor Corp.]
 9. [Vulcraft/Verco Group; a division of Nucor Corp.]
 10. <Insert manufacturer's name>
- B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
1. [ASC Steel Deck; ASC Profiles, LLC]
 2. [Canam Buildings US Inc.; Canam Group Inc.]
 3. [Marlyn Steel Decks, Inc.]
 4. [Miami Metal Deck]
 5. [New Millennium Building Systems, LLC]

6. [Roof Deck, Inc]
7. [Verco Decking, Inc.; a Nucor company]
8. [Vulcraft Group; Division of Nucor Corp.]
9. [Vulcraft/Verco Group; a division of Nucor Corp.]
10. <Insert manufacturer's name>

C. Fabrication of Noncomposite Vented Form Deck: Fabricate ribbed- and vented-steel sheet noncomposite deck panels used as a form to comply with SDI NC, and with the following:

1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), [Grade 33 (230)][Grade 40 (275)][Grade 80 (550)], [G30 (Z90)][G60 (Z180)][G90 (Z275)] zinc coating.
2. Galvanized- and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), [Grade 33 (230)][Grade 80 (550)], [G30 (Z90)][G60 (Z180)] zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: [Manufacturer's standard][Gray][White][Gray top surface with white underside].
3. Profile Depth: [9/16 inch (14 mm)][15/16 inch (24 mm)][1-5/16 inches (33 mm)][1-1/2 inches (38 mm)].
4. Design Uncoated-Steel Thickness: [0.0149 inch (0.38 mm)][0.0179 inch (0.45 mm)][0.0239 inch (0.61 mm)][0.0295 inch (0.75 mm)][0.0358 inch (0.91 mm)][0.0474 inch (1.20 mm)][0.0598 inch (1.52 mm)].
5. Span Condition: [As indicated][Simple span][Double span][Triple span or more].
6. Side Laps: [Overlapped][Interlocking seam][Overlapped or interlocking seam at Contractor's option].
7. Vent Slot Area: Manufacturer's standard vent slots providing [1-1/2]<Insert number> percent open area.

2.8 ACCESSORIES

- A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, **No. 10 (4.8-mm)** minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of **33,000 psi (230 MPa)**, not less than **0.0359-inch (0.91-mm)** design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of **33,000 psi (230 MPa)**, of same material and finish as deck, and of thickness and profile [indicated][recommended by SDI standards for overhang and slab depth].
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, [0.0598 inch (1.52 mm)][0.0747 inch (1.90

mm)] thick, with factory-punched hole of **3/8-inch (9.5-mm)** minimum diameter.

- J. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- K. Flat Sump Plates: Single-piece steel sheet, **0.0747 inch (1.90 mm)** thick, of same material and finish as deck. For drains, cut holes in the field.
- L. Recessed Sump Pans: Single-piece steel sheet, **0.0747 inch (1.90 mm)** thick, of same material and finish as deck, with **3-inch- (76-mm-)** wide flanges and **[level][sloped]** recessed pans of **1-1/2-inch (38-mm)** minimum depth. For drains, cut holes in the field.
- M. Galvanizing Repair Paint: **[ASTM A780/A780M][SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight].**
- N. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories in accordance with SDI C, SDI NC, and SDI RD, as applicable; manufacturer's written instructions; and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
 - 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install in accordance with deck manufacturer's written instructions.
- J. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

3.3 INSTALLATION OF ROOF DECK

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than **1-1/2 inches (38 mm)** long, and as follows:
 - 1. Weld Diameter: **[5/8 inch (16 mm)][3/4 inch (19 mm)]**, nominal.
 - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds **[18 inches (460 mm) apart, maximum][12 inches (300 mm) apart in Zone 1 and 6 inches (150 mm) apart in Zones 2 and 3, based on roof-area definitions in FM Global Loss Prevention Data Sheet 1-28][as indicated]**.
 - 3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or **[18 inches (460 mm)][36 inches (1 m)]**, and as follows:
 - 1. Mechanically fasten with self-drilling, **No. 10 (4.8-mm-)** diameter or larger, carbon-steel screws.
 - 2. Mechanically clinch or button punch.
 - 3. Fasten with a minimum of **1-1/2-inch- (38-mm-)** long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of **1-1/2 inches (38 mm)**, with end joints as follows:
 - 1. End Joints: **[Lapped 2 inches (50 mm) minimum][Butted][Lapped 2 inches (50 mm) minimum or butted at Contractor's option]**.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and **[weld][mechanically fasten]** flanges to top of deck. Space **[welds][mechanical fasteners]** not more than **12 inches (300 mm)** apart with at least one **[weld][fastener]** at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and **[weld][or][mechanically fasten]**.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels in accordance with deck manufacturer's written instructions. **[Weld][or][mechanically fasten]** to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive in accordance with manufacturer's written instructions to ensure complete closure.
- G. Sound-Absorbing Insulation: Installation into topside ribs of deck as specified in **<Insert Section number and title>**.

3.4 INSTALLATION OF FLOOR DECK

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: **[5/8 inch (16 mm)][3/4 inch (19 mm)]**, nominal.
 - 2. Weld Spacing:
 - a. Weld edge ribs of panels at each support. Space additional welds an average of **16 inches (400 mm)** apart, but not more than **18 inches (460 mm)** apart.
 - b. Space and locate welds as indicated.
 - 3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or **36 inches (1 m)**, and as follows:
 - 1. Mechanically fasten with self-drilling, **No. 10 (4.8-mm-)** diameter or larger, carbon-steel screws.
 - 2. Mechanically clinch or button punch.
 - 3. Fasten with a minimum of **1-1/2-inch- (38-mm-)** long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of **[1-1/2 inches (38 mm)]<Insert dimension>**, with end joints as follows:
 - 1. End Joints: **[Lapped][Butted][Lapped or butted at Contractor's option]**.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure in accordance with SDI recommendations unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, in accordance with SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.
- F. Electrified Cellular Floor Deck: Install cellular floor system with deck assembled from **[all-cellular units][alternating cellular units with noncellular composite units][units indicated]**.
 - 1. Coordinate layout and installation of trench headers, preset inserts, duct fittings, and other components specified in Section 260539 "Underfloor Raceways for Electrical Systems" with installation of electrified cellular metal floor deck.
- G. Install piercing hanger tabs at **[14 inches (355 mm)]<Insert dimension>** apart in both directions, within **9 inches (228 mm)** of walls at ends, and not more than **12 inches (305 mm)** from walls at sides unless otherwise indicated.

3.5 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.
- B. Repair Painting:
 - 1. Wire brush and clean rust spots, welds, and abraded areas on **[both surfaces][top surface]** of prime-painted deck immediately after installation, and apply repair paint.

2. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
3. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
4. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
 1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SDI QA/QC.
 - a. Field welds will be subject to inspection.
 2. Steel decking will be considered defective if it does not pass tests and inspections.
 3. Shear Stud Connectors: In addition to visual inspection, test and inspect field-welded shear connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
 - b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors that are already tested.
- C. Prepare test and inspection reports.

END OF SECTION 05 31 00 00



Task	Specification	Specification Description
05 31 13 00	05 31 00 00	Steel Decking
05 31 23 00	05 31 00 00	Steel Decking
05 31 33 00	05 31 00 00	Steel Decking
05 36 00 00	05 31 00 00	Steel Decking



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SECTION 05 40 00 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold-formed steel framing.
2. Load-bearing wall framing.
3. Exterior non-load-bearing wall framing.
4. Vertical deflection clips, exterior.
5. Interior non-load-bearing wall framing.
6. Vertical deflection clips, interior.
7. Joist framing.
8. Roof rafter framing.
9. Soffit framing.
10. Sill sealer/termite barrier.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.
3. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, within height limitations and ceiling-suspension assemblies.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]** <Insert location>.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
3. Signed and sealed by the qualified professional engineer responsible for their preparation.

- C. Delegated Design Submittal: For cold-formed steel framing, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for recycled content.>
2. <Double click to insert sustainable design text for EPDs and HPDs.>

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Certificates: For each type of code-compliance certification for studs and track.

D. Product Test Reports: For each listed product, for tests performed by **[manufacturer and witnessed by a qualified testing agency] [a qualified testing agency]**.

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

E. Research Reports:

1. For nonstandard cold-formed steel framing **[post-installed anchors] [and] [power-actuated fasteners]**, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
2. For sill sealer gasket/termite barrier, showing compliance with ICC-ES AC380.

F. Delegated Design Engineer Qualifications: For cold-formed steel framing.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by International Accreditation Service (IAS) to IAS AC98 criteria for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency[, **or in-house testing with calibrated test equipment,**] indicating steel sheet complies with requirements, including base-steel thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Code-Compliance Certification of Studs and Track: Provide documentation that framing members are certified in accordance with the product-certification program of **[the Steel Framing Industry Association] [the Steel Stud Manufacturers Association] [or] [the Supreme Steel Framing System Association]**.

D. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

- E. Comply with AISI S230 for one- and two-family dwellings.
- F. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in [state] <Insert jurisdiction> where Project is located and who is experienced in providing engineering services of the type indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: **[As indicated on Drawings] <Insert design loads>**.
 - 2. Deflection Limits: Design framing systems to withstand **[design loads]** without deflections greater than the following:
 - a. Exterior Load-Bearing Wall Framing: Horizontal deflection of **[1/240] [1/360] [1/600] [1/720]** of the wall height.
 - b. Interior Load-Bearing Wall Framing: Horizontal deflection of **[1/240] [1/360]** of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
 - c. Exterior Non-Load-Bearing Framing: Horizontal deflection of **[1/240] [1/360] [1/600] [1/720]** **<Insert ratio>** of the wall height.
 - d. Interior Non-Load-Bearing Framing: Horizontal deflection of **[1/240] [1/360]** of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
 - e. Floor Joist Framing: Vertical deflection of **[1/360] [1/480]** for live loads and 1/240 for total loads of the span.
 - f. Roof Rafter Framing: Vertical deflection of **[1/120] [1/240] [1/360]** of the horizontally projected span for live loads.
 - g. Ceiling Joist Framing: Vertical deflection of **[1/120] [1/240] [1/360]** of the span for live loads and 1/240 for total loads of the span.
 - 3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
 - 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of **[1/2 inch (13 mm)] [3/4 inch (19 mm)] [1 inch (25 mm)] [1-1/2 inches (38 mm)]**.
 - 5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

- C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S100 and **[ASTM C955] [AISI S200 and ASTM C955, Section 8] [AISI S240]**.
- D. Seismic Performance: Cold-formed steel framing to withstand the effects of earthquake motions determined in accordance with **[ASCE/SEI 7 and AISI S400] <Insert requirement>**.
- E. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Product iQ" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.
- F. Sound-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, in accordance with ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 COLD-FORMED STEEL FRAMING

- A. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- B. <Double click to insert sustainable design text for recycled content.>
- C. Framing Members, General: Comply with **[ASTM C955] [AISI S200 and ASTM C955, Section 8] [AISI S240]** for conditions indicated.
- D. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
 - 1. Grade: **[ST33H (ST230H)] [ST50H (ST340H)] [As required by structural performance] <Insert grade>**.
 - 2. Coating: **[G60 (Z180), A60 (ZF180), AZ50 (AZM150), or GF30 (ZGF90)] [G90 (Z275) or equivalent] <Insert coating designation>**.
- E. Steel Sheet for Vertical Deflection Drift Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: **[33 (230)] [50 (340), Class 1] [As required by structural performance] <Insert grade>**.
 - 2. Coating: **G90 (Z275) <Insert coating designation>**.

2.3 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Steel Thickness: **[0.0329 inch (0.84 mm)] [0.0428 inch (1.09 mm)] [0.0538 inch (1.37 mm)] [0.0677 inch (1.72 mm)] [0.0966 inch (2.45 mm)] [0.1180 inch (2.997 mm)] <Insert dimension>**.
 - 2. Flange Width: **[1-3/8 inches (35 mm)] [1-5/8 inches (41 mm)] [2 inches (51 mm)] [2-1/2 inches (63 mm)] [3 inches (76 mm)] [3-1/2 inches (89 mm)] <Insert dimension>**.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

1. Minimum Base-Steel Thickness: [0.0329 inch (0.84 mm)] [0.0428 inch (1.09 mm)] [0.0538 inch (1.37 mm)] [0.0677 inch (1.72 mm)] [0.0966 inch (2.45 mm)] [0.1180 inch (2.997 mm)] [Matching steel studs] <Insert dimension>.
 2. Flange Width: [1-1/4 inches (32 mm)] [1-1/2 inches (38 mm)] <Insert dimension if manufacturer's standard width is insufficient>.
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
1. Minimum Base Steel Thickness: [0.0329 inch (0.84 mm)] [0.0428 inch (1.09 mm)] [0.0538 inch (1.37 mm)] [0.0677 inch (1.72 mm)] [0.0966 inch (2.45 mm)] [0.1180 inch (2.997 mm)] <Insert dimension>.
 2. Flange Width: [1-3/8 inches (35 mm)] [1-5/8 inches (41 mm)] [2 inches (51 mm)] [2-1/2 inches (63 mm)] <Insert dimension>.
- D. Steel Single- or Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated, and as follows:
1. Minimum Base-Steel Thickness: [0.0329 inch (0.84 mm)] [0.0428 inch (1.09 mm)] [0.0538 inch (1.37 mm)] [0.0677 inch (1.72 mm)] [0.0966 inch (2.45 mm)] [0.1180 inch (2.997 mm)] <Insert dimension>.
 2. Top Flange Width: [1-1/2 inches (38 mm)] [1-5/8 inches (41 mm)] [2 inches (51 mm)] [2-1/2 inches (63 mm)] <Insert dimension>.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Steel Thickness: [0.0329 inch (0.84 mm)] [0.0428 inch (1.09 mm)] [0.0538 inch (1.37 mm)] [0.0677 inch (1.72 mm)] [0.0966 inch (2.45 mm)] [0.1180 inch (2.997 mm)] <Insert dimension>.
 2. Flange Width: [1-3/8 inches (35 mm)] [1-5/8 inches (41 mm)] [2 inches (51 mm)] [2-1/2 inches (63 mm)] <Insert dimension>.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Steel Thickness: [0.0329 inch (0.84 mm)] [0.0428 inch (1.09 mm)] [0.0538 inch (1.37 mm)] [0.0677 inch (1.72 mm)] [0.0966 inch (2.45 mm)] [0.1180 inch (2.997 mm)] [Matching steel studs] <Insert dimension>.
 2. Flange Width: [1-1/4 inches (32 mm)] <Insert dimension if manufacturer's standard width is insufficient>.
- C. Vertical Deflection Clips, Exterior: Manufacturer's standard [bypass] [head] clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Steel Thickness: **[0.0428 inch (1.09 mm)] [0.0538 inch (1.37 mm)] [0.0677 inch (1.72 mm)] [0.0966 inch (2.45 mm)] [0.1180 inch (2.997 mm)] <Insert dimension>.**
2. Flange Width: **[1 inch (25 mm) plus the design gap for one-story structures] [and] [1 inch (25 mm) plus twice the design gap for other applications] <Insert dimension>.**

- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 INTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Steel Thickness: **[0.0329 inch (0.84 mm)] [0.0428 inch (1.09 mm)] [0.0538 inch (1.37 mm)] [0.0677 inch (1.72 mm)] [0.0966 inch (2.45 mm)] [0.1180 inch (2.997 mm)] <Insert dimension>.**
2. Flange Width: **[1-3/8 inches (35 mm)] [1-5/8 inches (41 mm)] [2 inches (51 mm)] [2-1/2 inches (63 mm)] [3 inches (76 mm)] [3-1/2 inches (89 mm)] <Insert dimension>.**

- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Steel Thickness: **[0.0329 inch (0.84 mm)] [0.0428 inch (1.09 mm)] [0.0538 inch (1.37 mm)] [0.0677 inch (1.72 mm)] [0.0966 inch (2.45 mm)] [0.1180 inch (2.997 mm)] [Matching steel studs] <Insert dimension>.**
2. Flange Width: **[1-1/4 inches (32 mm)] [1-1/2 inches (38 mm)] [2 inches (51 mm)] <Insert dimension if manufacturer's standard width is insufficient>.**

- C. Vertical Deflection Clips, Interior: Manufacturer's standard **[bypass] [head]** clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Steel Thickness: **[0.0428 inch (1.09 mm)] [0.0538 inch (1.37 mm)] [0.0677 inch (1.72 mm)] [0.0966 inch (2.45 mm)] [0.1180 inch (2.997 mm)] <Insert dimension>.**
2. Flange Width: **[1 inch (25 mm) plus the design gap for one-story structures] [and] [1 inch (25 mm) plus twice the design gap for other applications] <Insert dimension>.**

- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 JOIST FRAMING

- A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, **[unpunched] [punched with standard holes] [punched with enlarged service holes]** with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: **[0.0329 inch (0.84 mm)] [0.0428 inch (1.09 mm)] [0.0538 inch (1.37 mm)] [0.0677 inch (1.72 mm)] [0.0966 inch (2.45 mm)] [0.1180 inch (2.997 mm)] <Insert dimension>.**
 2. Flange Width: **[1-5/8 inches (41 mm)] [2 inches (51 mm)] [2-1/2 inches (63 mm)] [3 inches (76 mm)] [3-1/2 inches (89 mm)] <Insert dimension>, minimum.**
- B. Steel Rim Joist Track: Manufacturer's standard U-shaped steel rim joist track, of web depths indicated, unpunched or punched at joist spacing, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: **[0.0329 inch (0.84 mm)] [0.0428 inch (1.09 mm)] [0.0538 inch (1.37 mm)] [0.0677 inch (1.72 mm)] [0.0966 inch (2.45 mm)] [0.1180 inch (2.997 mm)] [Matching steel joists] <Insert dimension>.**
 2. Flange Width: **[1-1/4 inches (32 mm)] [1-1/2 inches (38 mm)] [2 inches (51 mm)] <Insert dimension>, minimum.**

2.7 ROOF-RAFTER FRAMING

- A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Minimum Base-Steel Thickness: **[0.0329 inch (0.84 mm)] [0.0428 inch (1.09 mm)] [0.0538 inch (1.37 mm)] [0.0677 inch (1.72 mm)] [0.0966 inch (2.45 mm)] [0.1180 inch (2.997 mm)] <Insert dimension>.**
 2. Flange Width: **[1-5/8 inches (41 mm)] [2 inches (51 mm)] [2-1/2 inches (63 mm)] [3 inches (76 mm)] [3-1/2 inches (89 mm)] <Insert dimension>, minimum.**

2.8 SOFFIT FRAMING

- A. Exterior Soffit Framing: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: **[0.0329 inch (0.84 mm)] [0.0428 inch (1.09 mm)] [0.0538 inch (1.37 mm)] [0.0677 inch (1.72 mm)] [0.0966 inch (2.45 mm)] [0.1180 inch (2.997 mm)] <Insert dimension>.**
 2. Flange Width: **[1-5/8 inches (41 mm)] [2 inches (51 mm)] [2-1/2 inches (63 mm)] [3 inches (76 mm)] [3-1/2 inches (89 mm)] <Insert dimension>, minimum.**

2.9 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic-coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Anchor clips.
 5. End clips.
 6. Foundation clips.
 7. Gusset plates.
 8. Stud kickers and knee braces.

9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.10 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process in accordance with ASTM A123/A123M.
- B. Anchor Bolts: ASTM F1554, **[Grade 36] [Grade 55]**, threaded carbon-steel **[hex-headed bolts] [headless, hooked bolts] [headless bolts, with encased end threaded]** carbon-steel nuts, and flat, hardened-steel washers; zinc coated by **[hot-dip process in accordance with ASTM A153/A153M, Class C] [mechanically deposition according to ASTM B695, Class 50]**.
- C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on **[ICC-ES AC01] [ICC-ES AC193] [ICC-ES AC58] [or] [ICC-ES AC308]** as appropriate for the substrate.
 1. Uses: Securing cold-formed steel framing to structure.
 2. Type: **[Torque-controlled expansion anchor] [Torque-controlled adhesive anchor] [or] [adhesive anchor]**.
 3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/ASTM F1941M, Class Fe/Zn 5, unless otherwise indicated.
 4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy **[Group 1 (A1)] [Group 2 (A4)]** stainless steel bolts, ASTM F593 (ISO 3506-1), and nuts, ASTM F594 (ISO 3506-1).
- D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.11 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: **[ASTM A780/A780M] [MIL-P-21035B] [or] [SSPC-Paint 20]**.
- B. Cement Grout: Portland cement, ASTM C476, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.
- D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

- E. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch (6 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.
- F. Sill Sealer Gasket/Termite Barrier: Minimum 68-mil (1.7-mm) nominal thickness, self-adhering sheet consisting of 64 mils (1.6 mm) of rubberized asphalt laminated on one side to a 4-mil- (0.10-mm-) thick, polyethylene-film reinforcement, and with release liner on adhesive side[; **formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction**].
 - 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
 - 2. Physical Properties:
 - a. Peel Adhesion: 17.0 lb/in (2.9 N/mm) of width when tested in accordance with ASTM D412.
 - b. Low-Temperature Flexibility: Pass at minus 25 deg F (minus 32 deg C) when tested in accordance with ASTM D146/D146M.
 - c. Water Vapor Permeance: 0.05 perm (0.44 ng/Pa x s x sq. m) maximum when tested in accordance with ASTM E96/E96M, Method B.
 - d. Resistance to Termite Penetration: Comply with ICC-ES AC380.

2.12 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, in accordance with AISI S240 and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install in accordance with Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
 - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, in accordance with Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 ft. (1:960) and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative errors are not to exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or track to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.
- C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.
- E. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION OF COLD-FORMED STEEL FRAMING

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing in accordance with ASTM C1007, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

- a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install in accordance with Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 INSTALLATION OF LOAD-BEARING WALL FRAMING

- A. Install continuous top and bottom track sized to match studs. Align track accurately and securely anchor at corners and ends, and at spacings as follows:
 - 1. Anchor Spacing: **[As shown on Shop Drawings] <Insert dimension>**.
- B. Squarely seat studs against top and bottom track, with gap not exceeding 1/8 inch (3 mm) between the end of wall-framing member and the web of track.
 - 1. Fasten both flanges of studs to top and bottom track.
 - 2. Space studs as follows:
 - a. Stud Spacing: **[12 inches (305 mm)] [16 inches (406 mm)] [19.2 inches (488 mm)] [24 inches (610 mm)] [As indicated on Shop Drawings] <Insert dimension>**.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs in accordance with AISI S240, Section C3.5.2. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
 2. Install track and jack studs above and below wall openings. Anchor track to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced vertically **[48 inches (1220 mm)] [as indicated on Drawings] [as indicated on Shop Drawings] <Insert dimension>**. Fasten at each stud intersection.
1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.
 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
 3. Bar Bridging: Proprietary bridging bars installed in accordance with manufacturer's written instructions.
- J. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom track. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION OF EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Install continuous track sized to match studs. Align track accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to **[top and]** bottom track unless otherwise indicated. Space studs as follows:
1. Stud Spacing: **[12 inches (305 mm)] [16 inches (406 mm)] [19.2 inches (488 mm)] [24 inches (610 mm)] [As indicated on Shop Drawings] <Insert dimension>**.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install single deep-leg deflection track and anchor to building structure.
 2. Connect vertical deflection clips to **[bypassing] [infill]** studs and anchor to building structure.
 3. Connect drift clips to cold-formed steel framing and anchor to building structure.

- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated[**on Shop Drawings**] but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel U-channel, welded or mechanically fastened to webs of punched studs.
 - 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within [**12 inches (305 mm)**] [**18 inches (450 mm)**] of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 - 1. Install solid blocking at [**96-inch (2440-mm) centers**] [**centers indicated**] [**centers indicated on Shop Drawings**].
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 INSTALLATION OF INTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Install continuous track sized to match studs. Align track accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to[**top and**] bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: [**12 inches (305 mm)**] [**16 inches (406 mm)**] [**19.2 inches (488 mm)**] [**24 inches (610 mm)**] [**As indicated on Drawings**] <Insert dimension>.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single deep-leg deflection track and anchor to building structure.
 - 2. Connect vertical deflection clips to studs and anchor to building structure.
 - 3. Connect drift clips to cold-formed steel metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated[**on Shop Drawings**] but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within [**12 inches (305 mm)**] [**18 inches (450 mm)**] of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at **[96-inch (2440-mm) centers]** **[centers indicated]** **[centers indicated on Shop Drawings]**.

- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.7 INSTALLATION OF JOIST FRAMING

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated **[on Shop Drawings]**.

- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing as indicated on Shop Drawings.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.

- C. Space joists not more than 2 inches (51 mm) from abutting walls, and as follows:

1. Joist Spacing: **[12 inches (305 mm)] [16 inches (406 mm)] [19.2 inches (488 mm)] [24 inches (610 mm)] [As indicated on Drawings] <Insert dimension>**.

- D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.

- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.

1. Install web stiffeners to transfer axial loads of walls above.

- F. Install bridging at intervals indicated **[on Shop Drawings]**. Fasten bridging at each joist intersection as follows:

1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.8 INSTALLATION TOLERANCES

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 ft. (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.9 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.

3.10 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.11 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 40 00 00

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Task	Specification	Specification Description
05 41 00 00	05 40 00 00	Cold-Formed Metal Framing
05 42 00 00	05 40 00 00	Cold-Formed Metal Framing
05 42 13 00	05 40 00 00	Cold-Formed Metal Framing
05 42 23 00	05 40 00 00	Cold-Formed Metal Framing
05 43 00 00	01 11 19 00	No Specification Required
05 43 00 00	05 40 00 00	Cold-Formed Metal Framing
05 43 00 00	05 50 00 00	Metal Fabrications
05 45 00 00	05 40 00 00	Cold-Formed Metal Framing
05 45 13 00	05 40 00 00	Cold-Formed Metal Framing
05 45 16 00	05 40 00 00	Cold-Formed Metal Framing



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SECTION 05 50 00 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous framing and supports.
2. Prefabricated building columns.
3. Shelf angles.
4. Metal ladders.
5. Alternating tread devices.
6. Metal ships' ladders and pipe crossovers.
7. Metal floor plate.
8. Elevator pit sump covers.
9. Structural-steel door frames.
10. Miscellaneous steel trim.
11. Metal bollards.
12. Vehicular barrier cable systems.
13. Pipe and downspout guards.
14. Abrasive metal nosings, treads, and thresholds.
15. Cast-iron wheel guards.
16. Metal downspout boots.
17. Loose bearing and leveling plates.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
3. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Requirements:

1. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
2. Section 051200 "Structural Steel Framing" for steel framing, supports, elevator machine beams, hoist beams, divider beams, door frames, and other steel items attached to the structural-steel framing.
3. Section 077200 "Roof Accessories" for manufactured metal roof walkways and metal roof stairs.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.

Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Fasteners.
3. Shop primers.
4. Shrinkage-resisting grout.
5. Prefabricated building columns.
6. Slotted channel framing.
7. Manufactured metal ladders.
8. Alternating tread devices.
9. Metal ships' ladders and pipe crossovers.
10. Metal bollards.
11. Vehicular barrier cable systems.
12. Pipe and downspout guards.
13. Abrasive metal nosings, treads, and thresholds.
14. Cast-iron wheel guards.
15. Metal downspout boots.

B. Shop Drawings: Show fabrication and installation details. [**Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.**]

Provide Shop Drawings for the following:

1. Miscellaneous framing and supports for applications where framing and supports are not specified in other Sections.
2. Elevator machine beams, hoist beams, and divider beams.
3. Steel shapes for supporting elevator door sills.
4. Steel girders for supporting wood frame construction.
5. Steel pipe columns for supporting wood frame construction.
6. Prefabricated building columns.
7. Shelf angles.
8. Metal ladders.
9. Alternating tread devices.
10. Metal ships' ladders and pipe crossovers.
11. Metal floor plate and supports.
12. Elevator pit sump covers.
13. Structural-steel door frames.
14. Miscellaneous steel trim including [**steel angle corner guards**][**steel edgings**][**and**][**loading-dock edge angles**].
15. Metal bollards.
16. Loose steel lintels.
17. Vehicular barrier cable systems.

C. Samples for Verification: For each type and finish of extruded [**nosing**][**and**][**tread**].

D. Delegated Design Submittals: For [**ladders**][**alternating tread devices**][**and**][**vehicular barrier cable systems**], including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Environmental product declaration.
3. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
4. Environmental Product Declaration (EPD): For each product.
5. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
6. Environmental Product Declaration: For each product.
7. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
8. Environmental Product Declaration: For each product.
9. Environmental Product Declaration: For each product.
10. Third-Party Certifications: For each product.
11. Third-Party Certified Life Cycle Assessment: For each product.
12. Environmental Product Declaration (EPD): Provide one of the following EPDs: critically reviewed life-cycle assessment complying with ISO 14044; internally reviewed, product-specific Type III EPD; third-party-verified, industrywide Type III EPD.
13. Health Product Declaration (HPD): For each product.
14. Health Product Declaration (HPD): Provide HPD.
15. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

1.4 INFORMATIONAL SUBMITTALS

- A. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Research Reports: For post-installed anchors.
- E. Delegated design engineer qualifications.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS
2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design [ladders][alternating tread devices][and][vehicular barrier cable systems].
- B. Structural Performance of Aluminum Ladders: Ladders[, including landings,] are to withstand the effects of loads and stresses within limits and under conditions specified in ANSI/ASC A14.3.
- C. Structural Performance of Alternating Tread Devices: Alternating tread devices are to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: **100 lbf/sq. ft. (4.79 kN/sq. m)**.
 - 2. Concentrated Load: **300 lbf (1.33 kN)** applied on an area of **4 sq. in. (2580 sq. mm)**.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Alternating Tread Device Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Comply with applicable railing loadings in Section 055213 "Pipe and Tube Railings."
- D. Vehicular Barrier Cable Systems: Design vehicular barrier cable systems to resist a single **[6000-lbf (28.7-kN)]<Insert value>** service load and **[10,000-lbf (47.9-kN)]<Insert load>** ultimate load applied horizontally in any direction to the cable system, with anchorages or attachments capable of transferring this load to the structure. Limit deflection to **18 inches (457 mm)**. Design is to assume loads are applied at a height of **[18 inches (457 mm)]<Insert height>** above the floor or ramp surface on an area not to exceed **1 sq. ft. (0.09 sq. m)**.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature change>**.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Recycled Content: Provide manufacturer documentation for recycled content, indicating postconsumer and preconsumer recycled content.
- C. Regional Materials: Products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- D. Regional Materials: Products shall be manufactured within **500 miles (800 km)** of Project site.
- E. Regional Materials: Products shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- F. Indigenous Materials: Products shall be manufactured within **500 miles (800 km)** of Project site from

materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.

- G. Regional Materials: Products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- H. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- I. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, **[Type 304][Type 316L]**.
- J. Stainless Steel Bars and Shapes: ASTM A276/A276M, **[Type 304][Type 316L]**.
- K. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.
- L. Rolled-Stainless Steel Floor Plate: ASTM A793.
- M. Abrasive-Surface Floor Plate: Steel plate **[with abrasive granules rolled into surface][or][with abrasive material metallurgically bonded to steel]**.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[IKG]**
 - b. **[Ohio Gratings, Inc]**
 - c. **[SlipNOT Metal Safety Flooring, division of Traction Technologies Holdings, LLC]**
 - d. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[IKG]**
 - b. **[Ohio Gratings, Inc]**
 - c. **[SlipNOT Metal Safety Flooring, division of Traction Technologies Holdings, LLC]**
 - d. **<Insert manufacturer's name>**
 - 3. Source Limitations: Obtain floor plate from single source from single manufacturer.
- N. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- O. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- P. Zinc-Coated Steel Wire Rope: ASTM A741.
 - 1. Wire Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- Q. Stainless Steel Wire Rope: Wire rope manufactured from stainless steel wire complying with ASTM A492, Type 316.

1. Wire Rope Fittings: Stainless steel connectors, Type 316, with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- R. Steel Prestressing Strand: ASTM A416/A416M, **Grade 270 (Grade 1860)**, low-relaxation, seven-wire, with **0.9-lb/sq. ft. (4.39-kg/sq. m)** zinc coating.
1. Steel Prestressing Strand Fittings: Hot-dip galvanized-steel anchors and connectors with capability to sustain, without failure, a load equal to minimum breaking strength of steel prestressing strand with which they are used.
- S. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
1. Size of Channels: **[1-5/8 by 1-5/8 inches (41 by 41 mm)]****[As indicated]****<Insert size>**.
 2. Galvanized Steel: ASTM A653/A653M, **[commercial steel, Type B]****[structural steel, Grade 33 (Grade 230)]**, with **G90 (Z275)** coating; **[0.108-inch (2.8-mm)]****[0.079-inch (2-mm)]****[0.064-inch (1.6-mm)]** nominal thickness.
 3. Cold-Rolled Steel: ASTM A1008/A1008M, **[commercial steel, Type B]****[structural steel, Grade 33 (Grade 230)]**; **[0.0966-inch (2.5-mm)]****[0.0677-inch (1.7-mm)]****[0.0528-inch (1.35-mm)]** minimum thickness; **[unfinished]****[coated with rust-inhibitive, baked-on, acrylic enamel]****[hot-dip galvanized after fabrication]**.
- T. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
- U. Aluminum Plate and Sheet: **ASTM B209 (ASTM B209M)**, Alloy 6061-T6.
- V. Aluminum Extrusions: **ASTM B221 (ASTM B221M)**, Alloy 6063-T6.
- W. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.
- X. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.
- Y. Bronze Extrusions: ASTM B455, Alloy UNS No. C38500 (extruded architectural bronze).
- Z. Bronze Castings: ASTM B584, Alloy UNS No. C83600 (lead red brass) or UNS No. C84400 (lead semired brass).
- AA. Nickel Silver Extrusions: ASTM B151/B151M, Alloy UNS No. C74500.
- BB. Nickel Silver Castings: ASTM B584, Alloy UNS No. C97600 (20 percent lead nickel bronze).
- 2.3 FASTENERS
- A. General: Unless otherwise indicated, provide **[Type 304]****[Type 316]** stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
1. Provide stainless steel fasteners for fastening **[aluminum]****[stainless steel]****[or]****[nickel silver]**.
 2. Provide bronze fasteners for fastening bronze.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, **ASTM A307, Grade A (ISO 898-1, Property Class 4.6)**; with hex nuts, **ASTM A563 (ASTM A563M)**; and, where indicated, flat washers.

- C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, **Grade A325 (Grade A325M)**, Type 3, heavy-hex steel structural bolts; **ASTM A563, Grade DH3, (ASTM A563M, Class 10S3)** heavy-hex carbon-steel nuts; and where indicated, flat washers.
- D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, **ASTM F593 (ISO 3506-1)**; with hex nuts, **ASTM F594 (ASTM F836M)**; and, where indicated, flat washers; Alloy **[Group 1 (A1)][Group 2 (A4)]**.
- E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, **ASTM A563 (ASTM A563M)**; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
- G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- H. Post-Installed Anchors: **[Torque-controlled expansion anchors][or][chemical anchors]**.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy **[Group 1 (A1)][Group 2 (A4)]** stainless steel bolts, **ASTM F593 (ISO 3506-1)**, and nuts, **ASTM F594 (ASTM F836M)**.
- I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, **1-5/8 by 7/8 inches (41 by 22 mm)** by length indicated with anchor straps or studs not less than **3 inches (75 mm)** long at not more than **8 inches (200 mm)** o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with **[Section 099113 "Exterior Painting."][Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."][Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings.]**
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer that contains pigments that make it easily distinguishable from zinc-rich primer.
- C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- H. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- I. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of **3000 psi (20 MPa)**.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing[**and contour of welded surface matches that of adjacent surface**].
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, **1/8 by 1-1/2 inches (3.2 by 38 mm)**, with a minimum **6-inch (150-mm)** embedment and **2-inch (50-mm)** hook, not less than **8 inches (200 mm)** from ends and corners of units and **24 inches (600 mm)** o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
1. Fabricate units from slotted channel framing where indicated.
 2. Furnish inserts for units installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes **[indicated][recommended by partition manufacturer]** with attached bearing plates, anchors, and braces as **[indicated][recommended by partition manufacturer]**. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.
1. Provide bearing plates welded to beams where indicated.
 2. Drill or punch girders and plates for field-bolted connections where indicated.
 3. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at **24 inches (600 mm)** o.c.
- E. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.
1. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
 2. Unless otherwise indicated, provide **1/2-inch (12.7-mm)** baseplates with four **5/8-inch (16-mm)** anchor bolts and **1/4-inch (6.4-mm)** top plates.
- F. Galvanize miscellaneous framing and supports where indicated.
- G. Prime miscellaneous framing and supports with **[zinc-rich primer][primer specified in Section 099600 "High-Performance Coatings"]** where indicated.

2.7 PREFABRICATED BUILDING COLUMNS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[Black Rock Fireproof Column, a division of United Steel]**
 2. **[Dean Lally LLC / FireTrol Columns]**
 3. **<Insert manufacturer's name>**

- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Black Rock Fireproof Column, a division of United Steel]**
 2. **[Dean Lally LLC / FireTrol Columns]**
 3. **<Insert manufacturer's name>**
- C. Source Limitations: Obtain prefabricated building column from single source from single manufacturer.
- D. General: Provide prefabricated building columns consisting of load-bearing structural-steel members protected by concrete fireproofing encased in an outer non-load-bearing steel shell. Fabricate connections to comply with details shown or as needed to suit type of structure indicated.
- E. Fire-Resistance Ratings: Provide prefabricated building columns listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for ratings indicated, based on testing in accordance with ASTM E119.
1. Fire-Resistance Rating: **[4 hours][3 hours][2 hours][As indicated]**.

2.8 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive **3/4-inch (19-mm)** bolts, spaced not more than **6 inches (150 mm)** from ends and **24 inches (600 mm)** o.c., unless otherwise indicated.
1. Provide mitered and welded units at corners.
 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately **2 inches (50 mm)** larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize **[and prime]** shelf angles located in exterior walls.
- D. Prime shelf angles located in exterior walls with **[zinc-rich primer.][primer specified in Section 099600 "High-Performance Coatings."]**
- E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.9 METAL LADDERS

- A. General:
1. Comply with ANSI A14.3, **[except for elevator pit ladders]**.
 2. For elevator pit ladders, comply with ASME A17.1/CSA B44.
- B. Steel Ladders:
1. Space siderails **[16 inches (406 mm)][18 inches (457 mm)]** apart unless otherwise indicated.
 2. Siderails: Continuous, **[3/8-by-2-1/2-inch (9.5-by-64-mm)][1/2-by-2-1/2-inch (12.7-by-64-mm)]** steel flat bars, with eased edges.

3. Rungs: **[3/4-inch- (19-mm-) diameter][3/4-inch- (19-mm-) square][1-inch- (25-mm-) diameter][1-inch- (25-mm-) square]**, steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Nonslip Surfaces for Steel Ladders: Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1) **[IKG]**
 - 2) **[SlipNOT Metal Safety Flooring, division of Traction Technologies Holdings, LLC]**
 - 3) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[IKG]**
 - 2) **[SlipNOT Metal Safety Flooring, division of Traction Technologies Holdings, LLC]**
 - 3) **<Insert manufacturer's name>**
7. Source Limitations: Obtain nonslip surfaces from single source from single manufacturer.
8. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than **[1/2 inch (12 mm)][3/4 inch (19 mm)]** in least dimension.
9. Support each ladder **[at top and bottom and not more than 60 inches (1500 mm) o.c.]** with welded or bolted steel brackets.
10. Galvanize **[and prime][exterior]** ladders, including brackets.
11. Prime **[exterior]** ladders, including brackets and fasteners, with **[zinc-rich primer.][primer specified in Section 099600 "High-Performance Coatings."]**

C. Aluminum Ladders:

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Halliday Products]**
 - b. **[Kattsafe]**
 - c. **[O'Keeffe's Inc.]**
 - d. **[Precision Ladders, LLC]**
 - e. **[Royalite Manufacturing, Inc.]**
 - f. **[Thompson Fabricating, LLC]**
 - g. **[UPNOVR, Inc.]**
 - h. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the

following:

- a. [Halliday Products]
 - b. [Kattsafe]
 - c. [O'Keeffe's Inc.]
 - d. [Precision Ladders, LLC]
 - e. [Royalite Manufacturing, Inc.]
 - f. [Thompson Fabricating, LLC]
 - g. [UPNOVR, Inc.]
 - h. <Insert manufacturer's name>
3. Source Limitations: Obtain aluminum ladders from single source from single manufacturer.
 4. Space siderails [16 inches (406 mm)][18 inches (457 mm)] apart unless otherwise indicated.
 5. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches (64 mm) deep, 3/4 inch (19 mm) wide, and 1/8 inch (3.2 mm) thick.
 6. Rungs: Extruded-aluminum tubes, not less than 3/4 inch (19 mm) deep and not less than 1/8 inch (3.2 mm) thick, with ribbed tread surfaces.
 7. Fit rungs in centerline of siderails; fasten by welding or with stainless steel fasteners or brackets and aluminum rivets.
 8. Provide platforms as indicated fabricated from [pressure-locked aluminum bar grating][or][extruded-aluminum plank grating], supported by extruded-aluminum framing. Limit openings in gratings to no more than [1/2 inch (12 mm)][3/4 inch (19 mm)] in least dimension.
 9. Support each ladder[at top and bottom and not more than 60 inches (1500 mm) o.c.] with welded or bolted aluminum brackets.
 10. Provide minimum 72-inch- (1830-mm-) high, hinged security door with padlock hasp at foot of ladder to prevent unauthorized ladder use.

2.10 ALTERNATING TREAD DEVICES

- A. Alternating Tread Devices: Fabricate alternating tread devices of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Lapeyre Stair Inc.]
 - b. [Precision Ladders, LLC]
 - c. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Lapeyre Stair Inc.]
 - b. [Precision Ladders, LLC]
 - c. <Insert manufacturer's name>
 3. Tread depth is not to be less than 5 inches (127 mm) exclusive of nosing or less than 8-1/2 inches (216 mm), including the nosing, tread width is not to be less than 7 inches (178 mm), and riser height is not to be more than 9-1/2 inches (241 mm).
 4. Tread depth is not to be less than 8-1/2 inches (216 mm) exclusive of nosing or less than 10-1/2

- inches (267 mm), including the nosing, tread width is not to be less than 7 inches (178 mm), and riser height is not to be more than 8 inches (203 mm).
5. Fabricate from [steel][stainless steel][aluminum] and assemble by welding or with stainless steel fasteners.
 6. Comply with applicable railing requirements in Section 055213 "Pipe and Tube Railings."
- B. Galvanize[and prime][exterior]steel alternating tread devices, including treads, railings, brackets, and fasteners.
 - C. Prime [exterior]steel alternating tread devices, including treads, railings, brackets, and fasteners, with [zinc-rich primer.][primer specified in Section 099600 "High-Performance Coatings."]

2.11 METAL SHIPS' LADDERS AND PIPE CROSSOVERS

- A. Provide metal [ships' ladders][and][pipe crossovers] where indicated. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.
 1. Treads are not to be less than 5 inches (127 mm) exclusive of nosing or less than 8-1/2 inches (216 mm) including the nosing, and riser height is not to be more than 9-1/2 inches (241 mm).
 2. Fabricate [ships' ladders][and][pipe crossovers], including railings from [steel][stainless steel][aluminum].
 3. Fabricate treads[and platforms] from [welded or pressure-locked steel bar][pressure-locked stainless steel bar][pressure-locked aluminum bar][extruded-aluminum plank] grating. Limit openings in gratings to no more than [1/2 inch (12 mm)][3/4 inch (19 mm)] in least dimension.
 4. Fabricate treads[and platforms] from [rolled-steel floor][rolled-stainless steel floor][rolled-aluminum-alloy tread][abrasive-surface floor] plate.
 5. Comply with applicable railing requirements in Section 055213 "Pipe and Tube Railings."
- B. Galvanize[and prime][exterior]steel [ships' ladders][and][pipe crossovers], including treads, railings, brackets, and fasteners.
- C. Prime [exterior]steel [ships' ladders][and][pipe crossovers], including treads, railings, brackets, and fasteners, with [zinc-rich primer.][primer specified in Section 099600 "High-Performance Coatings."]

2.12 METAL FLOOR PLATE

- A. Fabricate from [rolled-steel floor][rolled-stainless steel floor][rolled-aluminum-alloy tread][abrasive-surface floor] plate of thickness indicated below:
 1. Thickness: [1/8 inch (3.2 mm)][3/16 inch (4.8 mm)][1/4 inch (6.4 mm)][5/16 inch (8 mm)][3/8 inch (9.5 mm)][As indicated].
- B. Provide grating sections where indicated, fabricated from [welded or pressure-locked steel bar][pressure-locked stainless steel bar][pressure-locked aluminum bar][extruded-aluminum plank] grating. Limit openings in gratings to no more than [1/2 inch (12 mm)][3/4 inch (19 mm)][1 inch (25 mm)] in least dimension.
- C. Provide [steel][stainless steel][aluminum] angle supports as indicated.
- D. Include [steel][stainless steel][aluminum] angle stiffeners, and fixed and removable sections as indicated.



- E. Provide flush **[steel][stainless steel][aluminum]** bar drop handles for lifting removable sections, one at each end of each section.

2.13 ELEVATOR PIT SUMP COVERS

- A. Fabricate from **[1/8-inch (3.2-mm)][3/16-inch (4.8-mm)][rolled-steel][abrasive-surface]** floor plate with four **1-inch- (25-mm-)** diameter holes for water drainage and for lifting.
- B. Fabricate from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than **[1/2 inch (12 mm)][3/4 inch (19 mm)][1 inch (25 mm)]** in least dimension.
- C. Provide steel angle supports unless otherwise indicated.

2.14 STRUCTURAL-STEEL DOOR FRAMES

- A. Fabricate structural-steel door frames from steel shapes, plates, and bars of size and to dimensions indicated, fully welded together, with **5/8-by-1-1/2-inch (16-by-38-mm)** steel channel stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than **10 inches (250 mm)** o.c. Reinforce frames and drill and tap as necessary to accept finish hardware.
 - 1. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.
- B. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.
- C. Galvanize **[and prime][exterior]** steel frames.
- D. Prime **[exterior]** steel frames with **[zinc-rich primer.][primer specified in Section 099600 "High-Performance Coatings."]**

2.15 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize **[and prime][exterior]** miscellaneous steel trim.
- D. Prime **[exterior]** miscellaneous steel trim with **[zinc-rich primer.][primer specified in Section 099600 "High-Performance Coatings."]**

2.16 METAL BOLLARDS

- A. Fabricate metal bollards from **[Schedule 80 steel pipe][Schedule 40 steel pipe][Schedule 80 stainless steel, No. 4/180-grit finish][1/4-inch (6.4-mm) wall-thickness rectangular steel tubing][steel shapes, as indicated]**.
1. Cap bollards with **1/4-inch- (6.4-mm-)** thick, **[steel][stainless steel, ASTM A480/A480M, No. 4 finish]** plate with **[flat][sloped][domed]** top.
 2. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
 3. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.
- B. Fabricate bollards with **3/8-inch- (9.5-mm-)** thick, **[steel][stainless steel, ASTM A480/A480M, No. 4 finish]** baseplates for bolting to concrete slab. Drill baseplates at all four corners for **3/4-inch (19-mm)** anchor bolts.
1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.
- C. Fabricate sleeves for bollard anchorage from steel or stainless steel **[pipe][or][tubing]** with **1/4-inch- (6.4-mm-)** thick, steel or stainless steel plate welded to bottom of sleeve. Make sleeves not less than **8 inches (200 mm)** deep and **3/4 inch (19 mm)** larger than OD of bollard.
- D. Fabricate internal sleeves for removable bollards from Schedule 80 **[steel][stainless steel]** pipe or **1/4-inch (6.4-mm)** wall-thickness **[steel][stainless steel]** tubing with an OD approximately **1/16 inch (1.5 mm)** less than ID of bollards. Match drill sleeve and bollard for **3/4-inch (19-mm) [steel][stainless steel]** machine bolt.
- E. Prime steel bollards with **[zinc-rich primer.][primer specified in Section 099600 "High-Performance Coatings."]**

2.17 VEHICULAR BARRIER CABLE SYSTEMS

- A. Vehicular Barrier Cable Systems: Of diameter required by performance requirements, but not less than **1/2-inch- (12-mm-)** diameter, **[zinc-coated steel wire rope][stainless steel wire rope][zinc-coated steel prestressing strand]** with turnbuckles, toggles, machine swage terminals, and other fittings and accessories for securing to structural columns and walls and for tightening barrier cable.

2.18 PIPE AND DOWNSPOUT GUARDS

- A. Fabricate **[pipe][downspout]** guards from **3/8-inch- (9.5-mm-)** thick by **12-inch- (300-mm-)** wide, **[steel][stainless steel, ASTM A480/A480M, No. 4 finish]** plate, bent to fit flat against the wall or column at both ends and to fit around pipe with **2-inch (50-mm)** clearance between pipe and pipe guard. Drill each end for two **3/4-inch (19-mm)** anchor bolts.
- B. Galvanize **[and prime]** steel **[pipe][downspout]** guards.
- C. Prime steel **[pipe][downspout]** guards with **[zinc-rich primer.][primer specified in Section 099600 "High-Performance Coatings."]**

2.19 ABRASIVE METAL NOSINGS, TREADS, AND THRESHOLDS

- A. Cast-Metal Units: Cast [iron][aluminum][**bronze (lead red or semired brass)**][**nickel silver (lead nickel bronze)**], with an integral-abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [American Safety Tread Co., Inc]
 - b. [Balco; a CSW Industrials Company]
 - c. [Barry Pattern & Foundry Co., Inc]
 - d. [Safe-T-Metal Company, Inc.]
 - e. [Wooster Products Inc]
 - f. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [American Safety Tread Co., Inc]
 - b. [Balco; a CSW Industrials Company]
 - c. [Barry Pattern & Foundry Co., Inc]
 - d. [Safe-T-Metal Company, Inc.]
 - e. [Wooster Products Inc]
 - f. <Insert manufacturer's name>
 3. Source Limitations: Obtain units from single source from single manufacturer.
 4. Cross-hatched nosings, **4 inches (100 mm)** wide, with **1/4-inch- (6-mm-)** thick **1-inch (25-mm)** lip, for casting into concrete.
 5. Cross-hatched nosings, **1-1/2 inches (38-mm)** wide, **3/8-inch- (9.5-mm-)** thick **1-1/2 inch (38-mm)** lip, for casting into concrete.
 6. Cross-hatched Treads: Full depth of tread with **3/4-by-3/4-inch (19-by-19-mm)** nosing, for application over bent plate treads or existing stairs.
 7. Fluted-Saddle-Type Thresholds: **5 inches (125 mm)** wide by **1/2 inch (12 mm)** high, with tapered edges.
 8. Fluted-Interlocking or -Hook-Strip Thresholds: **5 inches (125 mm)** wide by **5/8 inch (16 mm)** high, with tapered edge.
 9. Thresholds: Plain-stepped- (stop-) type units, **5 inches (125 mm)** wide by **1/2 inch (12 mm)** high, with **1/2-inch (12-mm)** step.
- B. Extruded Units: [**Aluminum**][**Bronze**], with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [American Safety Tread Co., Inc]
 - b. [Amstep Products]
 - c. [Armstrong Products, Inc]

- d. **[Balco; a CSW Industrials Company]**
 - e. **[Nystrom, Inc.]**
 - f. **[Wooster Products Inc]**
 - g. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[American Safety Tread Co., Inc]**
 - b. **[Amstep Products]**
 - c. **[Armstrong Products, Inc]**
 - d. **[Balco; a CSW Industrials Company]**
 - e. **[Nystrom, Inc.]**
 - f. **[Wooster Products Inc]**
 - g. **<Insert manufacturer's name>**
 3. Source Limitations: Obtain units from single source from single manufacturer.
 4. Provide ribbed units, with abrasive filler strips projecting **1/16 inch (1.5 mm)** above aluminum extrusion.
 5. Provide solid-abrasive-type units without ribs.
 6. Nosings:
 - a. Square-back units, **[1-7/8 inches (48 mm)][3 inches (75 mm)][4 inches (100 mm)]** wide, for casting into concrete steps.
 - b. Beveled-back units, **[3 inches (75 mm)][4 inches (100 mm)]** wide with **1-3/8-inch (35-mm)** lip, for surface mounting on existing stairs.
 - c. Two-piece units, **3 inches (75 mm)** wide, with subchannel for casting into concrete steps.
 7. Treads: **[Square][Beveled]-back** units, full depth of tread with **1-3/8-inch (35-mm)** lip, for application over existing stairs.
 - C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
 - D. Drill for mechanical anchors and countersink. Locate holes not more than **4 inches (100 mm)** from ends and not more than **12 inches (300 mm)** o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.
 1. Provide two rows of holes for units more than **5 inches (125 mm)** wide, with two holes aligned at ends and intermediate holes staggered.
 - E. Apply bituminous paint to concealed surfaces of cast-metal units.
 - F. Apply clear lacquer to concealed surfaces of extruded units.
- 2.20 CAST-IRON WHEEL GUARDS
- A. Provide wheel guards made from cast-iron, **3/4-inch- (19-mm-)** thick, hollow-core construction, of size and shape indicated. Provide holes for countersunk anchor bolts and grouting.
 - B. Prime cast-iron wheel guards with **[zinc-rich primer.][primer specified in Section 099600 "High-Performance Coatings."]**

2.21 METAL DOWNSPOUT BOOTS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[J.R. Hoe & Sons Inc.]**
 2. **[Neenah Foundry Company]**
 3. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[J.R. Hoe & Sons Inc.]**
 2. **[Neenah Foundry Company]**
 3. **<Insert manufacturer's name>**
- C. Source Limitations: Obtain downspout boots from single source from single manufacturer.
- D. Provide downspout boots made from cast **[iron][aluminum]** in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.
1. Outlet: **[Vertical, to discharge into pipe][Horizontal, to discharge into pipe][At 35 degrees from horizontal, to discharge onto splash block or pavement]**.
- E. Prime cast-iron downspout boots with **[zinc-rich primer.][primer specified in Section 099600 "High-Performance Coatings."]**

2.22 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize bearing and leveling plates.
- C. Prime plates with **[zinc-rich primer.][primer specified in Section 099600 "High-Performance Coatings."]**

2.23 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than **8 inches (200 mm)** unless otherwise indicated.
- C. Galvanize **[and prime]** loose steel lintels located in exterior walls.
- D. Prime loose steel lintels located in exterior walls with **[zinc-rich primer.][primer specified in Section 099600 "High-Performance Coatings."]**

2.24 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.25 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.26 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items[**not indicated to be galvanized**] unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with [**universal shop primer**][**primers specified in Section 099113 "Exterior Painting"**][**primers specified in Section 099123 "Interior Painting"**] unless [**zinc-rich primer is**][**primers specified in Section 099600 "High-Performance Coatings" are**] indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with [**SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."**][**SSPC-SP 3, "Power Tool Cleaning."**][**requirements indicated below:**]
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
 - 5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.27 ALUMINUM FINISHES

- A. As-Fabricated Finish: AA-M12.
- B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 - EXECUTION**3.1 INSTALLATION, GENERAL**

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for **[ceiling-hung toilet partitions][operable partitions][overhead doors][and][overhead grilles]** securely to, and rigidly brace from, building structure.
- C. Anchor shelf angles securely to existing construction with **[expansion anchors][anchor bolts][through bolts]**.
- D. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

- E. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installation of Bearing and Leveling Plates" Article.

- 1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLATION OF PREFABRICATED BUILDING COLUMNS

- A. Install prefabricated building columns to comply with ANSI/AISC 360, "Specifications for Structural Steel Buildings," and with requirements applicable to listing and labeling for fire-resistance rating indicated.

3.4 INSTALLATION OF SHELF ANGLES

- A. Install shelf angles as required to keep masonry level, at correct elevation, and flush with vertical plane.

3.5 INSTALLATION OF METAL LADDERS

- A. Secure ladders to adjacent construction with the clip angles attached to the stringer.
- B. Install brackets as required for securing of ladders welded or bolted to structural steel or built into masonry or concrete.

3.6 INSTALLATION OF ALTERNATING TREAD DEVICES

- A. Secure top and bottom of alternating tread devices to construction to comply with manufacturer's written instructions.

3.7 INSTALLATION OF METAL SHIPS' LADDERS AND PIPE CROSSOVERS

- A. Secure top and bottom of ships' ladders to construction to comply with manufacturer's written instructions.
- B. Secure pipe crossovers to construction to comply with manufacturer's written instructions.

3.8 INSTALLATION OF METAL FLOOR PLATE

- A. Install metal floor plates flush with finished surface. Adjust as required to avoid lippage that could present a tripping hazard.

3.9 INSTALLATION OF ELEVATOR PIT SUMP COVERS

- A. Install tops of elevator sump pit cover plates and frames flush with finished surface. Adjust as required to avoid lippage that could present a tripping hazard.

3.10 INSTALLATION OF STRUCTURAL-STEEL DOOR FRAMES

- A. Fasten structural steel door frames to the floor slab by means of angle clips and expansion bolts. Anchor door jambs to adjacent construction in accordance with shop drawing details.

3.11 INSTALLATION OF MISCELLANEOUS STEEL TRIM

- A. Anchor to concrete construction to comply with manufacturer's written instructions.

3.12 INSTALLATION OF METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
 - 1. Do not fill removable bollards with concrete.
- B. Anchor bollards to existing construction with **[expansion anchors][anchor bolts][through bolts]**. Provide four **3/4-inch (19-mm)** bolts at each bollard unless otherwise indicated.
 - 1. Embed anchor bolts at least **4 inches (100 mm)** in concrete.
- C. Anchor bollards in concrete **[with pipe sleeves preset and anchored into concrete][in formed or core-drilled holes not less than 42 inches (1050 mm) deep and 3/4 inch (19 mm) larger than OD of bollard]**. Fill annular space around bollard solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately **1/8 inch (3 mm)** toward bollard.
- D. Anchor bollards in place with concrete footings. Center and align bollards in holes **3 inches (75 mm)** above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- E. Anchor internal sleeves for removable bollards in **[concrete by inserting in pipe sleeves preset into concrete][formed or core-drilled holes not less than 42 inches (1050 mm) deep and 3/4 inch (19 mm) larger than OD of sleeve]**. Fill annular space around internal sleeves solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately **1/8 inch (3 mm)** toward internal sleeve.
- F. Anchor internal sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes **3 inches (75 mm)** above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.
- G. Place removable bollards over internal sleeves and secure with **3/4-inch (19-mm)** machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. Owner furnishes padlocks.
- H. Fill bollards solidly with concrete, mounding top surface to shed water.
 - 1. Do not fill removable bollards with concrete.

3.13 INSTALLATION OF VEHICULAR BARRIER CABLE SYSTEMS

- A. Install vehicular barrier cable systems at locations indicated, mounted at heights indicated on Drawings above the parking surface. Anchor **[wire ropes][steel prestressing strand]** to structural columns and walls and tension to withstand vehicle loading as specified in "Performance Requirements" Article with no cable tensioned less than **3000 lbf (13.3 kN)**. Do not displace supporting components.

3.14 INSTALLATION OF PIPE AND DOWNSPOUT GUARDS

- A. Provide pipe guards at exposed vertical pipes in **[parking garage][at locations indicated on Drawings]** where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide four **3/4-inch (19-mm)** bolts at each pipe guard. Mount pipe guards with top edge **26 inches (660 mm)** above driving surface.

3.15 INSTALLATION OF ABRASIVE METAL NOSINGS, TREADS, AND THRESHOLDS

- A. Center nosings on tread widths unless otherwise indicated.
- B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.
- C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 079200 "Joint Sealants" to provide a watertight installation.

3.16 INSTALLATION OF CAST-IRON WHEEL GUARDS

- A. Anchor wheel guards to concrete or masonry construction to comply with manufacturer's written instructions. Fill cores solidly with concrete.

3.17 INSTALLATION OF METAL DOWNSPOUT BOOTS

- A. Anchor metal downspout boots to concrete or masonry construction to comply with manufacturer's written instructions.
- B. Secure downspouts terminations to downspouts and substrate per manufacturer's instructions.

3.18 INSTALLATION OF LOOSE BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.19 REPAIRS

- A. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum **2.0-mil (0.05-mm)** dry film thickness.
 - 2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop



paint are specified in [**Section 099113 "Exterior Painting."**][**Section 099123 "Interior Painting."**]

- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 50 00 00

SECTION 05 51 00 00 - METAL FLOOR PLATE STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Industrial Class stairs with steel floor plate treads.
2. Steel railings and guards attached to metal stairs.
3. Steel handrails attached to walls adjacent to metal stairs.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs[, **railings, and guards**].
1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, [**blocking for attachment of wall-mounted handrails,**] and items with integral anchors, that are to be embedded in concrete or masonry.
 2. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.
- D. Schedule installation of railings and guards so wall attachments are made only to completed walls.
1. Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For metal floor plate stairs and the following:

1. Metal floor plate treads.
2. Woven-wire mesh.
3. Welded-wire mesh.
4. Shop primer products.
5. Grout.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Environmental product declaration.
3. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for

- each regional material.
- 4. Environmental Product Declaration (EPD): For each product.
- 5. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
- 6. Environmental Product Declaration: For each product.
- 7. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
- 8. Environmental Product Declaration: For each product.
- 9. Environmental Product Declaration: For each product.
- 10. Third-Party Certifications: For each product.
- 11. Third-Party Certified Life Cycle Assessment: For each product.
- 12. Health Product Declaration (HPD): For each product.
- 13. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

C. Shop Drawings:

- 1. Include plans, elevations, sections, details, and attachments to other work.
- 2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
- 3. Include plan at each level.
- 4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

D. Delegated Design Submittal: For stairs[, **railings, and guards**], including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the **[jurisdiction][State]** in which Project is located.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification.
 - 1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
 - 2. Protect steel members and packaged materials from corrosion and deterioration.

3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
 - a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs[, **railings, and guards**], including attachment to building construction.
- B. Structural Performance of Stairs: Metal stairs withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Uniform Load: **100 lbf/sq. ft. (4.79 kN/sq. m)**.
 2. Concentrated Load: **300 lbf (1.33 kN)** applied on an area of **4 sq. in. (2580 sq. mm)**.
 3. Uniform and concentrated loads need not be assumed to act concurrently.
 4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
 5. Limit deflection of treads, platforms, and framing members to **[L/360]<Insert deflection ratio>**.
- C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Handrails and Top Rails of Guards:
 - a. Uniform load of **50 lbf/ft. (0.73 kN/m)** applied in any direction.
 - b. Concentrated load of **200 lbf (0.89 kN)** applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 2. Infill of Guards:
 - a. Concentrated load of **50 lbf (0.22 kN)** applied horizontally on an area of **1 sq. ft. (0.093 sq. m)**.
 - b. Infill load and other loads need not be assumed to act concurrently.
 3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - a. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature change>**.
- D. Seismic Performance of Stairs: Metal stairs withstand the effects of earthquake motions determined according to **[ASCE/SEI 7]<Insert requirement>**.
 1. Component Importance Factor: **<Insert requirement>**.

2.2 METALS

- A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For

components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
2. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
3. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site.
4. Regional Materials: Products shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
5. Indigenous Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
6. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.

C. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
2. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
3. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site.
4. Regional Materials: Products shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
5. Indigenous Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
6. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.

D. Abrasive-Surface Floor Plate: Steel plate [with abrasive granules rolled into surface][or][with abrasive material metallurgically bonded to steel].

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[IKG]**
 - b. **[Ross Technology Company]**
 - c. **[SlipNOT Metal Safety Flooring, division of Traction Technologies Holdings, LLC]**

- d. <Insert manufacturer's name>
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [IKG]
 - b. [Ross Technology Company]
 - c. [SlipNOT Metal Safety Flooring, division of Traction Technologies Holdings, LLC]
 - d. <Insert manufacturer's name>
- 3. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25]<Insert value> percent.
- E. Steel Tubing for Railings and Guards: [ASTM A500/A500M (cold formed)][or][ASTM A513/A513M].
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25]<Insert value> percent.
 - 2. Regional Materials: Products shall be fabricated within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered within 500 miles (800 km) of Project site.
 - 3. Regional Materials: Products shall be fabricated within 500 miles (800 km) of Project site.
 - 4. Regional Materials: Products shall be fabricated within 100 miles (160 km) of Project site from materials that have been extracted, harvested, or recovered within 100 miles (160 km) of Project site.
 - 5. Indigenous Materials: Products shall be fabricated within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered within 500 miles (800 km) of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 - 6. Regional Materials: Products shall be fabricated within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered within 500 miles (800 km) of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 - 7. Provide galvanized finish for exterior installations and where indicated.
- F. Steel Pipe for Railings and Guards: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25]<Insert value> percent.
 - 2. Regional Materials: Products shall be fabricated within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered within 500 miles (800 km) of Project site.
 - 3. Regional Materials: Products shall be fabricated within 500 miles (800 km) of Project site.
 - 4. Regional Materials: Products shall be fabricated within 100 miles (160 km) of Project site from materials that have been extracted, harvested, or recovered within 100 miles (160 km) of Project site.
 - 5. Indigenous Materials: Products shall be fabricated within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered within 500 miles (800 km) of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 - 6. Regional Materials: Products shall be fabricated within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered within 500 miles (800 km) of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 - 7. Provide galvanized finish for exterior installations and where indicated.

- G. Woven-Wire Mesh, Steel: Intermediate-crimp, **[diamond][square]** pattern, **2-inch (50-mm)** woven-wire mesh, made from **0.135-inch (3.5-mm)** nominal-diameter steel wire complying with ASTM A510/A510M.
1. Recycled Content: Provide manufacturer documentation for recycled content, indicating postconsumer and preconsumer recycled content.
- H. Woven-Wire Mesh, Aluminum: Intermediate-crimp, **[diamond][square]** pattern, **2-inch (50-mm)** woven-wire mesh, made from **0.162-inch- (4.1-mm-)** diameter, aluminum wire complying with **ASTM B211 (ASTM B211M)**, Alloy 6061-T94.
1. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25][50]<Insert value>** percent.
 2. Recycled Content: Provide manufacturer documentation for recycled content, indicating postconsumer and preconsumer recycled content.
- I. Welded-Wire Mesh: **[Diamond][Square]** pattern, **2-inch (50-mm)** welded-wire mesh, made from **0.236-inch (6.0-mm)** nominal-diameter steel wire complying with ASTM A510/A510M.
1. Recycled Content: Provide manufacturer documentation for recycled content, indicating postconsumer and preconsumer recycled content.
- J. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.

2.3 FASTENERS

- A. General: Provide **[zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5][Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5]** where built into exterior walls.
1. Select fasteners for type, grade, and class required.
- B. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated **[and capable of withstanding design loads]**.
- C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, **ASTM A563 (ASTM A563M)**; and, where indicated, flat washers.
- D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, **ASTM A563 (ASTM A563M)**; and, where indicated, flat washers.
1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for **[exterior stairs][stairs indicated to be galvanized][stairs indicated to be shop primed with zinc-rich primer]**.
- E. Post-Installed Anchors: **[Torque-controlled expansion anchors][or][chemical anchors]** capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM

E488/E488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy **[Group 1 (A1)][Group 2 (A4)]** stainless steel bolts, ASTM F593, and nuts, **ASTM F594 (ASTM F836M)**.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Electrodes: Comply with AWS requirements.
- B. Shop Primers: Provide primers that comply with **[Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."][Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."]**
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Zinc-Rich Primer: Comply with SSPC-Paint 20, **[Type I-A][Type I-B][Type I-C][Type II]**, Level **[1][2][3]**, and compatible with topcoat.
- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with **[SSPC-Paint 20][ASTM A780/A780M]** and compatible with paints specified to be used over it.
- G. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for **[interior][exterior]** use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, railings, guards, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 1. Join components by welding unless otherwise indicated.
 2. Use connections that maintain structural value of joined pieces.
- B. Assemble stairs[, **railings, and guards**] in shop to greatest extent possible.
 1. Disassemble units only as necessary for shipping and handling limitations.
 2. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately.
 1. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated.
 2. Remove sharp or rough areas on exposed surfaces.

- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for **[Finish # 3 - Partially dressed weld with spatter removed][Finish #4 - Good quality, uniform undressed weld with minimal splatter]**.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
 - 1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
 - 2. Locate joints where least conspicuous.
 - 3. Fabricate joints that will be exposed to weather in a manner to exclude water.
 - 4. Provide weep holes where water may accumulate internally.

2.6 FABRICATION OF STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Industrial Class, unless more stringent requirements are indicated.
- B. Stair Framing:
 - 1. Stringers: Fabricate of **[steel plates][or][steel channels]**.
 - a. Stringer Size: **[As required to comply with "Performance Requirements" Article][As indicated on Drawings]**.
 - b. Provide closures for exposed ends of channel stringers.
 - c. Finish: **[Shop primed][Painted][Galvanized]**.
 - 2. Platforms and Tread Supports: Construct of **[steel plate][or][steel channel]** headers and miscellaneous framing members as **[required to comply with "Performance Requirements" Article][indicated on Drawings]**.
 - a. Provide closures for exposed ends of channel framing.
 - b. Finish: **[Shop primed][Painted][Galvanized]**.
 - 3. Weld **[or bolt]** stringers to headers; weld **[or bolt]** framing members to stringers and headers.
 - 4. Where stairs are enclosed by gypsum board **[shaft-wall]** assemblies, provide hanger rods or struts to support landings from floor construction above or below.
 - a. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal Floor Plate Stairs: Form treads and platforms to configurations shown from **[rolled-steel][abrasive-surface]** floor plate of thickness **[needed to comply with performance requirements, but not less than 1/4 inch (6.4 mm)][needed to comply with performance requirements, but not less than 3/16 inch (4.8 mm)][needed to comply with performance requirements, but not less than 1/8 inch (3.2 mm)][indicated on Drawings]**.
 1. Form treads with integral nosing and back edge stiffener. Form risers of same material as treads.
 2. Form treads with integral nosing and back edge stiffener. Form risers from steel sheet not less than **0.097 inch (2.5 mm)** thick, welded to tread nosings and stiffeners and to platforms.
 3. Form treads with integral nosing and back edge stiffener and with open risers.
 4. Weld steel supporting brackets to stringers and weld treads to brackets.
 5. Fabricate platforms with integral nosings matching treads and weld to platform framing.
 6. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.
- D. Risers: **[Open][Solid]**.
- E. Toe Plates: Provide toe plates around openings and at edge of open-sided floors and platforms, and at open ends and open back edges of treads.
 1. Material and Finish: Match treads and platforms.
 2. Fabricate to dimensions and details indicated.

2.7 FABRICATION OF STAIR RAILINGS AND GUARDS

- A. Comply with applicable requirements in Section 055213 "Pipe and Tube Railings."
- B. Fabricate railings and guards to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing, and anchorage, but not less than that needed to withstand indicated loads.
 1. Rails and Posts: **[1-5/8-inch- (41-mm-) diameter][1-1/2-inch- (38-mm-) square]** top and bottom rails and **1-1/2-inch- (38-mm-) square** posts.
 2. Picket Infill: **[1/2-inch- (13-mm-)][3/4-inch- (19-mm-)][round][square]** pickets spaced to prohibit the passage of a **4-inch (100-mm)** diameter sphere.
 3. Mesh Infill: **[Woven][Welded]-wire mesh [crimped][welded]** into **1-by-1/2-by-1/8-inch (25-by-13-by-3-mm)** steel channel frames. Orient wire mesh with **[diamonds vertical][wires perpendicular and parallel to top rail][wires horizontal and vertical]**.
 4. Intermediate Rails Infill: **[1-5/8-inch- (41-mm-) diameter][1-1/2-inch- (38-mm-) square]** intermediate rails spaced less than **[12 inches (305 mm)][21 inches (533 mm)]** clear.
- C. Welded Connections: Fabricate railings and guards with welded connections.
 1. Fabricate connections that are exposed to weather in a manner that excludes water.
 - a. Provide weep holes where water may accumulate internally.
 2. Cope components at connections to provide close fit, or use fittings designed for this purpose.
 3. Weld all around at connections, including at fittings.
 4. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 5. Obtain fusion without undercut or overlap.
 6. Remove flux immediately.

7. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for **[Finish #3 - Partially dressed weld with spatter removed][Finish #4 - Good quality, uniform undressed weld with minimal splatter]** as shown in NAAMM AMP 521.

D. Form changes in direction of railings and guards as follows:

1. As detailed.
2. By bending[**or by inserting prefabricated elbow fittings**].
3. By flush bends[**or by inserting prefabricated flush-elbow fittings**].
4. By radius bends of radius indicated[**or by inserting prefabricated elbow fittings of radius indicated**].
5. By inserting prefabricated **[elbow fittings][flush-elbow fittings][elbow fittings of radius indicated]**.

E. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required.

1. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

F. Close exposed ends of railing and guard members with prefabricated end fittings.

G. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

1. Close ends of returns unless clearance between end of rail and wall is **1/4 inch (6 mm)** or less.

H. Connect posts to stair framing by direct welding unless otherwise indicated.

I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.

1. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
2. For galvanized railings and guards, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
3. For nongalvanized railings and guards, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
4. Provide type of bracket **[with flange tapped for concealed anchorage to threaded hanger bolt][with predrilled hole for exposed bolt anchorage]** and that provides **1-1/2-inch (38-mm)** clearance from inside face of handrail to finished wall surface.

J. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports.

1. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.8 FINISHES

A. Finish metal stairs after assembly.

B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 2. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with **[SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."][SSPC-SP 3, "Power Tool Cleaning."][minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:]**
1. Exterior Stairs: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 2. Interior Stairs:
 - a. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. SSPC-SP 3, "Power Tool Cleaning."
- D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
 1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF METAL STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
 1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
 1. Grouted Baseplates: Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces.

- a. Clean bottom surface of baseplates.
- b. Set steel stair baseplates on wedges, shims, or leveling nuts.
- c. After stairs have been positioned and aligned, tighten anchor bolts.
- d. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
- e. Promptly pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
 - 1) Neatly finish exposed surfaces; protect grout and allow to cure.
 - 2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
3. Comply with requirements for welding in "Fabrication, General" Article.

3.3 INSTALLATION OF RAILINGS AND GUARDS

A. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.

1. Space posts at spacing indicated or, if not indicated, as required by design loads.
2. Plumb posts in each direction, within a tolerance of **1/16 inch in 3 feet (2 mm in 1 m)**.
3. Align rails and guards so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed **1/4 inch in 12 feet (6 mm in 3.5 m)**.
4. Secure posts, rail ends, and guard ends to building construction as follows:
 - a. Anchor posts to steel by **[welding][or][bolting]** to steel supporting members.
 - b. Anchor handrail and guard ends to concrete and masonry with steel round flanges welded to rail and guard ends and anchored with post-installed anchors and bolts.

B. Attach handrails to wall with wall brackets.

1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
2. Secure wall brackets to building construction as **required to comply with performance requirements.][follows:]**
 - a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - b. For hollow masonry anchorage, use toggle bolts.
 - c. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
 - d. For steel-framed partitions, use hanger or lag bolts set into **[fire-retardant-treated]**wood backing between studs. Coordinate with stud installation to locate backing members.
 - e. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
 - f. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or

through concealed steel reinforcements.

3.4 REPAIR

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum **2.0-mil (0.05-mm)** dry film thickness.
2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in [**Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."**][**Section 099600 "High-Performance Coatings."**][**Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."**]

- #### B. Repair of Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 51 00 00

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SECTION 05 51 13 00 - METAL PAN STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preassembled steel stairs with **[concrete-filled][precast concrete][precast terrazzo][epoxy-resin-filled][and][abrasive-coating-finished, formed-metal]** treads.
2. **[Steel tube]** railings and guards attached to metal stairs.
3. **[Steel tube]** handrails attached to walls adjacent to metal stairs.
4. Railing gates at the level of exit discharge.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs[, **railings, and guards**].
 1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, **[blocking for attachment of wall-mounted handrails,]** and items with integral anchors, that are to be embedded in concrete or masonry.
 2. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.
- D. Schedule installation of railings and guards so wall attachments are made only to completed walls.
 1. Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For metal pan stairs and the following:

1. Perforated metal.
2. Woven-wire mesh.
3. Welded-wire mesh.
4. Prefilled metal-pan-stair treads.
5. Abrasive nosings.
6. Shop primer products.
7. Nonslip-aggregate concrete finish.
8. Abrasive-coating finish to formed-metal stairs.
9. Precast concrete treads.
10. Precast terrazzo treads.
11. Epoxy-resin-filled stair treads.

12. Handrail wall brackets.
13. Grout.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Environmental product declaration.
3. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
4. Environmental Product Declaration (EPD): For each product.
5. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
6. Environmental Product Declaration: For each product.
7. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
8. Environmental Product Declaration: For each product.
9. Environmental Product Declaration: For each product.
10. Third-Party Certifications: For each product.
11. Third-Party Certified Life Cycle Assessment: For each product.
12. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

C. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.
4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.
5. Indicate profile and dimensions of precast terrazzo treads.
6. Indicate profile and dimensions of epoxy-resin-filled treads.

D. Samples for Verification: For each type and finish of **[nosing][precast terrazzo tread][epoxy-resin-filled tread]**.

E. Delegated Design Submittal: For stairs, **[railings and guards,][precast terrazzo treads,][epoxy-resin-filled treads]**, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the **[jurisdiction][State]** in which Project is located.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification.
 - 1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
 - 2. Protect steel members and packaged materials from corrosion and deterioration.
 - 3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
 - a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs, **[railings and guards,][precast terrazzo treads,][epoxy-resin-filled treads]**, including attachment to building construction.
- B. Structural Performance of Stairs: Metal stairs withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: **100 lbf/sq. ft. (4.79 kN/sq. m)**.
 - 2. Concentrated Load: **300 lbf (1.33 kN)** applied on an area of **4 sq. in. (2580 sq. mm)**.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to **[L/360]<Insert deflection ratio>** or **1/4 inch (6.4 mm)**, whichever is less.
- C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of **50 lbf/ft. (0.73 kN/m)** applied in any direction.
 - b. Concentrated load of **200 lbf (0.89 kN)** applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:

- a. Concentrated load of **50 lbf (0.22 kN)** applied horizontally on an area of **1 sq. ft. (0.093 sq. m)**.
 - b. Infill load and other loads need not be assumed to act concurrently.
3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - a. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature change>**.
- D. Seismic Performance of Stairs: Metal stairs withstand the effects of earthquake motions determined according to **[ASCE/SEI 7]<Insert requirement>**.
 1. Component Importance Factor: **<Insert requirement>**.

2.2 METALS

- A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
 1. Recycled Content: Provide manufacturer documentation for recycled content, indicating postconsumer and preconsumer recycled content.
 2. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
 3. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site.
 4. Regional Materials: Products shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
 5. Indigenous Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 6. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- C. Steel Tubing for Railings and Guards: **[ASTM A500/A500M (cold formed)][or][ASTM A513/A513M]**.
 1. Recycled Content: Provide manufacturer documentation for recycled content, indicating postconsumer and preconsumer recycled content.
 2. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
 3. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site.
 4. Regional Materials: Products shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
 5. Indigenous Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.

- site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
6. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 7. Provide galvanized finish for exterior installations and where indicated.
- D. Steel Pipe for Railings and Guards: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
 2. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
 3. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site.
 4. Regional Materials: Products shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
 5. Indigenous Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 6. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 7. Provide galvanized finish for exterior installations and where indicated.
- E. Uncoated, Cold-Rolled Steel Sheet: ASTM A1008/A1008M, [**either commercial steel, Type B, or** structural steel, **Grade 25 (Grade 170)**, unless another grade is required by design loads; exposed.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
 2. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
 3. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site.
 4. Regional Materials: Products shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
 5. Indigenous Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 6. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- F. Uncoated, Hot-Rolled Steel Sheet: ASTM A1011/A1011M, [**either commercial steel, Type B, or** structural steel, **Grade 30 (Grade 205)**, unless another grade is required by design loads.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.

2. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
 3. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site.
 4. Regional Materials: Products shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
 5. Indigenous Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 6. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- G. Galvanized Steel Sheet: ASTM A653/A653M, **G90 (Z275)** coating, [**either commercial steel, Type B, or** structural steel, **Grade 33 (Grade 230)**, unless another grade is required by design loads.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
 2. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
 3. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site.
 4. Regional Materials: Products shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
 5. Indigenous Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 6. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- H. Expanded-Metal, Carbon Steel: ASTM F1267, [**Type I (expanded)**][**Type II (expanded and flattened)**], Class 1 (uncoated).
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
 2. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
 3. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site.
 4. Regional Materials: Products shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
 5. Indigenous Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 6. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.

- site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
7. Style Designation: **[3/4 number 13][1-1/2 number 10]<Insert designation>**.
- I. Perforated Metal, Uncoated: Cold-rolled steel sheet, ASTM A1008/A1008M, or hot-rolled steel sheet, ASTM A1011/A1011M, commercial steel Type B, **[0.060 inch (1.52 mm)]<Insert dimension>** thick, **[with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows][with 1/8-by-1-inch (3.2-by-25.4-mm) round end slotted holes in staggered rows]<Insert description>**.
 1. Recycled Content: Provide manufacturer documentation for recycled content, indicating postconsumer and preconsumer recycled content.
 2. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
 3. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site.
 4. Regional Materials: Products shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
 5. Indigenous Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 6. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 - J. Perforated Metal, Galvanized Steel Sheet: ASTM A653/A653M, **G90 (Z275)** coating, commercial steel Type B, **[0.064 inch (1.63 mm)]<Insert dimension>** thick, **[with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows]<Insert description>**.
 1. Recycled Content: Provide manufacturer documentation for recycled content, indicating postconsumer and preconsumer recycled content.
 2. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
 3. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site.
 4. Regional Materials: Products shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
 5. Indigenous Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 6. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 - K. Perforated Metal, Aluminum Sheet: **ASTM B209 (ASTM B209M)**, **[0.125 inch (3.18 mm)][0.063 inch (1.60 mm)]<Insert dimension>** thick, **[with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows]<Insert description>**.
 1. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25][50]<Insert value>** percent.

- L. Woven-Wire Mesh, Steel: Intermediate-crimp, **[diamond][square]** pattern, **2-inch (50-mm)** woven-wire mesh, made from **0.135-inch (3.5-mm)** nominal-diameter steel wire complying with ASTM A510/A510M.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- M. Woven-Wire Mesh, Aluminum: Intermediate-crimp, **[diamond][square]** pattern, **2-inch (50-mm)** woven-wire mesh, made from **0.162-inch- (4.1-mm-)** diameter, aluminum wire complying with **ASTM B211 (ASTM B211M)**, Alloy 6061-T94.
1. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25][50]<Insert value>** percent.
- N. Welded-Wire Mesh: **[Diamond][Square]** pattern, **2-inch (50-mm)** welded-wire mesh, made from **0.236-inch (6.0-mm)** nominal-diameter steel wire complying with ASTM A510/A510M.
1. Recycled Content: Provide manufacturer documentation for recycled content, indicating postconsumer and preconsumer recycled content.
- O. Aluminum Extrusions: **ASTM B221 (ASTM B221M)**, Alloy 6063-T6.
1. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25][50]<Insert value>** percent.
- P. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.
1. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25][50]<Insert value>** percent.
- Q. Bronze Extrusions: ASTM B455, Alloy UNS No. C38500 (extruded architectural bronze).
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- R. Bronze Castings: ASTM B584, Alloy UNS No. C83600 (lead red brass) or No. C84400 (lead semired brass).
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- S. Nickel Silver Castings: ASTM B584, Alloy UNS No. C97600 (20 percent lead nickel bronze).
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- T. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.

2.3 ABRASIVE NOSINGS

- A. Cast-Metal Units: Cast [iron][aluminum][bronze][nickel silver], with an integral abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. [American Safety Tread Co., Inc]
 - b. [Balco; a CSW Industrials Company]
 - c. [Barry Pattern & Foundry Co., Inc]
 - d. [Ecoglo, Inc.]
 - e. [Granite State Casting Co]
 - f. [Safe-T-Metal Company, Inc.]
 - g. [TrueNorth Steel]
 - h. [Wooster Products Inc]
 - i. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [American Safety Tread Co., Inc]
 - b. [Balco; a CSW Industrials Company]
 - c. [Barry Pattern & Foundry Co., Inc]
 - d. [Ecoglo, Inc.]
 - e. [Granite State Casting Co]
 - f. [Safe-T-Metal Company, Inc.]
 - g. [TrueNorth Steel]
 - h. [Wooster Products Inc]
 - i. <Insert manufacturer's name>
 3. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert value> percent.
 4. Configuration: Cross-hatched units, **[3 inches (75 mm)][4 inches (100 mm)]** wide without lip.
- B. Extruded Units: **[Aluminum][Bronze]** units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. [American Safety Tread Co., Inc]
 - b. [Amstep Products]
 - c. [Armstrong Products, Inc]
 - d. [Balco; a CSW Industrials Company]
 - e. [Ecoglo, Inc.]
 - f. [Granite State Casting Co]
 - g. [Nystrom, Inc.]
 - h. [UPNOVR, Inc.]

- i. **[Wooster Products Inc]**
 - j. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[American Safety Tread Co., Inc]**
 - b. **[Amstep Products]**
 - c. **[Armstrong Products, Inc]**
 - d. **[Balco; a CSW Industrials Company]**
 - e. **[Ecoglo, Inc.]**
 - f. **[Granite State Casting Co]**
 - g. **[Nystrom, Inc.]**
 - h. **[UPNOVR, Inc.]**
 - i. **[Wooster Products Inc]**
 - j. **<Insert manufacturer's name>**
3. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
4. Provide ribbed units, with abrasive filler strips projecting **1/16 inch (1.5 mm)** above aluminum extrusion.
5. Provide solid-abrasive units without ribs.
6. Nosings, Square-Back Units: **[1-7/8 inches (48 mm)][3 inches (75 mm)][4 inches (100 mm)]** wide, without lip.
7. Nosings, Two-Piece Units: **3 inches (75 mm)** wide, with subchannel for casting into concrete.
- C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- D. Apply bituminous paint to concealed surfaces of cast-metal units set into concrete.
- E. Apply clear lacquer to concealed surfaces of extruded units set into concrete.

2.4 FASTENERS

- A. General: Provide **[zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5][Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5]** where built into exterior walls.
- 1. Select fasteners for type, grade, and class required.
- B. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated[**and capable of withstanding design loads**].
- C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, **ASTM A563 (ASTM A563M)**; and, where indicated, flat washers.
- D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, **ASTM A563 (ASTM A563M)**; and, where indicated, flat washers.
- 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for **[exterior stairs][stairs**

indicated to be galvanized][stairs indicated to be shop primed with zinc-rich primer].

- E. Post-Installed Anchors: **[Torque-controlled expansion anchors][or][chemical anchors]** capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy **[Group 1 (A1)][Group 2 (A4)]** stainless steel bolts, ASTM F593, and nuts, **ASTM F594 (ASTM F836M)**.

2.5 MISCELLANEOUS MATERIALS

- A. Handrail Wall Brackets: **[Cast nickel-silver,][Cast aluminum,][Cast bronze,][Cast stainless steel,]** center of rail **[2-1/2 inches (63.5 mm)][3-1/8 inches (79.4 mm)]<Insert dimension>** from face of wall.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Julius Blum & Co., Inc.]**
 - b. **[The Wagner Companies]**
 - c. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Julius Blum & Co., Inc.]**
 - b. **[The Wagner Companies]**
 - c. **<Insert manufacturer's name>**
- B. Welding Electrodes: Comply with AWS requirements.
- C. Shop Primers: Provide primers that comply with **[Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."][Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."]**
- D. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- E. Zinc-Rich Primer: Comply with SSPC-Paint 20, **[Type I-A][Type I-B][Type I-C][Type II]**, Level **[1][2][3]**, and compatible with topcoat.
- F. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish system indicated.
- G. Galvanizing Repair Paint: High-zinc-dust-content paint complying with **[SSPC-Paint 20][ASTM A780/A780M]** and compatible with paints specified to be used over it.

- H. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- I. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for **[interior][exterior]** use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.
- J. Prefilled Concrete Treads:
 - 1. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with minimum 28-day compressive strength of **3000 psi (20 MPa)** and maximum aggregate size of **1/2 inch (13 mm)** unless otherwise indicated.
 - 2. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.
 - 3. Plain Steel Welded-Wire Reinforcement: ASTM A1064/A10645M, **[steel,][galvanized steel,] 6 by 6 inches (152 by 152 mm)**, W1.4 by W1.4, unless otherwise indicated on Drawings.
 - a. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
 - 4. Reinforcement Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening welded-wire reinforcement in place.
 - a. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.
- K. For galvanized reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.6 PRECAST CONCRETE TREADS

- A. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of **5000 psi (35 MPa)** and a total air content of not less than 4 percent or more than 6 percent.
- B. Reinforcement: Galvanized, welded-wire reinforcement, **2 by 2 inches (50 by 50 mm)** by **0.062-inch-(1.6-mm-)** diameter steel wire; comply with ASTM A1064/A1064M, except for minimum wire size.

2.7 PRECAST TERRAZZO TREADS

- A. Precast Terrazzo Stair Treads: Epoxy terrazzo units cast in maximum lengths possible. Comply with manufacturer's written instructions for fabricating precast terrazzo units in sizes and profiles indicated.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Wausau Tile, Inc.]**
 - b. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert**

manufacturer's name; product name or designation> or comparable product by one of the following:

- a. **[Wausau Tile, Inc.]**
- b. **<Insert manufacturer's name>**
3. Epoxy Resin Matrix: Manufacturer's standard recommended for use indicated.
4. Aggregates: Comply with NTMA gradation standards for mix indicated, and containing no deleterious or foreign matter.
 - a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C131/C131M.
 - b. 24-Hour Absorption Rate: Less than 0.75 percent.
 - c. Dust Content: Less than 1.0 percent by weight.
5. Reinforcement: ASTM A615/A615M, **Grade 60 (Grade 420)** bars, as required by unit size, profile, and thickness.
6. Abrasive Inserts: **1/2-inch- (13-mm-)** wide, silicon carbon/epoxy mixture.
 - a. Provide three inserts, **1/2 inch (13 mm)** apart, with first insert located **1 inch (25 mm)** from nosing at adjacent stair riser locations.
7. Color: As selected by Architect from manufacturer's standard color selections.
8. Finish: Honed.
9. Surface Sealer: Slip- and stain-resistant, penetrating sealer that is chemically neutral with pH factor between 7 and 8; does not affect color or physical properties of terrazzo type indicated; is recommend by sealer manufacturer for use with specified terrazzo; and complies with NTMA guide specification for terrazzo type applicable for this Project.

2.8 EPOXY-RESIN-FILLED TREADS

- A. Epoxy-Resin-Filled Treads: **3/8-inch- (9.5-mm-)** thick, epoxy resin with **8000-psi (55 158-kPa)** compressive strength; set on steel subthread.
 1. Color: As selected by Architect from manufacturer's standard color selections.

2.9 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, **[railings and guards,]** clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 1. Join components by welding unless otherwise indicated.
 2. Use connections that maintain structural value of joined pieces.
- B. Assemble stairs **[, railings, and guards]** in shop to greatest extent possible.
 1. Disassemble units only as necessary for shipping and handling limitations.
 2. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately.
 1. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated.

2. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Weld exposed corners and seams continuously unless otherwise indicated.
 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for **[Finish #1 - No evidence of welded joint][Finish #2 - Completely sanded joint with some undercutting and pinholes okay][Finish #3 - Partially dressed weld with spatter removed][Finish #4 - Good quality, uniform undressed weld with minimal splatter]**.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
 1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
 2. Locate joints where least conspicuous.
 3. Fabricate joints that will be exposed to weather in a manner to exclude water.
 4. Provide weep holes where water may accumulate internally.

2.10 FABRICATION OF STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for **[Architectural][Commercial][Service]** Class, unless more stringent requirements are indicated.
- B. Stair Framing:
 1. Stringers: Fabricate of **[steel plates][or][steel channels][or][steel rectangular tubes][as indicated on Drawings]**.
 - a. Stringer Size: **[As required to comply with "Performance Requirements" Article][As indicated on Drawings]**.
 - b. Provide closures for exposed ends of channel and rectangular tube stringers.
 - c. Finish: **[Shop primed][Painted][Galvanized]**.
 2. Platforms: Construct of **[steel plate][or][steel channel][or][steel rectangular tube]** headers and miscellaneous framing members as **[required to comply with "Performance Requirements" Article][indicated on Drawings]**.
 - a. Provide closures for exposed ends of channel and rectangular tube framing.
 - b. Finish: **[Shop primed][Painted][Galvanized]**.
 3. Weld **[or bolt]** stringers to headers; weld **[or bolt]** framing members to stringers and headers. **[If using bolts, fabricate and join so bolts are not exposed on finished surfaces.]**
 4. Where stairs are enclosed by gypsum board **[shaft-wall]** assemblies, provide hanger rods or struts to support landings from floor construction above or below.

- a. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.
 5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
 - C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than **0.067 inch (1.7 mm)**.
 1. Fabricate treads and landing subplatforms of exterior stairs so finished walking surfaces slope to drain.
 2. Steel Sheet, Uncoated: [**Cold**][**Hot**]-rolled steel sheet[**unless otherwise indicated**].
 3. Galvanized Steel Sheet: Galvanized steel sheet[, **where indicated**].
 4. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
 5. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
 6. Shape metal pans to include nosing integral with riser.
 7. Attach abrasive nosings to risers.
 8. At Contractor's option, provide stair assemblies with metal pan subtreads filled with reinforced concrete during fabrication.
 9. Provide epoxy-resin-filled treads, reinforced with glass fibers, with non-slip-concrete aggregate finish to tread surface.
 10. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.
 - a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.
 - D. Abrasive-Coating-Finished, Formed-Metal Stairs: Form risers, treads, and platforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than **0.097 inch (2.5 mm)**.
 1. Steel Sheet: Uncoated, hot-rolled steel sheet unless otherwise indicated.
 2. Directly weld risers and treads to stringers; locate welds on underside of stairs.
 3. Provide platforms of configuration indicated or, if not indicated, the same as treads. Weld platforms to platform framing.
 4. Finish tread and platform surfaces with manufacturer's standard epoxy-bonded abrasive finish.
- 2.11 FABRICATION OF STAIR RAILINGS AND GUARDS
- A. Comply with applicable requirements in [**Section 055213 "Pipe and Tube Railings."**][**Section 057300 "Decorative Metal Railings."**]
 - B. Fabricate railings and guards to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing, and anchorage, but not less than that needed to withstand indicated loads.
 1. Rails and Posts: [**1-5/8-inch- (41-mm-) diameter**][**1-1/2-inch- (38-mm-) square**] top and bottom rails and **1-1/2-inch- (38-mm-) square** posts.
 2. Picket Infill: [**1/2-inch- (13-mm-)**][**3/4-inch- (19-mm-)**][**round**][**square**] pickets spaced to prohibit the passage of a **4-inch (100-mm)** diameter sphere.
 3. Expanded-Metal Infill: Expanded-metal panels edged with U-shaped channels made from steel sheet and not less than **0.043 inch (1.1 mm)** thick. Orient expanded metal with long dimension of

4. diamonds [parallel to top rail][perpendicular to top rail][vertical].
Perforated-Metal Infill: Perforated-metal panels edged with U-shaped channels made from metal sheet, of same metal as perforated metal, and not less than **0.043 inch (1.1 mm)** thick. Orient perforated metal with pattern [parallel to top rail][perpendicular to top rail][horizontal][vertical][as indicated on Drawings].
5. Mesh Infill: **[Woven][Welded]**-wire mesh crimped into **1-by-1/2-by-1/8-inch (25-by-13-by-3-mm)** steel channel frames. Orient wire mesh with [diamonds vertical][wires perpendicular and parallel to top rail][wires horizontal and vertical].
6. Intermediate Rails Infill: [1-5/8-inch- (41-mm-) diameter][1-1/2-inch- (38-mm-) square] intermediate rails spaced less than [12 inches (305 mm)][21 inches (533 mm)] clear.
7. Gates: Form gates from steel tube of same size and shape as top rails, with infill to match guards. Provide with [cam-type, self-closing][spring] hinges for fastening to wall and overlapping stop with rubber bumper to prevent gate from opening in direction opposite egress.

C. Welded Connections: Fabricate railings and guards with welded connections.

1. Fabricate connections that are exposed to weather in a manner that excludes water.
 - a. Provide weep holes where water may accumulate internally.
2. Cope components at connections to provide close fit, or use fittings designed for this purpose.
3. Weld all around at connections, including at fittings.
4. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
5. Obtain fusion without undercut or overlap.
6. Remove flux immediately.
7. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for **[Finish #1 - No evidence of a welded joint][Finish #2 - Completely sanded joint, some undercutting and pinholes are okay][Finish #3 - Partially dressed weld with spatter removed][Finish #4 - Good quality, uniform undressed weld with minimal splatter]** as shown in NAAMM AMP 521.

D. Form changes in direction of railings and guards as follows:

1. As detailed.
2. By bending[**or by inserting prefabricated elbow fittings**].
3. By flush bends[**or by inserting prefabricated flush-elbow fittings**].
4. By radius bends of radius indicated[**or by inserting prefabricated elbow fittings of radius indicated**].
5. By inserting prefabricated [elbow fittings][flush-elbow fittings][elbow fittings of radius indicated].

E. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

F. Close exposed ends of railing and guard members with prefabricated end fittings.

G. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

1. Close ends of returns unless clearance between end of rail and wall is **1/4 inch (6 mm)** or less.

H. Connect posts to stair framing by direct welding unless otherwise indicated.

I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.

1. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
 2. For galvanized railings and guards, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
 3. For nongalvanized railings and guards, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
 4. Provide type of bracket [**with flange tapped for concealed anchorage to threaded hanger bolt**][**with predrilled hole for exposed bolt anchorage**] and that provides **1-1/2-inch (38-mm)** clearance from inside face of handrail to finished wall surface.
- J. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports.
1. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.12 FINISHES

- A. Finish metal stairs after assembly.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. Preparation for Shop Priming: Prepare uncoated, ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF METAL PAN STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.

1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
 1. Grouted Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates.
 - a. Clean bottom surface of plates.
 - b. Set plates for structural members on wedges, shims, or setting nuts.
 - c. Tighten anchor bolts after supported members have been positioned and plumbed.
 - d. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - e. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.
 - 1) Neatly finish exposed surfaces; protect grout and allow to cure.
 - 2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints.
 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
 3. Comply with requirements for welding in "Fabrication, General" Article.
- F. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."
 1. Install abrasive nosings with anchors fully embedded in concrete.
 2. Center nosings on tread width.
- G. Install precast concrete treads with adhesive supplied by manufacturer.
- H. Install precast terrazzo treads according to manufacturer's written instructions.

3.3 INSTALLATION OF RAILINGS AND GUARDS

- A. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.
 1. Space posts at spacing indicated or, if not indicated, as required by design loads.
 2. Plumb posts in each direction, within a tolerance of **1/16 inch in 3 feet (2 mm in 1 m)**.
 3. Align rails and guards so variations from level for horizontal members and variations from parallel

- with rake of stairs for sloping members do not exceed **1/4 inch in 12 feet (6 mm in 3.5 m)**.
4. Secure posts, rail ends, and guard ends to building construction as follows:
 - a. Anchor posts to steel by **[welding][or][bolting]** to steel supporting members.
 - b. Anchor handrail and guard ends to concrete and masonry with steel round flanges welded to rail and guard ends and anchored with post-installed anchors and bolts.
 - B. Install railing gates level, plumb, and secure for full opening without interference.
 1. Attach hardware using tamper-resistant or concealed means.
 2. Adjust hardware for smooth operation.
 - C. Attach handrails to wall with wall brackets.
 1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
 2. Secure wall brackets to building construction as **[required to comply with performance requirements.][follows:]**
 - a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - b. For hollow masonry anchorage, use toggle bolts.
 - c. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
 - d. For steel-framed partitions, use hanger or lag bolts set into **[fire-retardant-treated]**wood backing between studs. Coordinate with stud installation to locate backing members.
 - e. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
 - f. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.4 REPAIR

- A. Touchup Painting:
 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum **2.0-mil (0.05-mm)** dry film thickness.
 2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in **[Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."][Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."]**
- B. Repair of Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

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Task	Specification	Specification Description
05 51 13 00	05 50 00 00	Metal Fabrications
05 51 13 00	05 51 00 00	Metal Floor Plate Stairs
05 51 13 00	05 71 13 00	Fabricated Metal Spiral Stairs



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SECTION 05 51 19 00 - METAL GRATING STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal grating stairs.
2. Steel railings and guards.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs[, **railings, and guards**].
1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, [**blocking for attachment of wall-mounted handrails,**] and items with integral anchors, that are to be embedded in concrete or masonry.
 2. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.
- D. Schedule installation of railings and guards so wall attachments are made only to completed walls.
1. Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For metal grating stairs and the following:

1. Gratings.
2. Woven-wire mesh.
3. Welded-wire mesh.
4. Shop primer products.
5. Grout.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Environmental product declaration.
3. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.

4. Environmental Product Declaration (EPD): For each product.
5. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
6. Environmental Product Declaration: For each product.
7. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
8. Environmental Product Declaration: For each product.
9. Environmental Product Declaration: For each product.
10. Third-Party Certifications: For each product.
11. Third-Party Certified Life Cycle Assessment: For each product.
12. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

C. Shop Drawings:

1. Include plans, elevations, sections, details, and attachment to other work.
2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
3. Include plan at each level.
4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

D. Delegated Design Submittal: For stairs[, **railings, and guards**], including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the **[jurisdiction][State]** in which Project is located.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification.
 1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
 2. Protect steel members and packaged materials from corrosion and deterioration.
 3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.

- a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs[, **railings, and guards**], including attachment to building construction.
- B. Structural Performance of Stairs: Metal stairs withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Uniform Load: **100 lbf/sq. ft. (4.79 kN/sq. m)**.
 2. Concentrated Load: **300 lbf (1.33 kN)** applied on an area of **4 sq. in. (2580 sq. mm)**.
 3. Uniform and concentrated loads need not be assumed to act concurrently.
 4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
 5. Limit deflection of treads, platforms, and framing members to **[L/360]<Insert deflection ratio>**.
- C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Handrails and Top Rails of Guards:
 - a. Uniform load of **50 lbf/ft. (0.73 kN/m)** applied in any direction.
 - b. Concentrated load of **200 lbf (0.89 kN)** applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 2. Infill of Guards:
 - a. Concentrated load of **50 lbf (0.22 kN)** applied horizontally on an area of **1 sq. ft. (0.093 sq. m)**.
 - b. Infill load and other loads need not be assumed to act concurrently.
 3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - a. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature change>**.
- D. Seismic Performance of Stairs: Metal stairs withstand the effects of earthquake motions determined according to **[ASCE/SEI 7]<Insert requirement>**.
 1. Component Importance Factor: **<Insert requirement>**.

2.2 METALS

- A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
 2. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
 3. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site.
 4. Regional Materials: Products shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
 5. Indigenous Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 6. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- C. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
 2. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
 3. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site.
 4. Regional Materials: Products shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
 5. Indigenous Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 6. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- D. Steel Bars for Grating Treads: ASTM A36/A36M or steel strip, ASTM A1011/A1011M or ASTM A1018/A1018M.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
 2. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
 3. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site.
 4. Regional Materials: Products shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
 5. Indigenous Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.

- site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
6. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- E. Steel Wire Rod for Grating Crossbars: ASTM A510/A510M.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
 2. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
 3. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site.
 4. Regional Materials: Products shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
 5. Indigenous Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 6. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- F. Aluminum Bars for Grating Treads: **ASTM B221 (ASTM B221M)** extruded aluminum, alloys as follows:
1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
 2. 6061-T1, for grating crossbars.
 3. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25][50]<Insert value>** percent.
- G. Steel Tubing for Railings and Guards: **[ASTM A500/A500M (cold formed)][or][ASTM A513/A513M]**.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
 2. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
 3. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site.
 4. Regional Materials: Products shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
 5. Indigenous Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 6. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 7. Provide galvanized finish for exterior installations and where indicated.
- H. Steel Pipe for Railings and Guards: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight

(Schedule 40), unless another grade and weight are required by structural loads.

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
 2. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site.
 3. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site.
 4. Regional Materials: Products shall be fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
 5. Indigenous Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 6. Regional Materials: Products shall be fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- I. Provide galvanized finish for exterior installations and where indicated.
- J. Woven-Wire Mesh, Steel: Intermediate-crimp, **[diamond][square]** pattern, **2-inch (50-mm)** woven-wire mesh, made from **0.135-inch (3.5-mm)** nominal-diameter steel wire complying with ASTM A510/A510M.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- K. Woven-Wire Mesh, Aluminum: Intermediate-crimp, **[diamond][square]** pattern, **2-inch (50-mm)** woven-wire mesh, made from **0.162-inch- (4.1-mm-)** diameter, aluminum wire complying with **ASTM B211 (ASTM B211M)**, Alloy 6061-T94.
1. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25][50]<Insert value>** percent.
- L. Welded-Wire Mesh: **[Diamond][Square]** pattern, **2-inch (50-mm)** welded-wire mesh, made from **0.236-inch (6.0-mm)** nominal-diameter steel wire complying with ASTM A510/A510M.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- M. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- N. Cast-Abrasive Nosings: Cast iron, with an integral abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.

2.3 FASTENERS

- A. General: Provide **[zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5][Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5]** where built into exterior walls.
 - 1. Select fasteners for type, grade, and class required.
- B. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated **[and capable of withstanding design loads]**.
- C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, **ASTM A563 (ASTM A563M)**; and, where indicated, flat washers.
- D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, **ASTM A563 (ASTM A563M)**; and, where indicated, flat washers.
 - 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for **[exterior stairs][stairs indicated to be galvanized][stairs indicated to be shop primed with zinc-rich primer]**.
- E. Post-Installed Anchors: **[Torque-controlled expansion anchors][or][chemical anchors]** capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy **[Group 1 (A1)][Group 2 (A4)]** stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Electrodes: Comply with AWS requirements.
- B. Shop Primers: Provide primers that comply with **[Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."][Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings.]**
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Zinc-Rich Primer: Comply with SSPC-Paint 20, **[Type I-A][Type I-B][Type I-C][Type II]**, Level **[1][2][3]**, and compatible with topcoat.
- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with **[SSPC-Paint 20][ASTM A780/A780M]** and compatible with paints specified to be used over it.

- G. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for **[interior][exterior]** use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, railings, guards, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
1. Join components by welding unless otherwise indicated.
 2. Use connections that maintain structural value of joined pieces.
- B. Assemble stairs[, **railings, and guards**] in shop to greatest extent possible.
1. Disassemble units only as necessary for shipping and handling limitations.
 2. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately.
1. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated.
 2. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Weld exposed corners and seams continuously unless otherwise indicated.
 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for **[Finish # 3 - Partially dressed weld with spatter removed][Finish #4 - Good quality, uniform undressed weld with minimal splatter]**.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
 2. Locate joints where least conspicuous.
 3. Fabricate joints that are exposed to weather in a manner to exclude water.
 4. Provide weep holes where water may accumulate internally.

2.6 FABRICATION OF STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Industrial Class,

unless more stringent requirements are indicated.

B. Stair Framing:

1. Fabricate stringers of steel **[plates][or][channels]**.
 - a. Stringer Size: **[As required to comply with "Performance Requirements" Article][As indicated on Drawings]**.
 - b. Provide closures for exposed ends of channel stringers.
 - c. Finish: **[Shop primed][Painted][Galvanized]**.
2. Construct platforms and tread supports of steel **[plate][or][channel]** headers and miscellaneous framing members as **[required to comply with "Performance Requirements" Article][indicated on Drawings]**.
 - a. Provide closures for exposed ends of channel framing.
 - b. Finish: **[Shop primed][Painted][Galvanized]**.
3. Weld **[or bolt]** stringers to headers; weld **[or bolt]** framing members to stringers and headers.
4. Where stairs are enclosed by gypsum board **[shaft-wall]** assemblies, provide hanger rods or struts to support landings from floor construction above or below.
 - a. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.
5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal Bar-Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual."

1. Fabricate treads and platforms from **[welded steel][or][pressure-locked steel][pressure-locked aluminum]** grating with **[1-1/4-by-3/16-inch (32-by-5-mm) bearing bars at 15/16 inch (24 mm) o.c.][1-by-3/16-inch (25-by-5-mm) bearing bars at 11/16 inch (17 mm) o.c.][1-by-1/8-inch (25-by-3-mm) bearing bars at 7/16 inch (11 mm) o.c.]** and crossbars at 4 inches (100 mm) o.c.
2. Fabricate treads and platforms from **[welded steel][or][pressure-locked steel][pressure-locked aluminum]** grating with openings in gratings no more than **[5/16 inch (8 mm)][1/2 inch (12 mm)][3/4 inch (19 mm)][1 inch (25 mm)]** in least dimension.
 - a. Surface: **[Plain][Serrated]**.
 - b. Finish: **[Shop primed][Painted][Galvanized][Mill]**.
3. Fabricate grating treads with **[rolled-steel floor plate][cast-abrasive]** nosing and with steel angle or steel plate carrier at each end for stringer connections.
 - a. Secure treads to stringers with bolts.
4. Fabricate grating platforms with nosing matching that on grating treads.
 - a. Secure grating to platform framing **[by welding][with bolts]**.

D. Risers: **[Open][Solid]**.

E. Toe Plates: Provide toe plates around openings and at edge of open-sided floors and platforms, and at open ends and open back edges of treads.

1. Material and Finish: Steel plate to match finish of other steel items.
2. Fabricate to dimensions and details indicated.

2.7 FABRICATION OF STAIR RAILINGS AND GUARDS

- A. Comply with applicable requirements in Section 055213 "Pipe and Tube Railings."
- B. Fabricate railings and guards to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing, and anchorage, but not less than that needed to withstand indicated loads.
 1. Rails and Posts: **[1-5/8-inch- (41-mm-) diameter][1-1/2-inch- (38-mm-) square]** top and bottom rails and **1-1/2-inch- (38-mm-) square** posts.
 2. Picket Infill: **[1/2-inch- (13-mm)][3/4-inch (19-mm)][round][square]** pickets spaced to prohibit the passage of a **4-inch (100-mm)** diameter sphere.
 3. Mesh Infill: **[Woven][Welded]-wire mesh [crimped][welded] into 1-by-1/2-by-1/8-inch (25-by-13-by-3-mm) steel channel frames. Orient wire mesh with [diamonds vertical][wires perpendicular and parallel to top rail][wires horizontal and vertical].**
 4. Intermediate Rails Infill: **[1-5/8-inch- (41-mm-) diameter][1-1/2-inch- (38-mm-) square]** intermediate rails spaced less than **[12 inches (305 mm)][21 inches (533 mm)]** clear.
- C. Welded Connections: Fabricate railings and guards with welded connections.
 1. Fabricate connections that are exposed to weather in a manner that excludes water.
 - a. Provide weep holes where water may accumulate internally.
 2. Cope components at connections to provide close fit, or use fittings designed for this purpose.
 3. Weld all around at connections, including at fittings.
 4. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 5. Obtain fusion without undercut or overlap.
 6. Remove flux immediately.
 7. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for **[Finish #3 - Partially dressed weld with spatter removed][Finish #4 - Good quality, uniform undressed weld with minimal splatter]** as shown in NAAMM AMP 521.
- D. Form changes in direction of railings and guards as follows:
 1. As detailed.
 2. By bending[**or by inserting prefabricated elbow fittings**].
 3. By flush bends[**or by inserting prefabricated flush-elbow fittings**].
 4. By radius bends of radius indicated[**or by inserting prefabricated elbow fittings of radius indicated**].
 5. By inserting prefabricated **[elbow fittings][flush-elbow fittings][elbow fittings of radius indicated]**.
- E. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required.
 1. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- F. Close exposed ends of railing and guard members with prefabricated end fittings.

- G. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.
 - 1. Close ends of returns unless clearance between end of rail and wall is **1/4 inch (6 mm)** or less.
- H. Connect posts to stair framing by direct welding unless otherwise indicated.
- I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.
 - 1. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
 - 2. For galvanized railings and guards, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
 - 3. For nongalvanized railings and guards, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
 - 4. Provide type of bracket [**with flange tapped for concealed anchorage to threaded hanger bolt**][**with predrilled hole for exposed bolt anchorage**] and that provides **1-1/2-inch (38-mm)** clearance from inside face of handrail to finished wall surface.
- J. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports.
 - 1. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.8 FINISHES

- A. Finish metal stairs after assembly.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 - 1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 - 2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with [**SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."**][**SSPC-SP 3, "Power Tool Cleaning."**][**minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:**]
 - 1. Exterior Stairs: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interior Stairs:
 - a. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - b. SSPC-SP 3, "Power Tool Cleaning."
- D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
 - 1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF METAL STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
 - 1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
 - 1. Grouted Baseplates: Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces.
 - a. Clean bottom surface of baseplates.
 - b. Set steel-stair baseplates on wedges, shims, or leveling nuts.
 - c. After stairs have been positioned and aligned, tighten anchor bolts.
 - d. Do not remove wedges or shims, but if protruding, cut off flush with edge of bearing plate before packing with grout.
 - e. Promptly pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
 - 1) Neatly finish exposed surfaces; protect grout and allow to cure.
 - 2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints.
 - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 - 2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
 - 3. Comply with requirements for welding in "Fabrication, General" Article.

3.3 INSTALLATION OF RAILINGS AND GUARDS

- A. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.
1. Space posts at spacing indicated or, if not indicated, as required by design loads.
 2. Plumb posts in each direction, within a tolerance of **1/16 inch in 3 feet (2 mm in 1 m)**.
 3. Align rails and guards so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed **1/4 inch in 12 feet (6 mm in 3.5 m)**.
 4. Secure posts, rail ends, and guard ends to building construction as follows:
 - a. Anchor posts to steel by **[welding][or][bolting]** to steel supporting members.
 - b. Anchor handrail and guard ends to concrete and masonry with steel round flanges welded to rail and guard ends and anchored with post-installed anchors and bolts.
- B. Attach handrails to wall with wall brackets.
1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
 2. Secure wall brackets to building construction as **[required to comply with performance requirements.][follows:]**
 - a. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - b. For hollow masonry anchorage, use toggle bolts.
 - c. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
 - d. For steel-framed partitions, use hanger or lag bolts set into **[fire-retardant-treated]**wood backing between studs. Coordinate with stud installation to locate backing members.
 - e. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
 - f. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.4 REPAIR

- A. Touchup Painting:
1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum **2.0-mil (0.05-mm)** dry film thickness.
 2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in **[Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."][Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."]**
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 51 19 00

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Task	Specification	Specification Description
05 51 19 00	05 50 00 00	Metal Fabrications
05 51 19 00	05 51 13 00	Metal Pan Stairs
05 51 19 00	05 51 00 00	Metal Floor Plate Stairs
05 51 19 00	05 71 13 00	Fabricated Metal Spiral Stairs
05 51 33 00	05 51 00 00	Metal Floor Plate Stairs
05 51 33 13	05 50 00 00	Metal Fabrications
05 51 33 13	05 51 00 00	Metal Floor Plate Stairs
05 51 33 13	05 52 13 00	Pipe And Tube Railings
05 51 33 16	05 50 00 00	Metal Fabrications
05 51 33 16	05 51 00 00	Metal Floor Plate Stairs
05 51 33 23	05 50 00 00	Metal Fabrications
05 51 33 23	05 51 00 00	Metal Floor Plate Stairs
05 51 33 23	05 52 13 00	Pipe And Tube Railings



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SECTION 05 52 13 00 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel railings.
2. Aluminum railings.
3. Stainless steel railings.

B. Related Requirements:

1. Section 055113 "Metal Pan Stairs" for steel tube railings associated with metal pan stairs.
2. Section 057300 "Decorative Metal Railings" for ornamental railings fabricated from pipes and tubes and guard-infill metals.
3. Section 096900 "Access Flooring" for railings included with access flooring.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of mechanically connected railings.
2. Expanded metal infill panels.
3. Perforated metal infill panels.
4. Woven-wire mesh infill panels.
5. Fasteners.
6. Post-installed anchors.
7. Handrail brackets.
8. Shop primer.
9. Intermediate coats and topcoats.
10. Bituminous paint.
11. Nonshrink, nonmetallic grout.
12. Anchoring cement.
13. Metal finishes.
14. Paint products.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- D. Samples for Initial Selection: For products involving selection of color, texture, or design[, **including mechanical finishes**].
- E. Samples for Verification: For each type of exposed finish required.
 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
 2. Fittings and brackets.
 3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
 - a. Show method of [**connecting**][**and**][**finishing**] members at intersections.
- F. Delegated Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For [**delegated design professional engineer**][**testing agency**].
- B. Welding certificates.
- C. Mill Certificates: Signed by manufacturers of stainless steel products, certifying that products furnished comply with requirements.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- E. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.
- F. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of **50 lbf/ ft. (0.73 kN/m)** applied in any direction.
 - b. Concentrated load of **200 lbf (0.89 kN)** applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of **50 lbf (0.22 kN)** applied horizontally on an area of **1 sq. ft. (0.093 sq. m)**.
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature change>**.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 - 1. Provide type of bracket with **[flange tapped for concealed anchorage to threaded hanger bolt][predrilled hole for exposed bolt anchorage]** and that provides **1-1/2-inch (38-mm)** clearance from inside face of handrail to finished wall surface.

2.3 STEEL RAILINGS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **[Hollaender Mfg. Co.]**

2. [Kee Safety, Inc.]
 3. [Trex Commercial Products, Inc.]
 4. [TrueNorth Steel]
 5. [Tuttle, a Dant Clayton Division]
 6. [VIVA Railings, LLC]
 7. [Wagner Companies (The); R&B Wagner, Inc.]
 8. <Insert manufacturer's name>
- B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
1. [Hollaender Mfg. Co.]
 2. [Kee Safety, Inc.]
 3. [Trex Commercial Products, Inc.]
 4. [TrueNorth Steel]
 5. [Tuttle, a Dant Clayton Division]
 6. [VIVA Railings, LLC]
 7. [Wagner Companies (The); R&B Wagner, Inc.]
 8. <Insert manufacturer's name>
- C. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- D. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25]<Insert value> percent.
- E. Tubing: [ASTM A500/A500M (cold formed)][or][ASTM A513/A513M, Type 5].
- F. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
1. Provide galvanized finish for exterior installations and where indicated.
- G. Plates, Shapes, and Bars: ASTM A36/A36M.
- H. Cast Iron Fittings: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
- I. Expanded Metal Infill Panels: ASTM F1267, [Type I (expanded)][Type II (expanded and flattened)], Class 1 (uncoated).
1. Style Designation: [3/4 number 13][1-1/2 number 10]<Insert designation>.
- J. Perforated-Metal Infill Panels:
1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, or hot-rolled steel sheet, ASTM A1011/A1011M, commercial steel, Type B, [0.060 inch (1.52 mm)]<Insert dimension> thick, [with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows]<Insert description>.
 - a. Basis-of-Design Product: Provide product with perforations matching [product indicated on Drawings]<Insert manufacturer's name; product name or designation>.
 2. Galvanized-Steel Sheet: ASTM A653/A653M, G90 (Z275) coating, commercial steel Type B, [0.064 inch (1.63 mm)]<Insert dimension> thick, [with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows][with 1/8-by-1-inch (3.2-by-25.4-mm) round end slotted holes in staggered rows]<Insert description>.

- a. Basis-of-Design Product: Provide product with perforations matching **[product indicated on Drawings]<Insert manufacturer's name; product name or designation>**.
- K. Woven-Wire Mesh Infill Panels: Intermediate-crimp, **[diamond][square]** pattern, **2-inch (50-mm)** woven-wire mesh, made from **0.134-inch- (3.42-mm-)** diameter steel wire complying with **ASTM A510 (ASTM A510M)**.
 - 1. Basis-of-Design Product: Provide product with crimp pattern matching **[product indicated on Drawings]<Insert manufacturer's name; product name or designation>**.

2.4 ALUMINUM RAILINGS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **[ATR Technologies, Inc.]**
 - 2. **[CraneVeyor Corp]**
 - 3. **[Hollaender Mfg. Co.]**
 - 4. **[Julius Blum & Co., Inc.]**
 - 5. **[Kane Innovations, Inc.]**
 - 6. **[Kattsafe]**
 - 7. **[Kee Safety, Inc.]**
 - 8. **[Moultrie Rail Systems]**
 - 9. **[Superior Aluminum Products, Inc]**
 - 10. **[Thompson Fabricating, LLC]**
 - 11. **[TimberTech, AZEK Building Products; The AZEK Company LLC]**
 - 12. **[Trex Commercial Products, Inc.]**
 - 13. **[Tri Tech, Inc.]**
 - 14. **[Tubular Specialties Manufacturing, Inc.]**
 - 15. **[Tuttle, a Dant Clayton Division]**
 - 16. **[Wagner Companies (The); R&B Wagner, Inc.]**
 - 17. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1. **[ATR Technologies, Inc.]**
 - 2. **[CraneVeyor Corp]**
 - 3. **[Hollaender Mfg. Co.]**
 - 4. **[Julius Blum & Co., Inc.]**
 - 5. **[Kane Innovations, Inc.]**
 - 6. **[Kattsafe]**
 - 7. **[Kee Safety, Inc.]**
 - 8. **[Moultrie Rail Systems]**
 - 9. **[Superior Aluminum Products, Inc]**
 - 10. **[Thompson Fabricating, LLC]**
 - 11. **[TimberTech, AZEK Building Products; The AZEK Company LLC]**
 - 12. **[Trex Commercial Products, Inc.]**
 - 13. **[Tri Tech, Inc.]**
 - 14. **[Tubular Specialties Manufacturing, Inc.]**
 - 15. **[Tuttle, a Dant Clayton Division]**
 - 16. **[Wagner Companies (The); R&B Wagner, Inc.]**
 - 17. **<Insert manufacturer's name>**

- C. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- D. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
- E. Extruded Bars and Tubing: **ASTM B221 (ASTM B221M)**, Alloy 6063-T5/T52.
- F. Extruded Structural Pipe and Round Tubing: ASTM B429/B429M, Alloy 6063-T6.
 - 1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.
- G. Drawn Seamless Tubing: ASTM B210/B210M, Alloy 6063-T832.
- H. Plate and Sheet: **ASTM B209 (ASTM B209M)**, Alloy 6061-T6.
- I. Die and Hand Forgings: **ASTM B247 (ASTM B247M)**, Alloy 6061-T6.
- J. Castings: ASTM B26/B26M, Alloy A356.0-T6.
- K. Perforated Metal Infill Panels: Aluminum sheet, **ASTM B209 (ASTM B209M)**, Alloy 6061-T6, **[0.063 inch (1.60 mm)]<Insert dimension> thick, [with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows]<Insert description>.**
 - 1. Basis-of-Design Product: Provide product with perforations matching **[product indicated on Drawings]<Insert manufacturer's name; product name or designation>.**
- L. Woven-Wire Mesh Infill Panels: Intermediate-crimp, **[diamond][square]** pattern, **2-inch (50-mm)** woven-wire mesh, made from **0.162-inch- (4.1-mm-)** diameter aluminum wire complying with ASTM B211/B211M, Alloy 6061-T94.
 - 1. Basis-of-Design Product: Provide product with crimp pattern matching **[product indicated on Drawings]<Insert manufacturer's name; product name or designation>.**

2.5 STAINLESS STEEL RAILINGS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - 1. **[CraneVeyor Corp]**
 - 2. **[Julius Blum & Co., Inc.]**
 - 3. **[Kane Innovations, Inc.]**
 - 4. **[Stainless Fabricators, Inc]**
 - 5. **[Trex Commercial Products, Inc.]**
 - 6. **[Tri Tech, Inc.]**
 - 7. **[Tubular Specialties Manufacturing, Inc.]**
 - 8. **[Tuttle, a Dant Clayton Division]**
 - 9. **[VIVA Railings, LLC]**
 - 10. **[Wagner Companies (The); R&B Wagner, Inc.]**
 - 11. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's**

name; product name or designation> or comparable product by one of the following:

1. [CraneVeyor Corp]
2. [Julius Blum & Co., Inc.]
3. [Kane Innovations, Inc.]
4. [Stainless Fabricators, Inc]
5. [Trex Commercial Products, Inc.]
6. [Tri Tech, Inc.]
7. [Tubular Specialties Manufacturing, Inc.]
8. [Tuttle, a Dant Clayton Division]
9. [VIVA Railings, LLC]
10. [Wagner Companies (The); R&B Wagner, Inc.]
11. <Insert manufacturer's name>

- C. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- D. Tubing: ASTM A554, [Grade MT 304][Grade MT 316L].
- E. Pipe: ASTM A312/A312M, [Grade TP 304][Grade TP 316L].
- F. Castings: ASTM A743/A743M, [Grade CF 8 or CF 20][Grade CF 8M or CF 3M].
- G. Plate and Sheet: ASTM A240/A240M or ASTM A666, [Type 304][Type 316L].
- H. Expanded Metal Infill Panels: ASTM F1267, [Type I (expanded)][Type II (expanded and flattened)], Class 3 (corrosion-resistant steel), made from stainless steel sheet, ASTM A240/A240M or ASTM A666, [Type 304][Type 316].
 1. Style Designation: [3/4 number 13][1-1/2 number 10]<Insert designation>.
- I. Perforated Metal Infill Panels: Stainless steel sheet, ASTM A240/A240M or ASTM A666, [Type 304][Type 316L], [0.062 inch (1.59 mm)]<Insert dimension> thick, [with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows]<Insert description>.
 1. Basis-of-Design Product: Provide product with perforations matching [product indicated on Drawings]<Insert manufacturer's name; product name or designation>.
- J. Woven-Wire Mesh Infill Panels: Intermediate-crimp, [diamond][square] pattern, 2-inch (50-mm) woven-wire mesh, made from 0.141-inch- (3.57-mm-) diameter stainless steel wire complying with ASTM A580/A580M, [Type 304][Type 316].
 1. Basis-of-Design Product: Provide product with crimp pattern matching [product indicated on Drawings]<Insert manufacturer's name; product name or designation>.

2.6 FASTENERS

A. Fastener Materials:

1. Ungalvanized-Steel Railing Components: Plated steel fasteners complying with ASTM F1941/F1941M, Class Fe/Zn 5 for zinc coating.
2. Hot-Dip Galvanized Railing Components: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
3. Aluminum Railing Components: [Type 304][Type 316] stainless steel fasteners.
4. Stainless Steel Railing Components: [Type 304][Type 316] stainless steel fasteners.
5. Finish exposed fasteners to match appearance, including color and texture, of railings.

- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction[**and capable of withstanding design loads**].
- C. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
 - 2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
 - 3. Provide **[Phillips][tamper-resistant][square or hex socket]** flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193[**or ICC-ES AC308**].
 - 1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy **[Group 1 (A1)][Group 2 (A4)]** stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.7 MISCELLANEOUS MATERIALS

- A. Handrail Brackets: **[Cast iron][Cast aluminum,][Cast stainless steel,][Cast nickel-silver,]** center of handrail **[2-1/2 inches (63.5 mm)][3-1/8 inches (79.4 mm)]<Insert dimension>** from **[face of railing][wall]**.
- B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.
 - 1. For **[aluminum][and][stainless steel]** railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Shop Primers: Provide primers that comply with **[Section 099113 "Exterior Painting."][Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings.]**
- F. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- G. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- H. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

- I. Intermediate Coats and Topcoats: Provide products that comply with [Section 099113 "Exterior Painting."][Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."]
- J. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.
- K. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.
- L. Bituminous Paint: Cold-applied asphalt emulsion, complying with ASTM D1187/D1187M.
- M. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- N. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: [At exterior locations][and][where indicated on Drawings], provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.8 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage[, **but not less than that required to support structural loads**].
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
 - 1. Clearly mark units for reassembly and coordinated installation.
 - 2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated.
 - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water.
 - 1. Provide weep holes where water may accumulate.
 - 2. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with [**welded**][or][**nonwelded**] connections unless otherwise indicated.
- H. Gates: Form gates from steel tube of same size and shape as top rails, with infill to match guards. Provide with [**cam-type, self-closing**][**spring**] hinges for fastening to wall and overlapping stop with rubber bumper to prevent gate from opening in direction opposite egress.

- I. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for **[Finish #1 welds; ornamental quality with no evidence of a welded joint][Finish #2 welds; good appearance, completely sanded joint, some undercutting and pinholes okay][Finish #3 welds; utilitarian appearance not subject to view, partially dressed weld with spatter removed]**.
- J. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
- K. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection, using an epoxy structural adhesive, if this is manufacturer's standard splicing method.
- L. Form changes in direction as follows:
 - 1. As detailed.
 - 2. **[By bending][or][by inserting prefabricated elbow fittings]**.
 - 3. **[By flush bends][or][by inserting prefabricated flush-elbow fittings]**.
 - 4. **[By radius bends of radius indicated][or][by inserting prefabricated elbow fittings of radius indicated]**.
 - 5. By bending to smallest radius that will not result in distortion of railing member.
- M. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- N. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
- O. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is **1/4 inch (6 mm)** or less.
- P. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- Q. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
 - 1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
 - 2. Coordinate anchorage devices with supporting structure.
- R. For railing posts set in concrete, provide stainless steel sleeves not less than **6 inches (150 mm)** long

with inside dimensions not less than **1/2 inch (13 mm)** greater than outside dimensions of post, with metal plate forming bottom closure.

- S. For removable railing posts, fabricate slip-fit sockets from stainless steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height.
 - 1. Provide socket covers designed and fabricated to resist being dislodged.
 - 2. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.
- T. Expanded-Metal Infill Panels: Fabricate infill panels from expanded-metal sheet of same metal as railings.
 - 1. Edge panels with U-shaped channels made from metal sheet, of same metal as expanded metal and not less than **0.043 inch (1.1 mm)** thick.
 - 2. Orient expanded metal with long dimension of diamonds **[parallel to top rail][perpendicular to top rail][horizontal][vertical]**.
- U. Perforated-Metal Infill Panels: Fabricate infill panels from perforated metal made from **[steel][galvanized steel][aluminum][stainless steel][same metal as railings in which they are installed]**.
 - 1. Edge panels with U-shaped channels made from metal sheet, of same metal as perforated metal and not less than **0.043 inch (1.1 mm)** thick.
 - 2. Orient perforated metal with pattern **[parallel to top rail][perpendicular to top rail][horizontal][vertical][as indicated on Drawings]**.
- V. Woven-Wire Mesh Infill Panels: Fabricate infill panels from woven-wire mesh crimped into **1-by-1/2-by-1/8-inch (25-by-13-by-3-mm)** metal channel frames.
 - 1. Fabricate wire mesh and frames from same metal as railings in which they are installed.
 - 2. Orient wire mesh with **[diamonds vertical][diamonds perpendicular to top rail][wires perpendicular and parallel to top rail][wires horizontal and vertical][as indicated on Drawings]**.
- W. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.9 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize **[exterior][indicated]** steel railings, including hardware, after fabrication.
 - 2. Comply with ASTM A123/A123M for hot-dip galvanized railings.
 - 3. Comply with ASTM A153/A153M for hot-dip galvanized hardware.
 - 4. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 - 5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner **[and as follows]**.

1. Comply with SSPC-SP 16.
- D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, hot-dip galvanize anchors to be embedded in exterior concrete or masonry.
- E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with **[SSPC-SP 6/NACE No. 3.]****[SSPC-SP 3.]****[requirements indicated below:]**
 1. Exterior Railings: SSPC-SP 6/NACE No. 3.
 2. Railings Indicated To Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3.
 3. Railings Indicated To Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3.
 4. Other Railings: SSPC-SP 3.
- F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 1. Shop prime uncoated railings with **[universal shop primer]****[primers specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting"]** unless **[zinc-rich primer is]****[primers specified in Section 099600 "High-Performance Coatings" are]** indicated.
 2. Do not apply primer to galvanized surfaces.
- G. Shop-Painted Finish: Comply with **[Section 099113 "Exterior Painting."]****[Section 099600 "High-Performance Coatings."]**
 1. Color: **[As indicated by manufacturer's designations]****[Match Architect's sample]****[As selected by Architect from manufacturer's full range]**.
- H. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1 for shop painting. Apply at spreading rates recommended by coating manufacturer.
 1. Color: **[As indicated by manufacturer's designations]****[Match Architect's sample]****[As selected by Architect from manufacturer's full range]**.

2.10 ALUMINUM FINISHES

- A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Mill Finish: AA-M12, nonspecular as fabricated.
- C. Clear Anodic Finish: AAMA 611, **[AA-M12C22A41]****[AA-M12C22A31]**.
- D. Color Anodic Finish: AAMA 611, **[AA-M12C22A42/A44]****[AA-M12C22A32/A34]**.
 1. Color: **[Light bronze]****[Medium bronze]****[Dark bronze]****[Black]****[Match Architect's sample]****[As selected by Architect from full range of industry colors and color densities]**.
- E. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5**

mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- F. High-Performance Organic Finish, Two-Coat Polyvinylidene Fluoride (PVDF): Fluoropolymer finish complying with **[AAMA 2604][AAMA 2605]** and containing not less than **[50][70]** percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- G. Superior Performance Organic Finish, Three-Coat Polyvinylidene Fluoride (PVDF): Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- H. Superior Performance Organic Finish, Four-Coat Polyvinylidene Fluoride (PVDF): Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- I. Single-Coat Superior Performance FEVE Organic Finish: Single-coat fluoroethylene vinyl ether (FEVE) fluoropolymer finish, complying with AAMA 2605. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- J. Two-Coat Superior Performance FEVE Organic Finish: Two-coat fluoroethylene vinyl ether (FEVE) fluoropolymer finish complying with AAMA 2605. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- 2.11 STAINLESS STEEL FINISHES
- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
1. Run grain with long dimension of each piece.

2. When polishing is completed, passivate and rinse surfaces.
3. Remove embedded foreign matter and leave surfaces chemically clean.

C. Stainless Steel Pipe and Tubing Finishes:

1. 180-Grit Polished Finish: Uniform, directionally textured finish.
2. 320-Grit Polished Finish: Oil-ground, uniform, fine, directionally textured finish.
3. Polished and Buffed Finish: 320-grit finish followed by buffing [**to a high luster finish**][**to a mirror-like finish**][**to match Architect's sample**].

D. Stainless Steel Sheet and Plate Finishes:

1. Directional Satin Finish: ASTM A480/A480, No. 4.
2. High-Luster Finish: ASTM A480/A480M, No. 7.
3. Mirror Finish: ASTM A480/A480M, No. 8.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.
1. Fit exposed connections together to form tight, hairline joints.
 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 5. Set posts plumb within a tolerance of **1/16 inch in 3 feet (2 mm in 1 m)**.
 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed **1/4 inch in 12 feet (6 mm in 3.5 m)**.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws, using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending **2 inches (50 mm)** beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within **6 inches (150 mm)** of post.

3.4 ANCHORING POSTS

- A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with **[nonshrink, nonmetallic grout][or][anchoring cement]**, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than **5 inches (125 mm)** deep and **3/4 inch (20 mm)** larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with **[nonshrink, nonmetallic grout][or][anchoring cement]**, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Cover anchorage joint with flange of same metal as post, **[welded to post after placing anchoring material][attached to post with setscrews]**.
- D. Leave anchorage joint exposed with **[1/8-inch (3-mm) buildup, sloped away from post][anchoring material flush with adjacent surface]**.
- E. Anchor posts to metal surfaces with flanges, angle type, or floor type, as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For steel railings, weld flanges to post and bolt to metal supporting surfaces.
 - 2. For aluminum railings, attach posts as indicated, using fittings designed and engineered for this purpose.
 - 3. For stainless steel railings, weld flanges to post and bolt to supporting surfaces.
- F. Install removable railing sections, where indicated, in slip-fit stainless steel sockets cast in concrete.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends to concrete and masonry with **[sleeves concealed within][flanges connected to][brackets on underside of rails connected to]** railing ends and anchored to wall construction with anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and **[welded to railing ends][or][connected to railing ends, using nonwelded connections]**.
- C. Attach handrails to walls with wall brackets[, **except where end flanges are used**]. Provide brackets

with [1-1/2-inch (38-mm)]<Insert dimension> clearance from inside face of handrail and finished wall surface.

1. Use type of bracket with [flange tapped for concealed anchorage to threaded hanger bolt][predrilled hole for exposed bolt anchorage].
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. Secure wall brackets[and railing end flanges] to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
4. For steel-framed partitions, use hanger or lag bolts set into [fire-retardant-treated]wood backing between studs. Coordinate with stud installation to locate backing members.
5. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements, using self-tapping screws of size and type required to support structural loads.
6. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

E. Install railing gates level, plumb, and secure for full opening without interference.

1. Attach hardware using tamper-resistant or concealed means.
2. Adjust hardware for smooth operation.

3.6 REPAIR

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum **2.0-mil (0.05-mm)** dry film thickness.
2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in [Section 099113 "Exterior Painting."][Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."]

3.7 CLEANING

- A. Clean [aluminum][and][stainless steel] by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

3.8 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings

approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

- B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 52 13 00

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Task	Specification	Specification Description
05 52 13 00	05 50 00 00	Metal Fabrications



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SECTION 05 53 00 00 - EXPANDED METAL GRATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Expanded metal gratings.
2. Grating frames and supports.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for structural-steel framing system components.
2. Section 055213 "Pipe and Tube Railings" for metal pipe and tube handrails and railings.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Paint products.

B. Shop Drawings:

1. Include plans, sections, and attachment details.
2. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Delegated Design Submittals: For gratings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Environmental Product Declaration (EPD): For each product.
4. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
5. Environmental Product Declaration: For each product.
6. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
7. Environmental Product Declaration: For each product.
8. Environmental Product Declaration: For each product.
9. Third-Party Certifications: For each product.
10. Third-Party Certified Life Cycle Assessment: For each product.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
- B. Mill Certificates: Signed by manufacturers of stainless steel certifying that products furnished comply with requirements.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- D. Welding certificates.
- E. Delegated design engineer qualifications.

1.4 QUALITY ASSURANCE

- A. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in [state]<Insert jurisdiction> where Project is located and who is experienced in providing engineering services of the type indicated.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:
 - 1. AWS D1.1/D1.1M.
 - 2. AWS D1.2/D1.2M.
 - 3. AWS D1.3/D1.3M.
 - 4. AWS D1.6/D1.6M.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design gratings.
- B. Structural Performance: Gratings to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Floors for Light Manufacturing: Uniform load of **125 lbf/sq. ft. (6.00 kN/sq. m)** or concentrated load of **2000 lbf (8.90 kN)**, whichever produces the greater stress.
 - 2. Floors for Heavy Manufacturing: Uniform load of **250 lbf/sq. ft. (11.97 kN/sq. m)** or concentrated load of **3000 lbf (13.40 kN)**, whichever produces the greater stress.
 - 3. Walkways and Elevated Platforms Other Than Exits: Uniform load of **60 lbf/sq. ft. (2.87**

- kN/sq. m).
 4. Walkways and Elevated Platforms Used as Exits: Uniform load of **100 lbf/sq. ft. (4.79 kN/sq. m)**.
 5. Sidewalks and Vehicular Driveways, Subject to Trucking: Uniform load of **250 lbf/sq. ft. (11.97 kN/sq. m)** or concentrated load of **8000 lbf (35.60 kN)**, whichever produces the greater stress.
 6. Limit deflection to **[L/360]<Insert deflection ratio>** or **1/4 inch (6.4 mm)**, whichever is less.
- C. Seismic Performance: Gratings to withstand the effects of earthquake motions determined in accordance with **[ASCE/SEI 7]<Insert requirement>**.
1. Component Importance Factor: 1.5.

2.2 EXPANDED METAL GRATINGS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[All American Grating]**
 2. **[AMICO, a Gibraltar Industries company]**
 3. **[Central Expanded Metal, Inc.]**
 4. **[Grating Pacific, Inc.]**
 5. **[Nucor Grating; a Nucor company]**
 6. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[All American Grating]**
 2. **[AMICO, a Gibraltar Industries company]**
 3. **[Central Expanded Metal, Inc.]**
 4. **[Grating Pacific, Inc.]**
 5. **[Nucor Grating; a Nucor company]**
 6. **<Insert manufacturer's name>**
- C. Provide expanded metal gratings in material, finish, style, size, thickness, weight, and type indicated or, if not indicated, as recommended by manufacturer for indicated applications and as needed to support indicated loads.
1. Material: **[Steel][Stainless steel][Aluminum]**.
 2. Steel Finish: **[Unfinished, oiled][Shop primed][Galvanized]**.
 3. Stainless Steel Finish: Mill finish, as fabricated.
 4. Aluminum Finish: Mill finish, as fabricated.
 5. Style Designation for Steel: **[4.27 lb][3/4 number 9]**.
 6. Style Designation for Stainless Steel: **[1-1/2 number 9][3/4 number 9]**.
 7. Size for Aluminum: **[2 lb][3/4 0.188][1-1/2 0.125]**.
 8. Type: **[I, expanded][II, expanded and flattened]**.

2.3 GRATING FRAMES AND SUPPORTS

- A. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

1. Unless otherwise indicated, fabricate from same basic metal as gratings.
2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors **24 inches (600 mm)** o.c. and provide minimum anchor units in the form of steel straps **1-1/4 inches (32 mm)** wide by **1/4 inch (6 mm)** thick by **8 inches (200 mm)** long.

B. Galvanize steel frames and supports in the following locations:

1. Exterior.
2. Interior[, **where indicated**].

2.4 FASTENERS

A. General: Unless otherwise indicated, provide **[Type 304][Type 316]** stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless steel fasteners for fastening aluminum.
2. Provide stainless steel fasteners for fastening stainless steel.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, **ASTM A307, Grade A (ISO 898-1, Property Class 4.6)**; with hex nuts, **ASTM A563 (ASTM A563M)**; and, where indicated, flat washers.

C. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, nuts, and, where indicated, flat washers; **ASTM F593 (ISO 3506-1)** for bolts and **ASTM F594 (ASTM F836M)** for nuts, Alloy **[Group 1 (A1)][Group 2 (A4)]**.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, **ASTM A563 (ASTM A563M)**; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Post-Installed Anchors: **[Torque-controlled expansion][or][chemical]** anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy **[Group 1 (A1)][Group 2 (A4)]** stainless steel bolts, **ASTM F593 (ISO 3506-1)**, and nuts, **ASTM F594 (ASTM F836M)**.

2.5 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with **[Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."][Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."]**

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer

compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

- C. Epoxy Zinc-Rich Primer: Compatible with topcoat.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

2.6 FERROUS METALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Uncoated Steel Sheet: ASTM A1011/A1011M, structural steel, **Grade 30 (Grade 205)**.
- D. Galvanized-Steel Sheet: ASTM A653/A653M, structural quality, **Grade 33 (Grade 230)**, with **G90 (Z275)** coating.
- E. Expanded Metal Carbon Steel: ASTM F1267, Class 1.
- F. Expanded Metal Galvanized Steel: ASTM F1267, Class 2, Grade A.
- G. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A240/A240M, **[Type 304][Type 316L]**.
- H. Stainless Steel Bars and Shapes: ASTM A276/A276M, **[Type 304][Type 316L]**.
- I. Expanded Metal Stainless Steel: ASTM F1267, Class 3, made from stainless steel sheet, ASTM A240/A240M, **[Type 304][Type 316L]**.

2.7 ALUMINUM

- A. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25][50]<Insert value>** percent.
- B. General: Provide alloy and temper recommended by aluminum producer for type of use indicated, with not less than the strength and durability properties of alloy, and temper designated below for each aluminum form required.
- C. Extruded Bars and Shapes: **ASTM B221 (ASTM B221M)**, alloys as follows:
 - 1. Alloy 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
 - 2. Alloy 6061-T1, for grating crossbars.
- D. Aluminum Sheet: **ASTM B209 (ASTM B209M)**, Alloy 5052-H32.

2.8 FABRICATION

- A. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated. Remove sharp or rough areas on exposed

surfaces.

- B. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- C. Fit exposed connections accurately together to form hairline joints.
- D. Welding: Comply with AWS recommendations and the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
- E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
 - 1. Fabricate toeplates for attaching in the field.
 - 2. Toeplate Height: **4 inches (100 mm)** unless otherwise indicated.
- F. Fabricate cutouts in grating sections for penetrations of sizes and at locations indicated. Cut openings neatly and accurately to size. Edge-band openings with bars having a thickness not less than overall grating thickness at contact points.
- G. Where gratings are pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and weld a strap collar not less than **1/8 inch (3 mm)** thick to the cut ends. Divide panels into sections only to extent required for installation where grating platforms and runways are to be placed around previously installed pipe, ducts, and structural members.

2.9 STEEL FINISHES

- A. Finish gratings, frames, and supports after assembly.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- C. Shop prime gratings, frames, and supports[**not indicated to be galvanized**] unless otherwise indicated.
 - 1. Shop prime with [**universal shop primer**][**primers specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting"**] unless [**zinc-rich primer is**][**primers specified in Section 099600 "High-Performance Coatings" are**] indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with [**SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."**][**SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."**][**requirements indicated below:**]
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

- 3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- 4. Other Items: SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.
 - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Attach toeplates to gratings by welding at locations indicated.
- F. Field Welding: Comply with AWS recommendations and the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.

3.2 INSTALLATION OF EXPANDED METAL GRATINGS

- A. Comply with manufacturer's written instructions for installing gratings.
- B. Place units with straight edge of bond up and with long direction of diamond-shaped openings parallel to direction of span.
- C. Attach removable units to supporting members by bolting at **6-inch (150-mm)** intervals.
- D. Attach nonremovable units to supporting members by welding unless otherwise indicated. Space welds at **6-inch (150-mm)** intervals.
- E. Attach aluminum units to steel supporting members by bolting at **6-inch (150-mm)** intervals.
- F. Butt edges parallel to long direction of diamond-shaped openings and weld at every second bond point.

Place individual grating sections so diamonds of one piece are aligned with those of adjacent sections.

3.3 REPAIR

A. Repair Painting:

1. Wire brush and clean rust spots, welds, and abraded areas on prime-painted gratings immediately after installation, and apply repair paint with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum **2.0-mil (0.05-mm)** dry film thickness.
2. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

B. Repair of Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 53 00 00

SECTION 05 53 13 00 - BAR GRATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal bar gratings.
2. Grating frames and supports.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for structural-steel framing system components.
2. Section 055119 "Metal Grating Stairs" for grating treads and landings of steel-framed stairs.
3. Section 055213 "Pipe and Tube Railings" for metal pipe and tube handrails and railings.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Clips and anchorage devices for gratings.
2. Paint products.

B. Shop Drawings:

1. Include plans, sections, and attachment details.
2. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Delegated Design Submittals: For gratings, including **[manufacturers' published load tables][analysis data signed and sealed by the qualified professional engineer responsible for their preparation]**.

D. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Environmental Product Declaration (EPD): For each product.
4. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
5. Environmental Product Declaration: For each product.
6. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
7. Environmental Product Declaration: For each product.
8. Environmental Product Declaration: For each product.
9. Third-Party Certifications: For each product.
10. Third-Party Certified Life Cycle Assessment: For each product.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
- B. Mill Certificates: Signed by manufacturers of stainless steel certifying that products furnished comply with requirements.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- D. Welding certificates.
- E. Delegated design engineer qualifications.

1.4 QUALITY ASSURANCE

- A. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in **[state]<Insert jurisdiction>** where Project is located and who is experienced in providing engineering services of the type indicated.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:
 - 1. AWS D1.1/D1.1M.
 - 2. AWS D1.2/D1.2M.
 - 3. AWS D1.3/D1.3M.
 - 4. AWS D1.6/D1.6M.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design gratings.
- B. Structural Performance: Gratings to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Floors for Light Manufacturing: Uniform load of **125 lbf/sq. ft. (6.00 kN/sq. m)** or concentrated load of **2000 lbf (8.90 kN)**, whichever produces the greater stress.
 - 2. Floors for Heavy Manufacturing: Uniform load of **250 lbf/sq. ft. (11.97 kN/sq. m)** or concentrated load of **3000 lbf (13.40 kN)**, whichever produces the greater stress.
 - 3. Walkways and Elevated Platforms Other Than Exits: Uniform load of **60 lbf/sq. ft. (2.87**

- kN/sq. m).
 - 4. Walkways and Elevated Platforms Used as Exits: Uniform load of **100 lbf/sq. ft. (4.79 kN/sq. m)**.
 - 5. Sidewalks and Vehicular Driveways, Subject to Trucking: Uniform load of **250 lbf/sq. ft. (11.97 kN/sq. m)** or concentrated load of **8000 lbf (35.60 kN)**, whichever produces the greater stress.
 - 6. Limit deflection to **[L/360]<Insert deflection ratio>** or **1/4 inch (6.4 mm)**, whichever is less.
- C. Seismic Performance: Gratings to withstand the effects of earthquake motions determined in accordance with **[ASCE/SEI 7]<Insert requirement>**.
- 1. Component Importance Factor: 1.5.

2.2 METAL BAR GRATINGS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
- 1. **[All American Grating]**
 - 2. **[BarnettBates Corporation]**
 - 3. **[Borden Metal Products (Canada) Limited]**
 - 4. **[Grating Pacific, Inc.]**
 - 5. **[Grupo Metelmex, S.A. de C.V.]**
 - 6. **[IKG]**
 - 7. **[MLP Steel Company; Laurel Steel Products Division]**
 - 8. **[Neenah Foundry Company]**
 - 9. **[Nucor Grating; a Nucor company]**
 - 10. **[Ross Technology Company]**
 - 11. **[Seidelhuber Metal Products; Brodhead Steel]**
 - 12. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- 1. **[All American Grating]**
 - 2. **[BarnettBates Corporation]**
 - 3. **[Borden Metal Products (Canada) Limited]**
 - 4. **[Grating Pacific, Inc.]**
 - 5. **[Grupo Metelmex, S.A. de C.V.]**
 - 6. **[IKG]**
 - 7. **[MLP Steel Company; Laurel Steel Products Division]**
 - 8. **[Neenah Foundry Company]**
 - 9. **[Nucor Grating; a Nucor company]**
 - 10. **[Ross Technology Company]**
 - 11. **[Seidelhuber Metal Products; Brodhead Steel]**
 - 12. **<Insert manufacturer's name>**
- C. Metal Bar Grating Standards: Comply with **[NAAMM MBG 531][and][NAAMM MBG 532]**.
- D. Welded Steel Grating:**[MBG-#.]**
- 1. Bearing Bar Spacing: **[7/16 or 1/2 inch (11 or 13 mm)][11/16 inch (17 mm)][15/16 inch (24 mm)][1-3/16 inches (30 mm)][1-3/8 inches (35 mm)][1-7/8 inches (48 mm)][2-3/8 inches (60 mm)]<Insert dimension(s)> o.c.**
 - 2. Bearing Bar Depth: **[3/4 inch (19 mm)][1 inch (25 mm)][1-1/4 inches (32 mm)][1-1/2 inches (38 mm)][1-3/4 inches (44 mm)][2 inches (51 mm)][2-1/4 inches (57 mm)][2-1/2 inches (64 mm)][3**

inches (76 mm)][3-1/2 inches (89 mm)][4 inches (102 mm)][4-1/2 inches (114 mm)][5 inches (127 mm)][As required to comply with structural performance requirements].

3. Bearing Bar Thickness: [1/8 inch (3.2 mm)][3/16 inch (4.8 mm)][1/4 inch (6.4 mm)][3/8 inch (9.5 mm)][As required to comply with structural performance requirements].
4. Crossbar Spacing: [2 inches (51 mm)][4 inches (102 mm)] o.c.
5. Grating Mark W-11-4 (1 x 3/16) STEEL: 1-by-3/16-inch (25-by-4.8-mm) bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
6. Grating Mark W-15-4 (1 x 1/8) STEEL: 1-by-1/8-inch (25-by-3.2-mm) bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
7. Grating Mark W-19-4 (1-1/4 x 3/16) STEEL: 1-1/4-by-3/16-inch (32-by-4.8-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
8. Grating Mark W-19-4 (1-1/2 x 3/16) STEEL: 1-1/2-by-3/16-inch (38-by-4.8-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
9. Grating Mark W-19-4 (2 x 1/4) STEEL: 2-by-1/4-inch (51-by-6.4-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
10. Grating Mark W-30-4 (5 x 3/8) STEEL: 5-by-3/8-inch (127-by-9.5-mm) bearing bars at 1-7/8 inches (60 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
11. Grating Mark: As indicated.
12. Traffic Surface: [Plain][Serrated][Knurled][Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive][As indicated].
13. Steel Finish: [Shop primed][Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface].

E. Pressure-Locked Steel Grating:[MBG-#.] Fabricated by [pressing rectangular flush-top crossbars into slotted bearing bars][or][swaging crossbars between bearing bars].

1. Bearing Bar Spacing: [7/16 or 1/2 inch (11 or 13 mm)][11/16 inch (17 mm)][15/16 inch (24 mm)][1-3/16 inches (30 mm)]<Insert dimension(s)> o.c.
2. Bearing Bar Depth: [3/4 inch (19 mm)][1 inch (25 mm)][1-1/4 inches (32 mm)][1-1/2 inches (38 mm)][1-3/4 inches (44 mm)][2 inches (51 mm)][2-1/4 inches (57 mm)][2-1/2 inches (64 mm)][As required to comply with structural performance requirements]<Insert depth>.
3. Bearing Bar Thickness: [1/8 inch (3.2 mm)][3/16 inch (4.8 mm)][As required to comply with structural performance requirements]<Insert thickness>.
4. Crossbar Spacing: [2 inches (51 mm)][4 inches (102 mm)] o.c.
5. Grating Mark P-11-4 (1 x 3/16) STEEL: 1-by-3/16-inch (25-by-4.8-mm) bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
6. Grating Mark P-15-4 (1-1/4 x 1/8) STEEL: 1-1/4-by-1/8-inch (32-by-3.2-mm) bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
7. Grating Mark P-19-4 (1-1/2 x 3/16) STEEL: 1-1/2-by-3/16-inch (38-by-4.8-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
8. Grating Mark: As indicated.
9. Traffic Surface: [Plain][Serrated][Knurled][Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive][As indicated].
10. Steel Finish: [Shop primed][Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface].

F. Riveted Steel Grating:[MBG-#.]

1. Bearing Bar Spacing: [3/4 inch (19 mm)][1-1/8 inches (29 mm)][2-5/16 inches (59 mm)]<Insert dimension>, clear.
2. Bearing Bar Depth: [3/4 inch (19 mm)][1 inch (25 mm)][1-1/4 inches (32 mm)][1-1/2 inches (38 mm)][1-3/4 inches (44 mm)][2 inches (51 mm)][2-1/4 inches (57 mm)][2-1/2 inches (64 mm)][3 inches (76 mm)][3-1/2 inches (89 mm)][4 inches (102 mm)][4-1/2 inches (114 mm)][5 inches (127 mm)][As required to comply with structural performance requirements].
3. Bearing Bar Thickness: [1/8 inch (3.2 mm)][3/16 inch (4.8 mm)][1/4 inch (6.4 mm)][3/8 inch (9.5 mm)]

- mm)][As required to comply with structural performance requirements].
4. Rivet Spacing: [3-1/2 inches (89 mm)][5 inches (127 mm)][7 inches (178 mm)] o.c. along bearing bar.
 5. Grating Mark R-12-3-1/2 (1 x 1/8) STEEL: 1-by-1/8-inch (25-by-3.2-mm) bearing bars with 3/4-inch (19-mm) clear space between bearing bars, and rivets at 3-1/2 inches (89 mm) o.c. along bearing bar.
 6. Grating Mark R-18-7 (1-1/2 x 3/16) STEEL: 1-1/2-by-3/16-inch (38-by-4.8-mm) bearing bars with 1-1/8-inch (29-mm) clear space between bearing bars, and rivets at 7 inches (178 mm) o.c. along bearing bar.
 7. Grating Mark R-37-5 (4 x 1/4) STEEL: 4-by-1/4-inch (102-by-6.4-mm) bearing bars with 2-5/16-inch (59-mm) clear space between bearing bars, and rivets at 5 inches (127 mm) o.c. along bearing bar.
 8. Grating Mark R-37-5 (5 x 3/8) STEEL: 5-by-3/8-inch (127-by-9.5-mm) bearing bars with 2-5/16-inch (59-mm) clear space between bearing bars, and rivets at 5 inches (127 mm) o.c. along bearing bar.
 9. Grating Mark: As indicated.
 10. Traffic Surface: [Plain][Serrated][Knurled][Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive][As indicated].
 11. Steel Finish: [Shop primed][Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface].
- G. Pressure-Locked, Stainless Steel Grating:[MBG-#.] Fabricated by [pressing rectangular flush-top crossbars into slotted bearing bars][or][swaging crossbars between bearing bars].
1. Bearing Bar Spacing: [7/16 or 1/2 inch (11 or 13 mm)][11/16 inch (17 mm)][15/16 inch (24 mm)][1-3/16 inches (30 mm)][1-3/8 inches (35 mm)][1-7/8 inches (48 mm)][2-3/8 inches (60 mm)]<Insert dimension(s)> o.c.
 2. Bearing Bar Depth: [3/4 inch (19 mm)][1 inch (25 mm)][1-1/4 inches (32 mm)][1-1/2 inches (38 mm)][1-3/4 inches (44 mm)][2 inches (51 mm)][2-1/4 inches (57 mm)][2-1/2 inches (64 mm)][3 inches (76 mm)][3-1/2 inches (89 mm)][4 inches (102 mm)][4-1/2 inches (114 mm)][5 inches (127 mm)][As required to comply with structural performance requirements].
 3. Bearing Bar Thickness: [1/8 inch (3.2 mm)][3/16 inch (4.8 mm)][1/4 inch (6.4 mm)][3/8 inch (9.5 mm)][As required to comply with structural performance requirements].
 4. Crossbar Spacing: [2 inches (51 mm)][4 inches (102 mm)] o.c.
 5. Grating Mark P-11-4 (1 x 3/16) STAINLESS STEEL: 1-by-3/16-inch (25-by-4.8-mm) bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 6. Grating Mark P-15-2 (1 x 1/8) STAINLESS STEEL: 1-by-1/8-inch (25-by-3.2-mm) bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 2 inches (51 mm) o.c.
 7. Grating Mark P-19-4 (1-1/2 x 3/16) STAINLESS STEEL: 1-1/2-by-3/16-inch (38-by-4.8-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 8. Grating Mark P-30-4 (3 x 3/8) STAINLESS STEEL: 3-by-3/8-inch (76-by-9.5-mm) bearing bars at 1-7/8 inches (48 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
 9. Grating Mark: As indicated.
 10. Traffic Surface: [Plain][Serrated][Knurled][Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive][As indicated].
 11. Finish: [Mill finish][Abrasive blasted][Electropolished].
- H. Pressure-Locked, Rectangular-Bar Aluminum Grating:[MBG-#.] Fabricated by [pressing rectangular flush-top crossbars into slotted bearing bars][or][swaging crossbars between bearing bars].
1. Bearing Bar Spacing: [7/16 or 1/2 inch (11 or 13 mm)][11/16 inch (17.5 mm)][15/16 inch (24 mm)][1-3/16 inches (30 mm)]<Insert dimension(s)> o.c.
 2. Bearing Bar Depth: [1 inch (25 mm)][1-1/4 inches (32 mm)][1-1/2 inches (38 mm)][1-3/4 inches (44 mm)][2 inches (51 mm)][2-1/4 inches (57 mm)][2-1/2 inches (64 mm)][As required to comply with structural performance requirements].
 3. Bearing Bar Thickness: [1/8 inch (3.2 mm)][3/16 inch (4.8 mm)][1/4 inch (6.4 mm)][As required

to comply with structural performance requirements].

4. Crossbar Spacing: [2 inches (51 mm)][4 inches (102 mm)] o.c.
5. Grating Mark P-7-4 (1 x 1/8) ALUMINUM: 1-by-1/8-inch (25-by-3.2-mm) bearing bars at 7/16 inch (11 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
6. Grating Mark P-11-4 (1 x 3/16) ALUMINUM: 1-by-3/16-inch (25-by-4.8-mm) bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
7. Grating Mark P-15-4 (1-1/2 x 3/16) ALUMINUM: 1-1/2-by-3/16-inch (38-by-4.8-mm) bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
8. Grating Mark P-19-4 (2 x 3/16) ALUMINUM: 2-by-3/16-inch (51-by-4.8-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
9. Grating Mark: As indicated.
10. Traffic Surface: [Plain][Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive][As indicated].
11. Aluminum Finish: [Mill finish][Class I, clear, anodized finish].

- I. Pressure-Locked, Aluminum I-Bar Grating: [MBG-#.] Fabricated by swaging crossbars between bearing bars.

1. Bearing Bar Spacing: [7/16 or 1/2 inch (11 or 13 mm)][11/16 inch (17 mm)][15/16 inch (24 mm)][1-3/16 inches (30 mm)]<Insert dimension(s)> o.c.
2. Bearing Bar Depth: [1 inch (25 mm)][1-1/4 inches (32 mm)][1-1/2 inches (38 mm)][1-3/4 inches (44 mm)][2 inches (51 mm)][2-1/4 inches (57 mm)][2-1/2 inches (64 mm)][As required to comply with structural performance requirements].
3. Bearing Bar Flange Width: 1/4 inch (6.4 mm).
4. Crossbar Spacing: [2 inches (51 mm)][4 inches (102 mm)] o.c.
5. Grating Mark P-11-4 (1 I-Bar) ALUMINUM: 1-inch (25-mm) I-bar bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
6. Grating Mark P-15-2 (1 I-Bar) ALUMINUM: 1-inch (25-mm) I-bar bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 2 inches (51 mm) o.c.
7. Grating Mark P-19-4 (1-1/2 I-Bar) ALUMINUM: 1-1/2-inch (38-mm) I-bar bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
8. Grating Mark: As indicated.
9. Traffic Surface: [Plain][Grooved][Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive][As indicated].
10. Aluminum Finish: [Mill finish][Class I, clear, anodized finish].

2.3 GRATING FRAMES AND SUPPORTS

- A. Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
 1. Unless otherwise indicated, fabricate from same basic metal as gratings.
 2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches (600 mm) o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long.
- B. Galvanize steel frames and supports in the following locations:
 1. Exterior.
 2. Interior[, where indicated].

2.4 FASTENERS

- A. General: Unless otherwise indicated, provide **[Type 304][Type 316]** stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
1. Provide stainless steel fasteners for fastening aluminum.
 2. Provide stainless steel fasteners for fastening stainless steel.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, **ASTM A307, Grade A (ISO 898-1, Property Class 4.6)**; with hex nuts, **ASTM A563 (ASTM A563M)**, and, where indicated, flat washers.
- C. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, nuts, and, where indicated, flat washers; **ASTM F593 (ISO 3506-1)** for bolts and **ASTM F594 (ASTM F836M)** for nuts, Alloy **[Group 1 (A1)][Group 2 (A4)]**.
- D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, **ASTM A563 (ASTM A563M)**, and, where indicated, flat washers.
1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. Post-Installed Anchors: **[Torque-controlled expansion][or][chemical]** anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy **[Group 1 (A1)][Group 2 (A4)]** stainless steel bolts, **ASTM F593 (ISO 3506-1)**, and nuts, **ASTM F594 (ASTM F836M)**.

2.5 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with **[Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."][Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."]**
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.6 FERROUS METALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Steel Bars for Bar Gratings: ASTM A36/A36M or steel strip, ASTM A1011/A1011M or ASTM A1018/A1018M.
- D. Wire Rod for Bar Grating Crossbars: ASTM A510/A510M.
- E. Uncoated Steel Sheet: ASTM A1011/A1011M, structural steel, **Grade 30 (Grade 205)**.
- F. Galvanized-Steel Sheet: ASTM A653/A653M, structural quality, **Grade 33 (Grade 230)**, with **G90 (Z275)** coating.
- G. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A240/A240M, **[Type 304][Type 316L]**.
- H. Stainless Steel Bars and Shapes: ASTM A276/A276M, **[Type 304][Type 316L]**.

2.7 ALUMINUM

- A. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25][50]<Insert value>** percent.
- B. General: Provide alloy and temper recommended by aluminum producer for type of use indicated, with not less than the strength and durability properties of alloy, and temper designated below for each aluminum form required.
- C. Extruded Bars and Shapes: **ASTM B221 (ASTM B221M)**, alloys as follows:
 - 1. Alloy 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
 - 2. Alloy 6061-T1, for grating crossbars.
- D. Aluminum Sheet: **ASTM B209 (ASTM B209M)**, Alloy 5052-H32.

2.8 FABRICATION

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- D. Fit exposed connections accurately together to form hairline joints.

- E. Welding: Comply with AWS recommendations and the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
- F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
1. Fabricate toeplates to fit grating units and weld to units in shop unless otherwise indicated.
 2. Fabricate toeplates for attaching in the field.
 3. Toeplate Height: **4 inches (100 mm)** unless otherwise indicated.
- G. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
1. Provide no fewer than four weld lugs for each heavy-duty grating section, with each lug shop welded to two bearing bars.
 2. Provide no fewer than four saddle clips for each grating section containing rectangular bearing bars **3/16 inch (4.8 mm)** or less in thickness and spaced **15/16 inch (24 mm)** or more o.c., with each clip designed and fabricated to fit over two bearing bars.
 3. Provide no fewer than four weld lugs for each grating section containing rectangular bearing bars **3/16 inch (4.8 mm)** or less in thickness and spaced less than **15/16 inch (24 mm)** o.c., with each lug shop welded to three or more bearing bars. Interrupt intermediate bearing bars as necessary for fasteners securing grating to supports.
 4. Provide no fewer than four flange blocks for each section of aluminum I-bar grating, with block designed to fit over lower flange of I-shaped bearing bars.
 5. Furnish threaded bolts with nuts and washers for securing grating to supports.
 6. Furnish self-drilling fasteners with washers for securing grating to supports.
 7. Grating Clamps: Furnish galvanized malleable-iron flange clamp with galvanized bolt for securing grating to supports. Furnish as a system designed to be installed from above grating by one person.
- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
- 1) **[Kee Safety, Inc.]**
 - 2) **[Lindapter International]**
 - 3) **[LNA Solutions, a Kee Safety company]**
 - 4) **<Insert manufacturer's name>**
- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- 1) **[Kee Safety, Inc.]**
 - 2) **[Lindapter International]**
 - 3) **[LNA Solutions, a Kee Safety company]**
 - 4) **<Insert manufacturer's name>**
- H. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating

removal without disturbing items penetrating gratings.

1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.

- I. Do not notch bearing bars at supports to maintain elevation.

2.9 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I.

2.10 STEEL FINISHES

- A. Finish gratings, frames, and supports after assembly.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

- C. Shop prime gratings, frames, and supports[**not indicated to be galvanized**] unless otherwise indicated.

1. Shop prime with [**universal shop primer**][**primers specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting"**] unless [**zinc-rich primer is**][**primers specified in Section 099600 "High-Performance Coatings" are**] indicated.

- D. Preparation for Shop Priming: Prepare surfaces to comply with [**SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."**][**SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."**][**requirements indicated below:**]

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Items: SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."

- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set

units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.
 - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Attach toeplates to gratings by welding at locations indicated.
- F. Field Welding: Comply with AWS recommendations and the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
- G. Corrosion Protection: With a heavy coat of bituminous paint, coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals.

3.2 INSTALLATION OF METAL BAR GRATINGS

- A. Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
- C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.3 REPAIR

- A. Repair Painting:
 - 1. Wire brush and clean rust spots, welds, and abraded areas on prime-painted gratings immediately after installation, and apply repair paint with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum **2.0-mil (0.05-mm)** dry film thickness.
 - 2. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- B. Repair of Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.



05 - Metals

END OF SECTION 05 53 13 00



Task	Specification	Specification Description
05 53 13 00	01 11 19 00	No Specification Required
05 53 13 00	05 50 00 00	Metal Fabrications
05 53 13 00	05 53 00 00	Expanded Metal Gratings



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SECTION 05 53 16 00 - PLANK GRATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formed-metal plank gratings.
2. Extruded-aluminum plank gratings.
3. Grating frames and supports.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for structural-steel framing system components.
2. Section 055213 "Pipe and Tube Railings" for metal pipe and tube handrails and railings.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Formed-metal plank gratings.
2. Extruded-aluminum plank gratings.
3. Paint products.

B. Shop Drawings:

1. Include plans, sections, and attachment details.
2. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Delegated Design Submittals: For gratings, including **[manufacturers' published load tables][analysis data signed and sealed by the qualified professional engineer responsible for their preparation]**.

D. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Environmental Product Declaration (EPD): For each product.
4. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
5. Environmental Product Declaration: For each product.
6. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
7. Environmental Product Declaration: For each product.
8. Environmental Product Declaration: For each product.
9. Third-Party Certifications: For each product.

10. Third-Party Certified Life Cycle Assessment: For each product.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
- B. Mill Certificates: Signed by manufacturers of stainless steel sheet certifying that products furnished comply with requirements.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- D. Welding certificates.
- E. Delegated design engineer qualifications.

1.4 QUALITY ASSURANCE

- A. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in **[state]<Insert jurisdiction>** where Project is located and who is experienced in providing engineering services of the type indicated.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:
 - 1. AWS D1.1/D1.1M.
 - 2. AWS D1.2/D1.2M.
 - 3. AWS D1.3/D1.3M.
 - 4. AWS D1.6/D1.6M.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design gratings.
- B. Structural Performance: Gratings to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Floors for Light Manufacturing: Uniform load of **125 lbf/sq. ft. (6.00 kN/sq. m)** or concentrated load of **2000 lbf (8.90 kN)**, whichever produces the greater stress.

2. Floors for Heavy Manufacturing: Uniform load of **250 lbf/sq. ft. (11.97 kN/sq. m)** or concentrated load of **3000 lbf (13.40 kN)**, whichever produces the greater stress.
 3. Walkways and Elevated Platforms Other Than Exits: Uniform load of **60 lbf/sq. ft. (2.87 kN/sq. m)**.
 4. Walkways and Elevated Platforms Used as Exits: Uniform load of **100 lbf/sq. ft. (4.79 kN/sq. m)**.
 5. Sidewalks and Vehicular Driveways, Subject to Trucking: Uniform load of **250 lbf/sq. ft. (11.97 kN/sq. m)** or concentrated load of **8000 lbf (35.60 kN)**, whichever produces the greater stress.
 6. Limit deflection to **[L/360]<Insert deflection ratio>** or **1/4 inch (6.4 mm)**, whichever is less.
- C. Seismic Performance: Gratings to withstand the effects of earthquake motions determined according to **[ASCE/SEI 7]<Insert requirement>**.
1. Component Importance Factor: 1.5.

2.2 FORMED-METAL PLANK GRATINGS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[AMICO, a Gibraltar Industries company]**
 2. **[Atkore Unistrut]**
 3. **[Cooper B-line; brand of Eaton, Electrical Sector]**
 4. **[Grating Pacific, Inc.]**
 5. **[IKG]**
 6. **[Metalex]**
 7. **[Nucor Grating; a Nucor company]**
 8. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[AMICO, a Gibraltar Industries company]**
 2. **[Atkore Unistrut]**
 3. **[Cooper B-line; brand of Eaton, Electrical Sector]**
 4. **[Grating Pacific, Inc.]**
 5. **[IKG]**
 6. **[Metalex]**
 7. **[Nucor Grating; a Nucor company]**
 8. **<Insert manufacturer's name>**
- C. C-Shaped Channels: Rolled from heavy sheet metal of thickness indicated, and punched in serrated diamond shape to produce raised slip-resistant surface and drainage holes.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[AMICO, a Gibraltar Industries company]**
 - b. **[Cooper B-line; brand of Eaton, Electrical Sector]**
 - c. **[IKG]**
 - d. **[Metalex]**
 - e. **[Nucor Grating; a Nucor company]**
 - f. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[AMICO, a Gibraltar Industries company]**
 - b. **[Cooper B-line; brand of Eaton, Electrical Sector]**
 - c. **[IKG]**
 - d. **[Metalex]**
 - e. **[Nucor Grating; a Nucor company]**
 - f. **<Insert manufacturer's name>**
3. Channel Width: **[4-3/4 inches (121 mm)][7 inches (178 mm)][9-1/2 inches (241 mm)][11-3/4 inches (298 mm)][18-3/4 inches (476 mm)][24 inches (610 mm)][As indicated][As required to comply with structural performance requirements]**.
4. Channel Depth: **[1-1/2 inches (38 mm)][2 inches (51 mm)][2-1/2 inches (64 mm)][3 inches (76 mm)][As indicated][As required to comply with structural performance requirements]**.
5. Material: **[0.074-inch- (1.9-mm-) thick steel sheet, shop primed][0.104-inch- (2.65-mm-) thick steel sheet, shop primed][0.079-inch- (2.0-mm-) thick, hot-dip galvanized-steel sheet][0.108-inch- (2.8-mm-) thick, hot-dip galvanized-steel sheet][0.074-inch- (1.9-mm-) thick steel sheet, hot-dip galvanized after fabrication][0.104-inch- (2.65-mm-) thick steel sheet, hot-dip galvanized after fabrication][0.062-inch- (1.6-mm-) thick, stainless steel sheet][0.078-inch- (2.0-mm-) thick, stainless steel sheet][0.080-inch- (2.0-mm-) thick aluminum sheet][0.100-inch- (2.5-mm-) thick aluminum sheet]**.

2.3 EXTRUDED-ALUMINUM PLANK GRATINGS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 1. **[AMICO, a Gibraltar Industries company]**
 2. **[IKG]**
 3. **[Ohio Gratings, Inc]**
 4. **[Seidelhuber Metal Products; Brodhead Steel]**
 5. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 1. **[AMICO, a Gibraltar Industries company]**
 2. **[IKG]**
 3. **[Ohio Gratings, Inc]**
 4. **[Seidelhuber Metal Products; Brodhead Steel]**
 5. **<Insert manufacturer's name>**
- C. Provide extruded-aluminum plank gratings in type, size, and finish indicated or, if not indicated, as recommended by manufacturer for indicated applications and as needed to support indicated loads.
 1. Type: Extruded-aluminum planks approximately **6 inches (152 mm)** wide with multiple flanges approximately **1.2 inches (30 mm)** o.c., acting as bearing bars connected by a web that serves as a walking surface. Top surface has raised ribs to increase slip resistance.
 2. Depth: **[1 inch (25 mm)][1-1/2 inches (38 mm)][2 inches (51 mm)][As required to comply with structural performance requirements]**.
 3. Perforations: **[None][Rectangular, 19/32 by 3 inches (15 by 76 mm), with adjacent rows]**

4. **staggered** [19/32 inch (15 mm) square, with adjacent rows aligned].
Finish: Mill finish, as fabricated.

2.4 GRATING FRAMES AND SUPPORTS

- A. Frames and Supports: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
1. Unless otherwise indicated, fabricate from same basic metal as gratings.
 2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors **24 inches (600 mm)** o.c. and provide minimum anchor units in the form of steel straps **1-1/4 inches (32 mm)** wide by **1/4 inch (6.4 mm)** thick by **8 inches (200 mm)** long.
- B. Galvanize steel frames and supports in the following locations:
1. Exterior.
 2. Interior[, **where indicated**].

2.5 FASTENERS

- A. General: Unless otherwise indicated, provide **[Type 304][Type 316]** stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
1. Provide stainless steel fasteners for fastening aluminum.
 2. Provide stainless steel fasteners for fastening stainless steel.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, **ASTM A307, Grade A (ISO 898-1, Property Class 4.6)**; with hex nuts, **ASTM A563 (ASTM A563M)**; and, where indicated, flat washers.
- C. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, nuts, and, where indicated, flat washers; **ASTM F593 (ISO 3506-1)** for bolts and **ASTM F594 (ASTM F836M)** for nuts, Alloy **[Group 1 (A1)][Group 2 (A4)]**.
- D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, **ASTM A563 (ASTM A563M)**; and, where indicated, flat washers.
1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. Post-Installed Anchors: **[Torque-controlled expansion anchors][or][chemical anchors]** capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy **[Group 1 (A1)][Group 2 (A4)]** stainless steel bolts, **ASTM F593 (ISO 3506-1)**, and nuts, **ASTM F594 (ASTM F836M)**.

2.6 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with [Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."][Section 099113 "Exterior Painting" and Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."]
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Epoxy Zinc-Rich Primer: Compatible with topcoat.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.7 FERROUS METALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25]<Insert value> percent.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Uncoated Steel Sheet: ASTM A1011/A1011M, structural steel, **Grade 30 (Grade 205)**.
- D. Galvanized-Steel Sheet: ASTM A653/A653M, structural quality, **Grade 33 (Grade 230)**, with **G90 (Z275)** coating.
- E. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A240/A240M, [**Type 304**][**Type 316L**].
- F. Stainless Steel Bars and Shapes: ASTM A276/A276M, [**Type 304**][**Type 316L**].

2.8 ALUMINUM

- A. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25][50]<Insert value> percent.
- B. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
- C. Extruded Bars and Shapes: **ASTM B221 (ASTM B221M)**, alloys as follows:
 - 1. Alloy 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
 - 2. Alloy 6061-T1, for grating crossbars.
- D. Aluminum Sheet: **ASTM B209 (ASTM B209M)**, Alloy 5052-H32.

2.9 FABRICATION

- A. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- B. Fit exposed connections accurately together to form hairline joints.
- C. Welding: Comply with AWS recommendations and the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
- D. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
 - 1. Fabricate toeplates for attaching in the field.
 - 2. Toeplate Height: **4 inches (100 mm)** unless otherwise indicated.
- E. Fabricate cutouts in grating sections for penetrations of sizes and at locations indicated. Cut openings neatly and accurately to size. Edge-band openings with metal sheet or bars having a thickness not less than grating material.
 - 1. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
- F. Where gratings are pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and weld a strap collar not less than **1/8 inch (3.2 mm)** thick to the cut ends. Divide panels into sections only to extent required for installation where grating platforms and runways are to be placed around previously installed pipe, ducts, and structural members.

2.10 ALUMINUM FINISHES

- A. Class I, Clear Anodic Finish: AA-M12C22A41 complying with AAMA 611.

2.11 STEEL FINISHES

- A. Finish gratings, frames, and supports after assembly.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- C. Shop prime gratings, frames and supports[**not indicated to be galvanized**] unless otherwise indicated.
 - 1. Shop prime with [universal shop primer][primers specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting"] unless [zinc-rich primer is][primers specified in Section 099600 "High-Performance Coatings" are] indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with [SSPC-SP 6/NACE No. 3, "Commercial

Blast Cleaning."][SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."][requirements indicated below:]

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 4. Other Items: SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.
1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Attach toeplates to gratings by welding at locations indicated.
- F. Field Welding: Comply with AWS recommendations and the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
- G. Corrosion Protection: With a heavy coat of bituminous paint, coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals.

3.2 INSTALLATION OF METAL PLANK GRATINGS

- A. Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard anchor clips and hold-down devices for bolted connections.

- B. Attach removable units to supporting members by bolting at every point of contact.
- C. Attach nonremovable units to supporting members by welding unless otherwise indicated. Comply with manufacturer's written instructions for size and spacing of welds.
- D. Attach aluminum units to steel supporting members by bolting at side channels at every point of contact and by bolting intermediate planks at each end on alternate sides. Bolt adjacent planks together at midspan.

3.3 REPAIR

- A. Repair Painting:
 - 1. Wire brush and clean rust spots, welds, and abraded areas on prime-painted gratings immediately after installation, and apply repair paint with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum **2.0-mil (0.05-mm)** dry film thickness.
 - 2. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- B. Repair of Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 53 16 00

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Task	Specification	Specification Description
05 53 16 00	05 53 00 00	Expanded Metal Gratings
05 54 00 00	05 50 00 00	Metal Fabrications
05 55 13 00	05 50 00 00	Metal Fabrications
05 55 13 00	05 51 13 00	Metal Pan Stairs
05 55 13 00	05 71 13 00	Fabricated Metal Spiral Stairs
05 55 16 00	05 50 00 00	Metal Fabrications
05 55 16 00	05 51 13 00	Metal Pan Stairs
05 55 16 00	05 71 13 00	Fabricated Metal Spiral Stairs
05 56 00 00	05 50 00 00	Metal Fabrications



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SECTION 05 58 00 00 - HEATING_COOLING UNIT COVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes heating-cooling unit enclosures.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, including finishing materials.
- B. Shop Drawings: Show fabrication and installation details for heating-cooling unit enclosures.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design[, **including mechanical finishes**].
- D. Samples for Verification: For each type of exposed finish required, prepared on **6-inch- (150-mm-)** square Samples of metal of same thickness and material indicated for the Work.
- E. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For heating-cooling unit enclosures. Show dimensions of heating-cooling units, including locations of housing penetrations and attachments, and necessary clearances.
- B. Qualification Data: For **[fabricator][organic-coating applicator][and][powder-coating applicator]**.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing heating-cooling unit enclosures similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Organic-Coating Applicator Qualifications: A firm experienced in successfully applying organic coatings of type indicated to metals of types indicated and that employs competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
- C. Powder-Coating Applicator Qualifications: A firm experienced in successfully applying powder coatings of type indicated to metals of types indicated and that employs competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.

- D. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
1. Build mockups of typical heating-cooling unit enclosures as shown on Drawings.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver heating-cooling unit enclosures wrapped in protective coverings or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with heating-cooling unit enclosures by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design heating-cooling unit enclosures.
- B. Structural Performance: Heating-cooling unit enclosures shall withstand the effects of gravity loads and the following loads and stresses without exceeding the allowable design working stress of materials involved and without exhibiting permanent deformation in any components:
1. Live Loads: **100 lbf/sq. ft. (4.8 kN/sq. m)** or a concentrated load of **300 lbf (1.3 kN)** on an area of **4 sq. in. (26 sq. cm)**, whichever produces the greater stress.

2.2 HEATING-COOLING UNIT ENCLOSURES

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[Airflex Industrial, Inc.]**
 2. **[ARSCO Metals LLC]**
 3. **[Barker Metalcraft]**
 4. **[HVAC Custom Enclosure Co., LLC]**
 5. **[Wenig Company (The)]**
 6. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Airflex Industrial, Inc.]**

2. [ARSCO Metals LLC]
 3. [Barker Metalcraft]
 4. [HVAC Custom Enclosure Co., LLC]
 5. [Wenig Company (The)]
 6. <Insert manufacturer's name>
- C. Fabricate heating-cooling unit enclosures from metal of type and thickness indicated below:
1. Galvanized-Steel Sheet:
 - a. Framing: [0.108 inch (2.74 mm)][Thickness required to comply with performance requirements]<Insert thickness>.
 - b. Sills and Stools: [0.079 inch (2.01 mm)][Thickness required to comply with performance requirements]<Insert thickness>.
 - c. Front Panels and Bases: [0.064 inch (1.63 mm)]<Insert dimension>.
 - d. Concealed Panels and Trim: [0.040 inch (1.02 mm)]<Insert dimension>.
 - e. Finish: [Factory primed][Baked enamel][Siliconized polyester][High-performance organic coating][Powder coat].
 2. Steel Sheet:
 - a. Framing: [0.105 inch (2.66 mm)][Thickness required to comply with performance requirements]<Insert thickness>.
 - b. Sills and Stools: [0.075 inch (1.90 mm)][Thickness required to comply with performance requirements]<Insert thickness>.
 - c. Front Panels and Bases: [0.060 inch (1.52 mm)]<Insert dimension>.
 - d. Concealed Panels and Trim: [0.036 inch (0.91 mm)]<Insert dimension>.
 - e. Finish: [Factory primed][Baked enamel][Powder coat].
- D. Weld seams and connections unless otherwise indicated or unless other methods are necessary for access to heating and cooling equipment.
- E. Incorporate stiffeners or laminated backing using noncombustible materials as needed for strength and rigidity.
1. Fill space between stiffeners with sound-deadening insulation attached to face sheet with insulation adhesive unless otherwise indicated.
 2. Coat concealed faces of metal panels more than **6 inches (150 mm)** wide with a heavy coating of sound-deadening mastic applied at the minimum rate of **20 sq. ft./gal. (0.5 sq. m/L)**.
- F. Provide louvers and grilles of size, type, and materials indicated.
1. For removable grilles, use modular units with recessed openings formed into surfaces of enclosures and without blank filler panels between grilles, so face panels and stools are continuous. Fabricate removable grilles and openings to precise tolerances to produce well-fitted assemblies free of warp or rattle, with grilles supported continuously along parallel edges and with tops flush with top of enclosure.
- G. Incorporate removable tops and fronts where indicated or needed for access to heating-cooling units and to piping, ductwork, controls, and electrical service, with panels and openings as follows:
1. Fabricate with a fitting tolerance of not less than **1/32 inch (0.8 mm)** and not more than **1/16 inch (1.6 mm)** at each edge, with face of panels flush with adjoining fixed surfaces of enclosure.
 2. Form panels for easy removal without interfering with adjoining construction or furniture. Hold panels in place with concealed clips and hardware that prevent warp and rattle.

- H. Incorporate hinged access panels in enclosures for access to heating-cooling unit controls, as either separate elements or integrated with grille openings, as indicated or needed.
- I. Coordinate construction, configuration, and dimensions of enclosures with those of heating-cooling units. Provide support for heating-cooling units and controls where indicated. Provide blind knockouts and supports for piping, ductwork, control lines, electrical conduit, and wiring where indicated or needed.
- J. Locate fixed surfaces of enclosure to coincide precisely with window mullions and partition system terminations. Provide closures at ends of units, at recessed openings in base of units, and at other locations where needed to conceal unfinished wall or floor surfaces, piping, conduit, ductwork, or heating-cooling units.
 - 1. Provide built-in partitions (bulkheads) within enclosures between heating-cooling units, located to coincide with mullions and partition system terminations. Seal partitions to faces of enclosures with compressible gaskets or mastic sealing tape, and cover both sides of partitions with sound-deadening insulation attached to partitions with insulation adhesive.

2.3 SHEET METAL

- A. Fabricate units from sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.
- B. Galvanized-Steel Sheet: ASTM A653/A653M, **G90 (Z275)** coating, either commercial steel or forming steel.
- C. Steel Sheet: **[Uncoated, cold-rolled, ASTM A1008/A1008M, commercial steel, exposed][or][electrolytic zinc-coated, ASTM A879/A879M, with steel sheet substrate complying with ASTM A1008/A1008M, commercial steel, exposed].**

2.4 MISCELLANEOUS MATERIALS

- A. Gaskets: As required to seal joints in heating-cooling unit enclosures; as recommended in writing by heating-cooling unit enclosure manufacturer.
 - 1. ASTM D1056, Type 1, Class A, and grade as recommended by gasket manufacturer to obtain seal for application indicated.
 - 2. Closed-cell polyurethane foam, adhesive on two sides, and release paper protected.
- B. Filler Metal and Electrodes: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as necessary for strength, corrosion resistance, and compatibility in fabricated items.
- C. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated. Do not use metals that are incompatible with materials joined.
 - 1. Provide concealed fasteners for interconnecting decorative formed metal items and for attaching them to other work unless **[otherwise indicated][exposed fasteners are unavoidable or are the standard fastening method]**.
 - 2. Provide **[Phillips][tamper-resistant][square or hex socket]** flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Sound-Deadening Materials:

1. Insulation: Unfaced mineral-fiber blanket insulation complying with ASTM C665, Type I, and passing ASTM E136 test.
2. Mastic: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

E. Isolation Coating: Manufacturer's standard [**alkali-resistant coating**][**bituminous paint**][**epoxy coating**].

2.5 PAINTS AND COATINGS

- A. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. Shop Primers: Comply with [**Section 099123 "Interior Painting."**][**Section 099600 "High-Performance Coatings."**]
- D. Universal Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
- E. Shop Primer for Galvanized Steel: Water-based galvanized metal primer complying with MPI#134.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.6 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble heating-cooling unit enclosures in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Coordinate dimensions and attachment methods of heating-cooling unit enclosures with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.
- C. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a **1/2-inch- (12-mm-)** wide hem on the concealed side, or ease edges to a radius of approximately **1/32 inch (1 mm)** and support with concealed stiffeners.
- D. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use.
 1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.
- E. Build in straps, plates, and brackets as needed to support and anchor heating-cooling unit enclosures to adjoining construction.
- F. Provide support framing, mounting, and attachment clips; splice sleeves; fasteners; and accessories needed to install heating-cooling unit enclosures.

- G. Where welding is indicated, weld joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed.

2.7 GALVANIZED-STEEL SHEET FINISHES

- A. Preparing Galvanized Items for Factory Priming: Thoroughly clean galvanized decorative formed metal of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- B. Preparing Galvanized Items for Factory Finishing: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
- C. Repairing Galvanized Surfaces: Clean welds and abraded areas and repair galvanizing to comply with ASTM A780/A780M.
- D. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply shop primer to prepared surfaces of items unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
- E. Baked-Enamel Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of **1 mil (0.025 mm)** for topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of **2 mils (0.05 mm)**.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- F. Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than **1.5 mils (0.04 mm)**. Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- G. Siliconized-Polyester Coating: After cleaning and pretreating, apply manufacturer's standard epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than **0.2 mil (0.005 mm)** for primer and **0.8 mil (0.02 mm)** for topcoat.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- H. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- I. Superior-Performance Organic Finish: **[Two][Three][Four]**-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

2.8 STEEL SHEET FINISHES

- A. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
- B. Pretreatment: Immediately after cleaning, apply a conversion coating of type suited to organic coating applied over it.
- C. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply shop primer to prepared surfaces of items unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
- D. Baked-Enamel Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of **2 mils (0.05 mm)**.
 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- E. Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than **1.5 mils (0.04 mm)**. Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.
 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of heating-cooling unit enclosures.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Locate and place heating-cooling unit enclosures level and plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install heating-cooling unit enclosures.
 1. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- B. Use concealed anchorages where possible.

- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.
- D. Install concealed gaskets, joint fillers, sealants, and insulation, as the Work progresses.
- E. Corrosion Protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum **2.0-mil (0.05-mm)** dry film thickness.
 - 2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in [**Section 099123 "Interior Painting."**][**Section 099600 "High-Performance Coatings."**][**Section 099123 "Interior Painting"** and **Section 099600 "High-Performance Coatings."**]
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

3.4 PROTECTION

- A. Protect finishes of heating-cooling unit enclosures from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

END OF SECTION 05 58 00 00



Task	Specification	Specification Description
05 58 16 00	05 58 00 00	Heating_Cooling Unit Covers
05 58 16 00	05 70 00 00	Decorative Metal
05 58 16 00	05 75 00 00	Decorative Formed Metal
05 58 23 00	05 58 00 00	Heating_Cooling Unit Covers
05 59 65 00	01 11 19 00	No Specification Required
05 59 65 00	05 70 00 00	Decorative Metal



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SECTION 05 70 00 00 - DECORATIVE METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Decorative window security bars.
2. Decorative mechanical grilles and frames.
3. Custom door pulls.
4. Combination hall push-button stations.
5. Metal reveals at wood paneling.
6. Cast-metal rosettes at marble joints.

B. Related Requirements:

1. Section 057300 "Decorative Metal Railings" for decorative metal railings.
2. Section 057500 "Decorative Formed Metal" for decorative metal items made from sheet metal.

1.2 COORDINATION

- A. Coordinate installation of anchorages for decorative metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including finishing materials.
- B. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- C. Shop Drawings: Show fabrication and installation details for decorative metal.
1. Include plans, elevations, component details, and attachment details.
 2. Indicate materials and profiles of each decorative metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.
- D. Patterns, Models, or Plaster Castings: Made from proposed patterns for each design of custom casting required.

- E. Samples for Initial Selection: For products involving selection of color, texture, or design[**including mechanical finishes**].
- F. Samples for Verification: For each type of exposed finish.
 - 1. Sections of linear shapes.
 - 2. Full-size Samples of castings and forgings.
 - a. For custom castings, submit finished Samples showing ability to reproduce detail[, **cast-metal color,**] and quality of finish.[**Samples may be of similar previous work.**]
 - 3. Samples of [**welded**][**and**][**brazed**] joints showing quality of workmanship[**and color matching of materials**].

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For [**fabricator**][**organic-coating applicator**][**anodic finisher**][**powder-coating applicator**].
- B. Mill Certificates: Signed by manufacturers of stainless steel certifying that products furnished comply with requirements.
- C. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing decorative metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Installer Qualifications: Fabricator of products.
- C. Organic-Coating Applicator Qualifications: A firm experienced in successfully applying organic coatings, of type indicated, to aluminum extrusions and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
- D. Anodic Finisher Qualifications: A firm experienced in successfully applying anodic finishes of type indicated and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
- E. Powder-Coating Applicator Qualifications: A firm experienced in successfully applying powder coatings of type indicated and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
- F. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
 - 4. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockups for the following types of decorative metal:
 - a. **<Insert, in separate subparagraphs, description of each decorative metal type including mockup size>.**
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store decorative metal in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.
- B. Deliver and store cast-metal products in wooden crates surrounded by enough packing material to ensure that products are not cracked or otherwise damaged.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 DECORATIVE METAL FABRICATORS

- A. Fabricator: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **<Insert manufacturer's name>.**

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Use materials with smooth, flat surfaces unless otherwise indicated. Use materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2.3 ALUMINUM

- A. Fabricate products from alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
- B. Bars and Shapes: **ASTM B221 (ASTM B221M)**, Alloy 6063-T5/T52.

- C. Pipe and Round Tubing: ASTM B429/B429M, Alloy 6063-T6.
- D. Tubing: **ASTM B210 (ASTM B210M)**, Alloy 6063-T832.
- E. Plate and Sheet: **ASTM B209 (ASTM B209M)**, [**Alloy 3003-H14**][**Alloy 5005-H32**][**Alloy 6061-T6**].
- F. Forgings: **ASTM B247 (ASTM B247M)**, Alloy 6061-T6.
- G. Castings: ASTM B26/B26M, Alloy A356.0-T6.

2.4 COPPER AND COPPER ALLOYS

- A. Fabricate products from alloys indicated and temper to suit application and forming methods but with strength and stiffness not less than H01 (quarter-hard) for plate, sheet, strip, and bars and H55 (light-drawn) for tube and pipe.

2.5 BRONZE

- A. Extruded Shapes: ASTM B455, Alloy UNS C38500 (architectural bronze).
- B. Pipe: ASTM B43, Alloy UNS C23000 (red brass, 85 percent copper).
- C. Tube: **ASTM B135 (ASTM B135M)**, Alloy UNS C23000 (red brass, 85 percent copper).
- D. Castings: [**ASTM B62, Alloy UNS C83600 (85-5-5-5 or No. 1 composition commercial red brass)**][or][**ASTM B584, Alloy UNS C86500 (No. 1 manganese bronze)**].
- E. Plate, Sheet, Strip, and Bars: ASTM B36/B36M, Alloy UNS C28000 (muntz metal, 60 percent copper).

2.6 BRASS

- A. Extruded Shapes: ASTM B249/B249M, Alloy UNS C36000 (free-cutting brass).
- B. Seamless Tube: **ASTM B135 (ASTM B135M)**, Alloy UNS C26000 (cartridge brass, 70 percent copper).
- C. Castings: ASTM B584, Alloy UNS C85200 (high-copper yellow brass).
- D. Plate, Sheet, Strip, and Bars: ASTM B36/B36M, Alloy UNS C26000 (cartridge brass, 70 percent copper).

2.7 NICKEL SILVER

- A. Extruded Shapes: ASTM B249/B249M, Alloy UNS C79600.
- B. Castings: ASTM B584, Alloy UNS C97300 (12 percent leaded nickel silver).

2.8 COPPER

- A. Tube: ASTM B75/B75M, Alloy UNS C12200 (phosphorous deoxidized, high residual phosphorous

copper).

- B. Castings: ASTM B824, with a minimum of 99.9 percent copper.
- C. Plate, Sheet, Strip, and Bars: ASTM B152/B152M, Alloy UNS C11000 (electrolytic tough pitch copper) or Alloy UNS C12200 (phosphorous deoxidized, high-residual phosphorous copper).

2.9 STAINLESS STEEL

- A. Tubing: ASTM A554, **[Grade MT 304][Grade MT 316][Grade MT 316L]**.
- B. Pipe: ASTM A312/A312M, **[Grade TP 304][Grade TP 316][Grade TP 316L]**.
- C. Castings: ASTM A743/A743M, **[Grade CF 8 or Grade CF 20][Grade CF 8M or Grade CF 3M]**.
- D. Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, **[Type 304][Type 316][Type 316L]**.
- E. Flat Bar: ASTM A666, **[Type 304][Type 316][Type 316L]**.
- F. Bars and Shapes: ASTM A276, **[Type 304][Type 316][Type 316L]**.
- G. Wire Rope and Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Carl Stahl DecorCable, Inc.]**
 - b. **[Esmet, Inc.]**
 - c. **[Feeney Inc.]**
 - d. **[Hayn Enterprises, LLC]**
 - e. **[Johnson, C. Sherman, Co., Inc]**
 - f. **[Ronstan International Inc]**
 - g. **[Seco South, Inc.]**
 - h. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Carl Stahl DecorCable, Inc.]**
 - b. **[Esmet, Inc.]**
 - c. **[Feeney Inc.]**
 - d. **[Hayn Enterprises, LLC]**
 - e. **[Johnson, C. Sherman, Co., Inc]**
 - f. **[Ronstan International Inc]**
 - g. **[Seco South, Inc.]**
 - h. **<Insert manufacturer's name>**
 - 3. Wire Rope: **[1-by-19][7-by-7][7-by-19]<Insert designation>** wire rope made from wire complying with ASTM A492, Type 316.
 - 4. Wire-Rope Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain without failure a load equal to minimum breaking strength of wire rope with which they are used.

2.10 STEEL AND IRON

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- B. Tubing: **[ASTM A500/A500M (cold formed)][or][ASTM A513, Type 5 (mandrel drawn)]**.
- C. Bars: Hot-rolled, carbon steel complying with ASTM A29/A29M, Grade 1010.
- D. Plates, Shapes, and Bars: ASTM A36/A36M.
- E. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M unless otherwise indicated.
- F. Steel Sheet, Cold Rolled: ASTM A1008/A1008M, either commercial steel or structural steel, exposed.

2.11 TITANIUM

- A. Strip, Sheet, and Plate: ASTM B265, Grade 1.
- B. Bars: ASTM B348, Grade 1.

2.12 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
 - 1. Aluminum Items: **[Aluminum][Type 304 stainless steel][Type 316 stainless steel]** fasteners.
 - 2. Copper-Alloy (Bronze) Items: Silicon bronze (Alloy 651 or Alloy 655) fasteners **[where concealed, muntz metal (Alloy 280) fasteners where exposed]**.
 - 3. Copper-Alloy (Brass) Items: Silicon bronze (Alloy 651 or Alloy 655) fasteners **[where concealed, brass (Alloy 260 or 360) fasteners where exposed]**.
 - 4. Stainless Steel Items: **[Type 304][Type 316]** stainless steel fasteners.
 - 5. Titanium Items: **[Type 304][Type 316]** stainless steel fasteners.
 - 6. Uncoated-Steel Items: Plated steel fasteners complying with ASTM B633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed, Type 304 stainless steel fasteners where exposed.
 - 7. Galvanized-Steel Items: Plated steel fasteners complying with ASTM B633, Class Fe/Zn 25 for electrodeposited zinc coating.
 - 8. Dissimilar Metals: **[Type 304][Type 316]** stainless steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.
- C. Provide concealed fasteners for interconnecting components and for attaching decorative metal items to other work unless **[otherwise indicated][exposed fasteners are unavoidable]**.
 - 1. Provide **[Phillips][tamper-resistant][square or hex socket]** flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 **[or ICC-ES AC308]**.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or **ASTM F1941 (ASTM F1941M)**, Class Fe/Zn 5 unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy **[Group 1 (A1)][Group 2 (A4)]** stainless steel bolts, **ASTM F593 (ASTM F738M)**, and nuts, **ASTM F594 (ASTM F836M)**.

2.13 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Brazing Rods: For copper alloys, provide type and alloy as recommended by producer of metal to be brazed and as required for color match, strength, and compatibility in fabricated items.
- C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Lacquer for Copper Alloys: Clear, acrylic lacquer specially developed for coating copper-alloy products.
- F. Shop Primers: Provide primers that comply with **[Section 099113 "Exterior Painting."][Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings.]**
- G. Universal Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- H. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- I. Shop Primer for Galvanized Steel: **[Cementitious galvanized metal primer complying with MPI#26][Vinyl wash primer complying with MPI#80][Water-based galvanized metal primer complying with MPI#134].**
- J. Intermediate Coats and Topcoats for Steel: Provide products that comply with **[Section 099113 "Exterior Painting."][Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings.]**
- K. Epoxy Intermediate Coat for Steel: Complying with MPI#77 and compatible with primer and topcoat.
- L. Polyurethane Topcoat for Steel: Complying with MPI#72 and compatible with undercoat.
- M. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.14 FABRICATION, GENERAL

- A. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly.
 1. Disassemble units only as necessary for shipping and handling limitations.
 2. Clearly mark units for reassembly and coordinated installation.

3. Use connections that maintain structural value of joined pieces.
 - B. Make up wire-rope assemblies in the shop to field-measured dimensions with fittings machine swaged.
 1. Minimize amount of turnbuckle take-up used for dimensional adjustment so maximum amount is available for tensioning wire ropes.
 2. Tag wire-rope assemblies and fittings to identify installation locations and orientations for coordinated installation.
 - C. Form decorative metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.
 - D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
 - E. Form simple and compound curves in bars, pipe, tubing, and extruded shapes by bending members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.
 - F. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
 - G. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.
 - H. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
 - I. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as needed to receive finish hardware, screws, and similar items unless otherwise indicated.
 - J. Comply with AWS for recommended practices in shop **[welding][and][brazing]**. **[Weld][and][braze]** behind finished surfaces without distorting or discoloring exposed side. Clean exposed **[welded][and][brazed]** joints of flux, and dress exposed and contact surfaces.
 1. Where **[welding][and][brazing]** cannot be concealed behind finished surfaces, finish joints to comply with NOMMA's "Voluntary Joint Finish Standards" for **[Type 1 Welds: no evidence of a welded joint][Type 2 Welds: completely sanded joint, some undercutting and pinholes okay][Type 3 Welds: partially dressed weld with spatter removed][Type 4 Welds: good quality, uniform undressed weld with minimal splatter]**.
 - K. Provide castings that are sound and free of warp, cracks, blowholes, or other defects that impair strength or appearance. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks.
- 2.15 FABRICATION OF DECORATIVE WINDOW SECURITY BARS
- A. Fabricate decorative window grilles to designs indicated from steel bars and shapes of sizes and profiles indicated. Form steel bars by bending, forging, coping, mitering, and welding.
 - B. Welding: Interconnect grille members with full-length, full-penetration welds unless otherwise indicated. Use welding method that is appropriate for metal and finish indicated and that develops full strength of

members joined. Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces.

- C. Brackets, Fittings, and Anchors: Provide wall brackets, fittings, and anchors to connect decorative window grilles to other work unless otherwise indicated.
1. Furnish inserts and other anchorage devices to connect decorative window grilles to concrete and masonry work. Coordinate anchorage devices with supporting structure.
 2. Fabricate anchorage devices that are capable of withstanding loads indicated.

2.16 DECORATIVE MECHANICAL GRILLES

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[Architectural Grille]**
 2. **[Beaux-Arts Classic Products]**
 3. **[DLSS Manufacturing]**
 4. **[H&K Perforating LLC]**
 5. **[Precision Metal Fabricators, Inc.]**
 6. **[Reggio Register Company, Inc.]**
 7. **[Register & Grille Mfg. Co., Inc.]**
 8. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Architectural Grille]**
 2. **[Beaux-Arts Classic Products]**
 3. **[DLSS Manufacturing]**
 4. **[H&K Perforating LLC]**
 5. **[Precision Metal Fabricators, Inc.]**
 6. **[Reggio Register Company, Inc.]**
 7. **[Register & Grille Mfg. Co., Inc.]**
 8. **<Insert manufacturer's name>**
- C. Fabricate decorative grilles from perforated **[aluminum][brass][bronze][stainless steel][steel]** sheet or plate of thickness, size, and pattern indicated. Form perforations by punching, cutting, or drilling to produce openings of sizes and shapes indicated. Roll, press, and grind perforated metal to flatten and to remove burrs and deformations.
1. Form perforations to match existing grilles.
 2. Drawings indicate perforated metal patterns required and are based on products of one manufacturer. Perforated metal patterns produced by other manufacturers may be considered, provided deviations are minor and do not change design concept as judged solely by Architect.
- D. Drill and countersink grilles for mounting screws at **2 inches (50 mm)** from corners and at **10 inches (250 mm)** or less o.c. Provide units with oval-head **[wood][self-tapping machine]** screws.
- E. Fabricate grille frames from extruded **[aluminum][brass][bronze][stainless steel][steel]** of profiles and to sizes and shapes indicated. Miter frame members at corners and connect with concealed splice plates **[welded][brazed]** to back of frames.
1. Secure grilles in frames with **0.5-inch- (12-mm-)** long **[welds][brazing]** along perimeter of grilles

- at **4 inches (100 mm)** o.c.
 - 2. Provide frame profiles to match existing frames.
 - 3. Drawings indicate frame profiles required and are based on products of one manufacturer. Similar frame profiles produced by other manufacturers may be considered, provided deviations are minor and do not change design concept as judged solely by Architect.
- F. Drill and countersink frames for mounting screws at **4 inches (100 mm)** from corners and at **16 inches (400 mm)** or less o.c. Provide units with oval-head **[wood][self-tapping machine]** screws.

2.17 FABRICATION OF CUSTOM DOOR PULLS

- A. Fabricate custom door pulls from **[brass][bronze][stainless steel]** bar stock of profile indicated, fabricated to shapes indicated.
- 1. Form curves by bending to produce uniform curvature of radii indicated; maintain profile of member throughout entire bend without buckling, twisting, or otherwise deforming exposed surfaces.
 - 2. Where radii of bends are too small to avoid buckling, grind bars after bending to restore original profile.
 - 3. Drill and tap door pulls to receive through bolts for attachment to doors.
- B. Fabricate backing plates for custom door pulls from **1/8-inch (3.2-mm) [brass][bronze][stainless steel]** sheet.
- 1. Cut to shape indicated and bevel edges at a 45-degree angle for one-half thickness of metal.
 - 2. Drill and countersink holes where indicated for screws and bolts.
- C. Provide units with oval-head through bolts for mounting pulls and with oval-head wood screws for mounting backing plates.

2.18 FABRICATION OF COMBINATION HALL PUSH-BUTTON STATIONS

- A. Fabricate units of **[brass][bronze][stainless steel]** to comply with details indicated. Coordinate with elevator signal equipment to provide integrated, closely fitted assemblies.
- 1. Fabricate faceplates from **1/8-inch- (3.2-mm-)** thick sheet with edges beveled at a 45-degree angle for one-half thickness of metal.
 - 2. Provide units with rectangular, split-bowl trash receptacle, designed for recess mounting in nominal **4-inch (100-mm)** wall depth. Fabricate recessed cabinets, top rings, and split bowls of same metal as face of units; fabricate removable receptacles of drawn aluminum. Nominal dimensions of units are **10 by 10 by 3-1/2 inches (250 by 250 by 90 mm)** in depth.
 - 3. Provide units with emergency pictorial signs and text, complying with requirements of authorities having jurisdiction, indicating that in fire emergency, elevators should not be used and that stairways should be used instead. Engrave pictorial sign and text into front surface of faceplates to a depth of **1/16 inch (1.6 mm)** with engraving painted red. Make signs **5 inches (125 mm)** wide by **8 inches (200 mm)** high.
 - 4. Provide cutouts in faceplates of units for push buttons of elevator hall push-button station[, **card reader,**] and elevator key switches. Coordinate locations and sizes of cutouts so additional faceplate is not required and so faces of push buttons are flush with fronts of faceplates and key switches project beyond faceplate only by depth of bezel.

2.19 FABRICATION OF METAL REVEALS

- A. Fabricate metal reveals for wood paneling from **[3/4-by-3/4-by-1/16-inch (19-by-19-by-3-mm) extruded-bronze][3/4-by-3/4-by-0.025-inch (19-by-19-by-0.6-mm) brake-formed, stainless steel][3/4-by-3/4-by-0.015-inch (19-by-19-by-0.4-mm) brake-formed titanium]** channels.
1. Drill for mounting screws **6 inches (150 mm)** from ends of channels and not more than **24 inches (600 mm)** o.c.
 2. Locate mounting screws at same heights for all channels.
 3. Provide **[black-finished,]**hex-socket, wafer-head screws for mounting reveals.

2.20 FABRICATION OF CAST-METAL ROSETTES

- A. Fabricate cast-metal rosettes to design indicated from **[aluminum][brass][bronze][nickel silver]**. Drill and tap castings for threaded mounting studs.
1. Provide custom castings to match design indicated.
 2. Manufacturer's stock castings may be considered, provided deviations are minor and do not change design concept as judged solely by Architect.
 3. Drawings indicate cast-metal rosette designs required and are based on products of one manufacturer. Castings produced by other manufacturers may be considered, provided deviations are minor and do not change design concept as judged solely by Architect.

2.21 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.22 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Clear Anodic Finish: AAMA 611, **[AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm]** or thicker.
- C. Color Anodic Finish: AAMA 611, **[AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm]** or thicker.
1. Color: **[Champagne][Light bronze][Medium bronze][Dark bronze][Black]<Insert color>**.
 2. **[Match Architect's sample][As selected by Architect from full range of industry colors and color densities]**.
- D. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.

- E. Siliconized Polyester Finish: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than **0.2 mil (0.005 mm)** for primer and **0.8 mil (0.02 mm)** for topcoat.
 - 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]**.
- F. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- G. Superior-Performance Organic Finish: **[Two][Three][Four]**-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.

2.23 COPPER-ALLOY FINISHES

- A. Finish designations for copper alloys comply with the system established for designating copper-alloy finish systems defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."
- B. Buffed Finish: M21 (Mechanical Finish: buffed, smooth specular).
- C. Hand-Rubbed Finish: M31-M34 (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed).
- D. Medium-Satin Finish: M32 (Mechanical Finish: directionally textured, medium satin).
- E. Fine-Matte Finish: M42 (Mechanical Finish: nondirectional finish, fine matte).
- F. Buffed Finish, Lacquered: M21-O6x (Mechanical Finish: buffed, smooth specular; Coating: clear, organic, air dried, as specified below):
 - 1. Clear, Organic Coating: Lacquer specified for copper alloys; applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.
- G. Hand-Rubbed Finish, Lacquered: M31-M34-O6x (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed; Coating: clear, organic, air dried, as specified below):
 - 1. Clear, Organic Coating: Lacquer specified for copper alloys; applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.
- H. Medium-Satin Finish, Lacquered: M32-O6x (Mechanical Finish: directionally textured, medium satin; Coating: clear, organic, air dried, as specified below):
 - 1. Clear, Organic Coating: Lacquer specified for copper alloys; applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.

- I. Fine-Matte Finish, Lacquered: M42-O6x (Mechanical Finish: nondirectional finish, fine matte; Coating: clear, organic, air dried, as specified below):
 - 1. Clear, Organic Coating: Lacquer specified for copper alloys; applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.
- J. Statuary Conversion Coating over Satin Finish: M31-C55 (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide)[, **with color matching Architect's sample**].
- K. Patina Conversion Coating: M36-C12-C52 (Mechanical Finish: directionally textured, uniform; Chemical Finish: nonetched cleaned, degreased; Chemical Finish: conversion coating, ammonium sulfate)[, **with color matching Architect's sample**].
- L. Statuary Conversion Coating, Bright Relieved and Lacquered: M12-C55-M2x-O6x (Mechanical Finish: matte finish, as cast; Chemical Finish: conversion coating, sulfide; Mechanical Finish: buffed, as specified; Coating: clear, organic, air dried, as specified below)[, **with color matching Architect's sample**]:
 - 1. Clear, Organic Coating: Lacquer specified for copper alloys; applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.
- M. Blackened, Bright Relieved, and Lacquered: M33-O60-M2x-O6x (Mechanical Finish: directionally textured, coarse satin; Coating: black, air dried; Mechanical Finish: buffed, as specified; Coating: clear, organic, air dried, as specified below)[, **with blackening and buffing matching Architect's sample**]:
 - 1. Clear, Organic Coating: Lacquer specified for copper alloys; applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.

2.24 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
- C. Stainless Steel Tubing Finishes:
 - 1. 180-Grit Polished Finish: Uniform, directionally textured finish.
 - 2. 320-Grit Polished Finish: Oil-ground, uniform, fine, directionally textured finish.
 - 3. Polished and Buffed Finish: 320-grit finish followed by buffing [**to a high luster finish**][**to a mirror-like finish**][**to match Architect's sample**].
- D. Stainless Steel Sheet and Plate Finishes:
 - 1. Bright, Cold-Rolled, Unpolished Finish: ASTM A480/A480M, No. 2B.
 - 2. Directional Satin Finish: ASTM A480/A480M, No. 4.
 - 3. Dull Satin Finish: ASTM A480/A480M, No. 6.
 - 4. High Luster Finish: ASTM A480/A480M, No. 7.
 - 5. Mirror Finish: ASTM A480/A480M, No. 8.
- E. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

- F. Sputter-Coated Finish: Titanium nitride coating deposited by magnetic sputter-coating process over indicated mechanical finish.
- G. Colored, Oxide-Film Finish: Clear, oxide interference film produced by degreasing and then immersing in a mixture of chromic and sulfuric acids.
 - 1. Product: Subject to compliance with requirements, provide INCO colored stainless steel finish as developed and licensed by International Nickel Co., Ltd.
 - 2. Color: **[Match Architect's sample][As selected by Architect from finisher's full range].**

2.25 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize products made from rolled, pressed, and forged steel shapes, castings, plates, bars, and strips indicated to be galvanized to comply with ASTM A123/A123M.
 - 1. Hot-dip galvanize steel and iron hardware indicated to be galvanized to comply with ASTM A153/A153M.
 - 2. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 - 3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. Preparing Galvanized Items for Shop Priming: After galvanizing, thoroughly clean decorative metal of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- C. Preparing Nongalvanized Items for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with **[SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."][SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."][requirements indicated below:]**
 - 1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interiors (SSPC Zone 1A): SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
- D. Primer Application: Apply shop primer to prepared surfaces of items unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 - 1. Shop prime uncoated ferrous-metal surfaces with **[universal shop primer][primers specified in Section 099113 "Exterior Painting."][primers specified in Section 099123 "Interior Painting."]** unless **[zinc-rich primer is][primers specified in Section 099600 "High-Performance Coatings" are]** indicated.
 - 2. Do not apply primer to galvanized surfaces.
- E. Shop-Painted Finish: Comply with **[Section 099113 "Exterior Painting."][Section 099600 "High-Performance Coatings."]**
 - 1. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range].**
- F. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.
 - 1. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As**

selected by Architect from manufacturer's full range].

- G. Powder-Coat Finish, Nongalvanized: Prepare, treat, and coat nongalvanized ferrous metal to comply with resin manufacturer's written instructions and as follows:
1. Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 2. Treat prepared metal with iron-phosphate pretreatment, rinse, and seal surfaces.
 3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than **1.5 mils (0.04 mm)**.
 4. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range].**
- H. Powder-Coat Finish, Galvanized: Prepare, treat, and coat galvanized metal to comply with resin manufacturer's written instructions and as follows:
1. Prepare galvanized metal by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
 2. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
 3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than **1.5 mils (0.04 mm)**.
 4. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range].**

2.26 TITANIUM FINISHES

- A. General: Fabricate items from finished titanium stock, taking care not to damage finish during fabrication. Protect finish as needed during fabrication by applying a strippable, temporary protective covering.
- B. Dull Matte Finish: Pickled and annealed.
- C. Bright Matte Finish: Vacuum annealed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Provide anchorage devices and fasteners where needed to secure decorative metal to in-place construction.
- B. Perform cutting, drilling, and fitting required to install decorative metal. Set products accurately in location, alignment, and elevation, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.

- C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.
- D. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- E. Install concealed gaskets, joint fillers, insulation, and flashings as work progresses.
- F. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.
 - 1. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude nonuniform oxidation and discoloration.
- G. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding and requirements for welding and for finishing welded connections in "Fabrication, General" Article. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
- H. Field Brazing: Comply with requirements for brazing and for finishing brazed connections in "Fabrication, General" Article. Braze connections that are not to be left as exposed joints but cannot be shop brazed because of shipping size limitations.
- I. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.3 INSTALLATION OF DECORATIVE WINDOW SECURITY BARS

- A. Fasten security bar frames to concrete and masonry walls with cast-in-place or post-installed anchors. Peen exposed threads of anchors to prevent removal of security bars.

3.4 INSTALLATION OF DECORATIVE MECHANICAL GRILLES

- A. Mount decorative grilles at heights and in positions indicated, adjusting ductwork to be centered on grilles if any.
 - 1. Secure to framing and blocking with specified fasteners.
 - 2. On marble, brick, and other solid surfaces, secure with wood screws in plastic plugs.

3.5 INSTALLATION OF DECORATIVE-METAL-CLAD, HOLLOW-METAL DOORS AND FRAMES

- A. Install doors and frames to comply with requirements specified in Section 081113 "Hollow Metal Doors and Frames."

3.6 INSTALLATION OF CUSTOM DOOR PULLS

- A. Install door pulls at heights and locations shown. Install with backing plates on both sides of doors. Fasten backing plates to doors with oval-head [wood][self-tapping metal] screws and secure pulls through doors and backing plates with oval-head machine screws.

3.7 INSTALLATION OF COMBINATION HALL PUSH-BUTTON STATIONS

- A. Coordinate installation of combination hall push-button stations with installation of related elevator signal equipment components. Secure units in place with faceplate overlapping surrounding wall finish and drawn into contact with surrounding wall finish at entire perimeter of faceplate.

3.8 INSTALLATION OF METAL REVEALS AT WOOD PANELING

- A. Install metal reveals between wood panels as paneling is installed. Secure to wood grounds with specified screws.

3.9 INSTALLATION OF CAST-METAL ROSETTES AT MARBLE JOINTS

- A. Install cast-metal rosettes at intersections of marble joints where indicated. Install only after marble work is complete and joints are grouted. Secure to wall by drilling a **3/4-inch- (19-mm-)** round hole at intersection of marble joints and by filling hole with molding plaster into which threaded stud is embedded. Angle drill and rotate so bottom of hole is larger than at surface.
 - 1. Secure rosettes in place with masking tape until plaster sets. After plaster has set, remove masking tape and adhesive residue.

3.10 CLEANING AND PROTECTION

- A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.
- B. Clean copper alloys according to metal finisher's written instructions in a manner that leaves an undamaged and uniform finish matching approved Sample.
- C. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum **2.0-mil (0.05-mm)** dry film thickness.
 - 2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in [Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."][Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."]
- D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

05 - Metals



- E. Protect finishes of decorative metal from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.
- F. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 70 00 00

SECTION 05 71 00 00 - DECORATIVE METAL STAIRS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes decorative metal stairs.
- B. Related Requirements:
 - 1. Section 057113 "Fabricated Metal Spiral Stairs."
 - 2. Section 093013 "Ceramic Tiling" for ceramic-tile treads and landings.
 - 3. Section 096340 "Stone Flooring" for stone treads and landings.
 - 4. Section 096400 "Wood Flooring" for wood treads and landings.
 - 5. **[Section 096613 "Portland Cement Terrazzo Flooring"]****[Section 096623 "Resinous Matrix Terrazzo Flooring"]** for field-cast terrazzo treads and landings.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs.
 - 1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
 - 2. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For metal stairs and the following:
 - 1. Shop primer products.
 - 2. Precast concrete treads.
 - 3. Precast terrazzo treads.
 - 4. Grout.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Environmental product declaration.
 - 3. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 - 4. Environmental Product Declaration (EPD): For each product.
 - 5. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means

- of transportation, and cost for each indigenous material.
- 6. Environmental Product Declaration: For each product.
- 7. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
- 8. Environmental Product Declaration: For each product.
- 9. Environmental Product Declaration: For each product.
- 10. Third-Party Certifications: For each product.
- 11. Third-Party Certified Life Cycle Assessment: For each product.

C. Shop Drawings:

- 1. Include plans, elevations, sections, details, and attachments to other work.
- 2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
- 3. Include plan at each level.

D. Samples for Verification: For each type and finish of tread.

E. Delegated Design Submittal: For stairs, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that the engineer is licensed in the **[jurisdiction][State]** in which Project is located.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
 - 4. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification.
 - 1. Keep members off ground and spaced by using pallets, dunnage, or other supports and spacers.
 - 2. Protect members and packaged materials from corrosion and deterioration.
 - 3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.

- a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs, [**and railings,**] including attachment to building construction.
- B. Structural Performance of Stairs: Metal stairs withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Uniform Load: **100 lbf/sq. ft. (4.79 kN/sq. m).**
 2. Concentrated Load: **300 lbf (1.33 kN)** applied on an area of **4 sq. in. (2580 sq. mm).**
 3. Uniform and concentrated loads need not be assumed to act concurrently.
 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 5. Limit deflection of treads, platforms, and framing members to [L/360][L/720]<Insert deflection ratio> or 1/4 inch (6.4 mm), whichever is less.
- C. Seismic Performance of Stairs: Metal stairs withstand the effects of earthquake motions determined according to [ASCE/SEI 7]<Insert requirement>.
 1. Component Importance Factor: <Insert requirement>.

2.2 METALS

- A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25]<Insert value> percent.
- C. Steel Tubing: [ASTM A500/A500M (cold formed)][or][ASTM A513/A513M].
 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25]<Insert value> percent.
- D. Stainless Steel Bars and Shapes: ASTM A276/A276M, [Type 304][Type 316L].
 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25]<Insert value> percent.
- E. Uncoated, Cold-Rolled Steel Sheet: ASTM A1008/A1008M, [**either commercial steel, Type B, or**] structural steel, **Grade 25 (Grade 170)**, unless another grade is required by design loads; exposed.
 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25]<Insert value> percent.



- F. Uncoated, Hot-Rolled Steel Sheet: ASTM A1011/A1011M, [**either commercial steel, Type B, or** structural steel, **Grade 30 (Grade 205)**, unless another grade is required by design loads.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- G. Galvanized-Steel Sheet: ASTM A653/A653M, **G90 (Z275)** coating, [**either commercial steel, Type B, or** structural steel, **Grade 33 (Grade 230)**, unless another grade is required by design loads.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- H. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, [**Type 304**][**Type 316**], stretcher-leveled standard of flatness.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- I. Bronze Sheet: ASTM B36/B36M, Alloy UNS C28000 (muntz metal, 60 percent copper) or Alloy UNS C23000 (red brass, 85 percent copper).
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- J. Brass Sheet: ASTM B36/B36M, Alloy UNS C26000 (cartridge brass, 70 percent copper).
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- K. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 temper.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- L. Titanium Sheet: ASTM B265, Grade 1.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- M. Aluminum Sheet: Flat sheet complying with **ASTM B209 (ASTM B209M)**, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties of not less than Alloy 5005-H32.
1. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25][50]<Insert value>** percent.
- N. Aluminum Extrusions: **ASTM B221 (ASTM B221M)**, Alloy 6063-T6.
1. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25][50]<Insert value>** percent.
- O. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.
1. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of

preconsumer recycled content not less than [25][50]<Insert value> percent.

- P. Bronze Extrusions: ASTM B455, Alloy UNS No. C38500 (extruded architectural bronze).
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25]<Insert value> percent.
- Q. Bronze Castings: ASTM B584, Alloy UNS No. C83600 (lead red brass) or No. C84400 (lead semired brass).
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25]<Insert value> percent.
- R. Nickel Silver Extrusions: ASTM B151/B151M, Alloy UNS No. C74500.
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25]<Insert value> percent.
- S. Nickel Silver Castings: ASTM B584, Alloy UNS No. C97600 (20 percent lead nickel bronze).
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25]<Insert value> percent.
- T. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25]<Insert value> percent.

2.3 ABRASIVE NOSINGS

- A. Cast-Metal Units: Cast [iron][aluminum][bronze][nickel silver], with an integral abrasive, as-cast finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in lengths necessary to accurately fit openings or conditions.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[American Safety Tread Co., Inc]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Barry Pattern & Foundry Co., Inc]**
 - d. **[Granite State Casting Co]**
 - e. **[Safe-T-Metal Company, Inc.]**
 - f. **[TrueNorth Steel]**
 - g. **[Wooster Products Inc]**
 - h. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[American Safety Tread Co., Inc]**

- b. **[Balco; a CSW Industrials Company]**
 - c. **[Barry Pattern & Foundry Co., Inc]**
 - d. **[Granite State Casting Co]**
 - e. **[Safe-T-Metal Company, Inc.]**
 - f. **[TrueNorth Steel]**
 - g. **[Wooster Products Inc]**
 - h. **<Insert manufacturer's name>**
 3. Configuration: Cross-hatched units, **[3 inches (75 mm)][4 inches (100 mm)]** wide without lip.
 4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- B. Extruded Units: **[Aluminum][Bronze]** units with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in lengths necessary to accurately fit openings or conditions.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[American Safety Tread Co., Inc]**
 - b. **[Amstep Products]**
 - c. **[Armstrong Products, Inc]**
 - d. **[Balco; a CSW Industrials Company]**
 - e. **[Ecoglo, Inc.]**
 - f. **[Granite State Casting Co]**
 - g. **[Nystrom, Inc.]**
 - h. **[UPNOVR, Inc.]**
 - i. **[Wooster Products Inc]**
 - j. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[American Safety Tread Co., Inc]**
 - b. **[Amstep Products]**
 - c. **[Armstrong Products, Inc]**
 - d. **[Balco; a CSW Industrials Company]**
 - e. **[Ecoglo, Inc.]**
 - f. **[Granite State Casting Co]**
 - g. **[Nystrom, Inc.]**
 - h. **[UPNOVR, Inc.]**
 - i. **[Wooster Products Inc]**
 - j. **<Insert manufacturer's name>**
 3. Provide ribbed units, with abrasive filler strips projecting **1/16 inch (1.5 mm)** above aluminum extrusion.
 4. Provide solid-abrasive units without ribs.
 5. Nosings: Square-back units, **[1-7/8 inches (48 mm)][3 inches (75 mm)][4 inches (100 mm)]** wide, without lip.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.

2.4 FASTENERS

- A. General: Provide **[zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5][Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5]** where built into exterior walls.
 - 1. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, **ASTM A563 (ASTM A563M)**; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, **ASTM A563 (ASTM A563M)**; and, where indicated, flat washers.
 - 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for **[exterior stairs][stairs indicated to be galvanized][stairs indicated to be shop primed with zinc-rich primer]**.
- D. Post-Installed Anchors: **[Torque-controlled expansion anchors][or][chemical anchors]** capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy **[Group 1 (A1)][Group 2 (A4)]** stainless steel bolts, ASTM F593, and nuts, **ASTM F594 (ASTM F836M)**.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Electrodes: Comply with AWS requirements.
- B. Shop Primers: Provide primers that comply with **[Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."][Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings.]**
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Zinc-Rich Primer: Complying with SSPC-Paint 20, **[Type I-A][Type I-B][Type I-C][Type II]**, Level **[1][2][3]**, and compatible with topcoat.
- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with **[SSPC-Paint 20][ASTM A780/A780M]** and compatible with paints specified to be used over it.
- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- H. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place

Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of **3000 psi (20 MPa)** unless otherwise indicated.

- I. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.
- J. Plain Steel Welded-Wire Reinforcement: ASTM A1064/A10645M, **[steel],[galvanized steel], 6 by 6 inches (152 by 152 mm)**, W1.4 by W1.4, unless otherwise indicated on Drawings.
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- K. Reinforcement Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
 - 1. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.
 - 2. For galvanized reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
- L. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for **[interior][exterior]** use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

2.6 PRECAST CONCRETE TREADS

- A. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of **5000 psi (35 MPa)** and a total air content of not less than 4 percent or more than 6 percent.
- B. Reinforcement: Galvanized, welded-wire reinforcement, **2 by 2 inches (50 by 50 mm)** by **0.062-inch-(1.6-mm-)** diameter steel wire; comply with ASTM A1064/A1064M, except for minimum wire size.

2.7 PRECAST TERRAZZO TREADS

- A. Precast Terrazzo Stair Treads: Epoxy terrazzo units cast in maximum lengths possible. Comply with manufacturer's written instructions for fabricating precast terrazzo units in sizes and profiles indicated.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Wausau Tile, Inc.]**
 - b. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Wausau Tile, Inc.]**
 - b. **<Insert manufacturer's name>**

3. Epoxy Resin Matrix: Manufacturer's standard, recommended for use indicated.
4. Aggregates: Comply with NTMA gradation standards for mix indicated, and containing no deleterious or foreign matter.
 - a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C131/C131M.
 - b. 24-Hour Absorption Rate: Less than 0.75 percent.
 - c. Dust Content: Less than 1.0 percent by weight.
5. Reinforcement: ASTM A615/A615M, **Grade 60 (Grade 420)** bars, as required by unit size, profile, and thickness.
6. Abrasive Inserts: **1/2-inch- (13-mm-)** wide, alundum oxide/epoxy mixture.
 - a. Provide three inserts, **1/2 inch (13 mm)** apart, with first insert located **1 inch (25 mm)** from nosing at adjacent stair riser locations.
7. Color: As selected from manufacturer's standard color selections.
8. Finish: Honed.
9. Surface Sealer: Slip and stain-resistant, penetrating sealer that is chemically neutral with pH factor between 7 and 12; does not affect color or physical properties of terrazzo type indicated; is recommend by sealer manufacturer for use with specified terrazzo; and complies with NTMA guide specification for terrazzo type applicable for this Project.

2.8 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 1. Join components by welding unless otherwise indicated.
 2. Use connections that maintain structural value of joined pieces.
- B. Assemble stairs in shop to greatest extent possible.
 1. Disassemble units only as necessary for shipping and handling limitations.
 2. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately.
 1. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated.
 2. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Weld exposed corners and seams continuously unless otherwise indicated.
 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish

Standards" for Finish #1 - No evidence of a welded joint.

- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.

1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
2. Locate joints where least conspicuous.

2.9 FABRICATION OF STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Architectural Class, unless more stringent requirements are indicated.

- B. Stair Framing:

1. Stringers: Fabricate of **[steel plates][steel channels][steel plates or channels][steel tubes][as indicated on Drawings]**.
 - a. Stringer Size: **[As required to comply with "Performance Requirements" Article][As indicated on Drawings]**.
 - b. Provide closures for exposed ends of **[channel][tube]** stringers.
 - c. Finish: **[Shop primed][Painted][Galvanized]**.
2. Platforms: Construct of steel **[plate][channel][plate or channel][rectangular tube]** headers and miscellaneous framing members as **[required to comply with "Performance Requirements" Article][indicated on Drawings]**.
 - a. Provide closures for exposed ends of **[channel][tube]** framing.
 - b. Finish: **[Shop primed][Painted][Galvanized]**.
3. Weld **[or bolt]** stringers to headers; weld **[or bolt]** framing members to stringers and headers. **[If using bolts, fabricate and join so bolts are not exposed on finished surfaces.]**

- C. Subtreads, Risers, and Subplatforms:

1. Fabricate subtreads and subplatforms of steel **[plates][shapes indicated on Drawings]**.
2. Form subtreads, risers, and subplatforms to configurations indicated from **[uncoated, cold-rolled steel sheet][uncoated, hot-rolled steel sheet][galvanized steel sheet][of thickness needed to comply with performance requirements, but not less than 0.075 inch (1.9 mm) thick][of thickness indicated on Drawings]**.
3. Weld subtreads to stringers.
 - a. Locate welds on top of subtreads where they will be concealed by finished treads.
4. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads.
 - a. Weld subplatforms to platform framing.
 - b. Locate welds on top of subplatforms where they will be concealed by finished flooring.
 - c. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.10 STAIR RAILINGS

- A. Comply with applicable requirements in Section 057300 "Decorative Metal Railings."

1. Connect posts to stair framing by direct welding unless otherwise indicated.

2.11 FINISHES

- A. Finish metal stairs after assembly.

- B. Steel Galvanized Finish: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
2. Fill vent and drain holes that are exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

- C. Steel Shop Prime Finish:

1. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with **[SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."][SSPC-SP 3, "Power Tool Cleaning."]**
2. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting.

- a. Stripe paint corners, crevices, bolts, welds, and sharp edges.

- D. Aluminum Finishes:

1. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.
2. Color Anodic Finish: AAMA 611, **[AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm]** or thicker.
 - a. Color: **[Champagne][Light bronze][Medium bronze][Dark bronze][Black]<Insert color>**.

- E. Stainless Steel Finishes:

1. Stainless Steel Tubing Finishes:

- a. 180-Grit Polished Finish: Uniform, directionally textured finish.
- b. 320-Grit Polished Finish: Oil-ground, uniform, fine, directionally textured finish.
- c. Polished and Buffed Finish: 320-grit finish followed by buffing **[to a high luster finish][to a mirror-like finish][to match Architect's sample]**.

2. Stainless Steel Sheet and Plate Finishes:

- a. Directional Satin Finish: ASTM A480/A480M, No. 4.
- b. High Luster Finish: ASTM A480/A480M, No. 7.
- c. Mirror Finish: ASTM A480/A480M, No. 8.

- F. Bronze Finishes:

1. Statuary Conversion Coating over Satin Finish: CDA M31-C55 (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide)[, **with color matching**

Architect's sample].

2. Statuary Conversion Coating over Satin Finish, Lacquered: CDA M31-C55-O6x (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide; Coating: clear, organic, air dried, as specified below)[, **with color matching Architect's sample]**:
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.
3. Hand-Rubbed Finish, Lacquered: CDA M31-M34-O6x (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed; Coating: clear, organic, air dried, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.

G. Brass Finishes:

1. Buffed Finish, Lacquered: CDA M21-O6x (Mechanical Finish: buffed, smooth specular; Coating: clear, organic, air dried, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.
2. Hand-Rubbed Finish, Lacquered: CDA M31-M34-O6x (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed; Coating: clear, organic, air dried, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.

H. Copper Finishes:

1. As Fabricated: CDA M12 (Matte finish as fabricated).
2. Buffed Finish: CDA M21 (Mechanical Finish: buffed, smooth specular).
3. Hand-Rubbed Finish: CDA M31-M34 (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed).
4. Medium-Satin Finish: CDA M32 (Mechanical Finish: directionally textured, medium satin).
5. Fine-Matte Finish: CDA M42 (Mechanical Finish: nondirectional finish, fine matte).
6. Buffed Finish, Lacquered: CDA M21-O6x (Mechanical Finish: buffed, smooth specular; Coating: clear, organic, air dried, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.
7. Hand-Rubbed Finish, Lacquered: CDA M31-M34-O6x (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed; Coating: clear, organic, air dried, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.

mil (0.025 mm).

8. Medium-Satin Finish, Lacquered: CDA M32-O6x (Mechanical Finish: directionally textured, medium satin; Coating: clear, organic, air dried, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).
9. Fine-Matte Finish, Lacquered: CDA M42-O6x (Mechanical Finish: nondirectional finish, fine matte; Coating: clear, organic, air dried, as specified below).
 - a. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of 1 mil (0.025 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLING METAL STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
 1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
 1. Grouted Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates.
 - a. Clean bottom surface of plates.
 - b. Set plates for structural members on wedges, shims, or setting nuts.
 - c. Tighten anchor bolts after supported members have been positioned and plumbed.
 - d. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - e. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.
 - 1) Neatly finish exposed surfaces; protect grout and allow to cure.
 - 2) Comply with manufacturer's written installation instructions for shrinkage-resistant

grouts.

- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- E. Fit exposed connections accurately together to form hairline joints.
 - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 - 2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
 - 3. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.
- F. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."
 - 1. Install abrasive nosings with anchors fully embedded in concrete.
 - 2. Center nosings on tread width.
- G. Install precast concrete treads with adhesive supplied by manufacturer.
- H. Install precast terrazzo treads according to manufacturer's written instructions.

3.3 REPAIRS

- A. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum **2.0-mil (0.05-mm)** dry film thickness.
 - 2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in [**Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."**][**Section 099600 "High-Performance Coatings."**][**Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."**]
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 71 00 00



Task	Specification	Specification Description
05 71 00 00	05 70 00 00	Decorative Metal



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SECTION 05 71 13 00 - FABRICATED METAL SPIRAL STAIRS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes fabricated metal spiral stairs with steel central-supporting columns, radiating treads, and railings.
- B. Related Requirements:
 - 1. Section 062023 "Interior Finish Carpentry" for wood treads.
 - 2. Section 096513 "Resilient Base and Accessories" for resilient treads.
 - 3. Section 096816 "Sheet Carpeting" for carpeting treads.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for fabricated metal spiral stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Coordinate fabricated metal spiral stairs with finish flooring materials.

1.3 ACTION SUBMITTALS

- A. Product Data: For fabricated metal spiral stairs, including railings. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for components.
- B. Shop Drawings: For fabricated metal spiral stairs and railings. Include plans, elevations, sections, details, attachments to other work, and field measurements.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design.
- D. Samples for Verification: For the following products, in manufacturer's standard sizes:
 - 1. Treads.
 - 2. Metal with painted finish.
 - 3. Railing members.
- E. Delegated Design Submittal: For fabricated metal spiral stairs and railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content

- and cost.
- 2. Environmental product declaration.
- 3. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
- 4. Environmental Product Declaration (EPD): For each product.
- 5. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
- 6. Environmental Product Declaration: For each product.
- 7. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
- 8. Environmental Product Declaration: For each product.
- 9. Environmental Product Declaration: For each product.
- 10. Third-Party Certifications: For each product.
- 11. Third-Party Certified Life Cycle Assessment: For each product.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with fabricated metal spiral stairs by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain fabricated metal spiral stairs from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design fabricated metal spiral stairs and railings.
- B. Structural Performance of Stairs: Fabricated metal spiral stairs are to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated in accordance with **[ASCE/SEI 7]<Insert requirement>**:
 - 1. Uniform Load: **[40 lbf/sq. ft. (1.92 kN/sq. m)][100 lbf/sq. ft. (4.79 kN/sq. m)]**.
 - 2. Concentrated Load: **300 lbf (1.33 kN)** applied on an area of **4 sq. in. (2580 sq. mm)**.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Railing Loads: Stairs are to withstand stresses resulting from railing loads in addition to loads specified above.
 - 5. Deflection: Limit deflection of treads, landings, and framing members to **[L/360]** but not to exceed **[1/4 inch (6 mm)]**.
- C. Structural Performance of Railings: Railings are to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated in accordance with **[ASCE/SEI 7]<Insert requirement>**:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of **50 lbf/ft. (0.73 kN/m)** applied in any direction.
 - b. Concentrated load of **200 lbf (0.89 kN)** applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of **50 lbf (0.22 kN)** applied horizontally on an area of **1 sq. ft. (0.093 sq. m)**.
 - b. Infill load and other loads need not be assumed to act concurrently.
- D. Seismic Performance: Fabricated metal spiral stairs are to withstand the effects of earthquake motions determined in accordance with **[ASCE/SEI 7]<Insert requirement>**.

2.3 SPIRAL STAIRS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **[Accent Stairs; ADPG, LLC]**
 - 2. **[Boston Stair]**
 - 3. **[Couturier Iron Craft, Inc.]**
 - 4. **[Custom Iron]**
 - 5. **[Duvinage LLC]**
 - 6. **[Goddard Manufacturing]**
 - 7. **[Innovative Metalcraft, LLC]**
 - 8. **[Iron Shop (The)]**
 - 9. **[Mylon Stairs]**
 - 10. **[Salter Spiral Stair]**
 - 11. **[Stairways Inc.]**
 - 12. **[Steptoe & Wife Antiques Ltd]**
 - 13. **<Insert manufacturer's name>**

- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Accent Stairs; ADPG, LLC]**
 2. **[Boston Stair]**
 3. **[Couturier Iron Craft, Inc.]**
 4. **[Custom Iron]**
 5. **[Duvirage LLC]**
 6. **[Goddard Manufacturing]**
 7. **[Innovative Metalcraft, LLC]**
 8. **[Iron Shop (The)]**
 9. **[Mylen Stairs]**
 10. **[Salter Spiral Stair]**
 11. **[Stairways Inc.]**
 12. **[Steptoe & Wife Antiques Ltd]**
 13. **<Insert manufacturer's name>**
- C. Center Column: **[Steel][or][aluminum]** pipe welded to baseplate for anchorage to floor structure. Brace column at upper floors by means of landings attached to column and floor structure unless otherwise indicated. Provide cap for column if top is exposed.
- D. Treads, Cast Metal: Cast **[aluminum][iron]** treads[**and platforms**] with integral frames, legs, and hubs.
1. Provide treads[**and platforms**] with abrasive surfaces.
- E. Treads, Metal Bar Grating: Steel-bar grating treads[**and platforms**] with welded hubs and as follows:
1. Radial grating treads.
 2. **[Abrasive][Rolled-steel, floor-plate]** nosings.
 3. Straight flanges and welded-on legs.
 4. Tapered flanges without legs.
- F. Treads, Formed Metal Plate: Formed **[steel-][aluminum-]**plate treads[**and platforms**], welded to hubs or center column, and as follows:
1. Straight flanges and welded-on legs.
 2. Tapered flanges without legs.
 3. Pan treads without legs.
 4. One-piece treads and risers, **[with][without]** legs.
 5. Rolled-steel, floor-plate wearing surfaces.
 6. Aluminum-alloy, rolled tread-plate wearing surfaces.
 7. Smooth steel-plate wearing surfaces.
 8. Rubber wearing surfaces.
 9. Plywood subtreed for covering with finish flooring specified in another Section.
- G. Treads, Metal Framed: Steel-framed treads[**and platforms**], welded to hubs or center column, and without legs; wearing surface as follows:
1. Cast iron with integral abrasive.
 2. Smooth steel plate with integral abrasive.
 3. Wood.
 4. Plywood insert for covering with finish flooring specified in another Section.
- H. Railings: Uniformly bent to spiral shape[, **and continuing at top to form guardrail around floor opening**].

1. Space balusters less than [4 inches (102 mm)][4-3/8 inches (111 mm)]<Insert dimension>, clear.
2. Space balusters to provide one baluster per tread, and less than [21 inches (533 mm)][30 inches (762 mm)]<Insert dimension>, clear.
3. Space intermediate rails less than [4 inches (101 mm)][4-3/8 inches (111 mm)][21 inches (533 mm)]<Insert dimension>, clear.
4. Locate bottom rail so that a [6-inch- (152-mm-)]<Insert dimension> diameter sphere cannot pass between the stair and rail.
5. Hand Rail:
 - a. [1-1/4- to 2-inch- (32- to 51-mm-) OD]<Insert dimension> steel [pipe][or][round tubing].
 - b. Steel of shape and size indicated.
 - c. [1-1/4- to 2-inch- (32- to 51-mm-) OD]<Insert dimension> round [aluminum][bronze][brass][stainless steel] tubing.
 - d. Extruded bronze of shape and size indicated.
 - e. Wood of shape and size indicated.
6. Top Rail:
 - a. [1-1/4- to 2-inch- (32- to 51-mm-) OD]<Insert dimension> steel [pipe][or][round tubing].
 - b. Steel of shape and size indicated.
 - c. [1-1/4- to 2-inch- (32- to 51-mm-) OD]<Insert dimension> round [aluminum][bronze][brass][stainless steel] tubing.
 - d. Extruded bronze of shape and size indicated.
 - e. Wood of shape and size indicated.
7. Balusters:
 - a. [7/8-inch- (22-mm-) OD][1-inch- (25-mm-) OD][1-1/4-inch- (32-mm-) OD]<Insert dimension> steel pipe[or round tubing].
 - b. [1/2-inch- (13-mm-) OD][5/8-inch- (16-mm-) OD]<Insert dimension> round steel [bars][tubing].
 - c. [1/2-inch- (13-mm-)][5/8-inch- (16-mm-)][3/4-inch- (19-mm-)]<Insert dimension> square steel [bars][tubing].
 - d. [5/8-inch- (16-mm-) OD][3/4-inch- (19-mm-) OD]<Insert dimension> round aluminum tubing.
8. Intermediate Rails:
 - a. [7/8-inch- (22-mm-) OD][1-inch- (25-mm-) OD][1-1/4-inch- (32-mm-) OD]<Insert dimension> steel pipe[or round tubing].
 - b. Steel pipe[or round tubing] same size as top rail.
 - c. [5/8-inch- (16-mm-) OD][3/4-inch- (19-mm-) OD]<Insert dimension> round steel [bars][tubing].
 - d. [5/8-inch- (16-mm-) OD][3/4-inch- (19-mm-) OD][1-inch- (25-mm-) OD][1-1/4-inch- (32-mm-) OD]<Insert dimension> round aluminum tubing.
 - e. Round aluminum tubing same size as top rail.

2.4 MATERIALS

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25]<Insert value> percent.

- C. Brackets, Flanges, and Anchors: Same metal and finish as supported item unless otherwise indicated.
- D. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- E. Steel Bars for Grating Treads and Platforms: ASTM A36/A36M or ASTM A1011/A1011M.
- F. Wire Rod for Grating Crossbars: ASTM A510/A510M.
- G. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or Grade D.
- H. Steel Pipe Columns: ASTM A53/A53M, Schedule 40. Provide Schedule 80 for columns larger than **NPS 4 (DN 100)** and where required to support loads.
- I. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- J. Steel Tubing: Either cold-formed steel tubing complying with ASTM A500/A500M or mandrel-drawn mechanical tubing complying with ASTM A513, Type 5.
- K. Iron Castings: Either gray iron complying with ASTM A48/A48M or malleable iron complying with ASTM A47/A47M unless otherwise indicated or required by structural loads.
- L. Aluminum Sheet and Plate: **ASTM B209 (ASTM B209M)**, Alloy 6061-T6.
- M. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.
- N. Aluminum Pipe and Structural Round Tubing: ASTM B429/B429M, Alloy 6063-T6.
- O. Extruded-Aluminum Tubing: **ASTM B221 (ASTM B221M)**, Alloy 6063-T5/T52.
- P. Aluminum Castings: ASTM B26/B26M, Alloy 319.0-F.
- Q. Extruded-Bronze Handrails: ASTM B455, Alloy UNS No. C38500 (architectural bronze).
- R. Seamless Bronze Tubing: ASTM B135/B135M, Alloy UNS No. C23000 (red brass, 85 percent copper).
- S. Seamless Brass Tubing: ASTM B135/B135M, Alloy UNS No. C26000 (cartridge brass, 70 percent copper).
- T. Stainless Steel Tubing: ASTM A554, Grade MT 304.
- U. Stainless Steel Sheet: Sheet, Strip, Plate, and Flat Bar: ASTM A666, **[Type 304][Type 316][Type 316L]**.
- V. Stainless Steel Bars and Shapes: ASTM A276/A276M, **[Type 304][Type 316][Type 316L]**.

2.5 MISCELLANEOUS MATERIALS

- A. Fasteners: For connecting stair components and for anchoring stairs to other construction, select fasteners of type, grade, and class required to produce connections capable of withstanding design loadings.
 - 1. For aluminum, provide fasteners fabricated from Type 304 stainless steel.
 - 2. For stainless steel, provide fasteners fabricated from Type 304 stainless steel.

3. For steel and cast iron, use plated steel fasteners complying with ASTM B633, Class Fe/Zn 25 for electrodeposited zinc coating.
4. For exterior locations, provide fasteners fabricated from Type 304 stainless steel.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
- C. Lacquer for Brass and Bronze: Clear, air-drying, acrylic lacquer specially developed for coating copper-alloy products.
 1. Product: Subject to compliance with requirements, provide "Incralac" developed by International Copper Research Corporation.
- D. Shop Primers: Provide primers that comply with **[Section 099113 "Exterior Painting."][Section 099123 "Interior Painting.]**
- E. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer compatible with finish paint systems indicated.
- F. Shop Primer for Galvanized Steel: Primer formulated for use over zinc-coated metal and compatible with finish paint systems indicated.
- G. Shop Primer for Aluminum: Primer formulated for use over aluminum and compatible with finish paint systems indicated.
- H. Wood for Stair Treads, Handrails, and Platforms: Laminated red oak, sanded to 120-grit smoothness. Apply uniform coat of manufacturer's standard clear sealer.
- I. Rubber Wearing Surfaces: Manufacturer's standard, **1/4-inch- (6-mm-)** thick, molded-rubber covering in pattern and color indicated or, if not indicated, as selected by Architect from manufacturer's standard colors and patterns.

2.6 FABRICATION

- A. Assemble fabricated metal spiral stairs in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form work true to line and level with accurate angles and surfaces.
- D. Fabricate connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- E. Cut, reinforce, drill, and tap as needed to receive hardware, screws, and similar items.
- F. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. Finish exposed welds to comply with NOMMA Guideline 1, "Joint Finishes," for **[Finish #1 -No evidence of a welded joint][Finish #2 - Completely sanded joint, some undercutting and pinholes okay][Finish #3 - Partially dressed weld with spatter removed]**.
5. Finish exposed surfaces smooth and blended and, except for fillet welds, so welded surface matches contours of adjoining surfaces.

- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

2.7 STEEL AND IRON FINISHES

- A. Galvanized Finish: Hot-dip galvanize fabricated metal spiral stairs and railings after fabrication to comply with ASTM A123/A123M.
1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with **[SSPC-SP 6 (WAB)/NACE WAB-3, "Commercial Blast Cleaning."][SSPC-SP 7 (WAB)/NACE WAB-4, "Brush-off Blast Cleaning."]**
- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter; treat with etching cleaner **[or][in accordance with SSPC-SP 16]**.
- D. Apply shop primer to prepared surfaces of handrails and railing components unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

2.8 ALUMINUM FINISHES

- A. Mechanical Finish: AA-M3x; sand top rails, handrails, and intermediate rails in one direction only, parallel to length of railing, with 120- and 320-grit abrasive. After installation, polish railings with No. 0 steel wool immersed in paste wax, then rub to a luster with a soft dry cloth.
- B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- C. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
1. Color:
 - a. **[Champagne][Light bronze][Medium bronze][Dark bronze][Black]<Insert color>.**
 - b. **[Match Architect's sample][As selected by Architect from full range of industry colors and color densities].**
- D. Conversion-Coated and Factory-Primed Finish: AA-C12C42R1x (cleaned with inhibited chemicals; acid chromate-fluoride-phosphate conversion coating; shop primer).

1. Apply shop primer with a minimum dry film thickness of **1.5 mils (0.04 mm)**.
- E. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.

2.9 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 1. Run grain of directional finishes with long dimension of each piece.
 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- C. Stainless Steel Tubing Finishes:
 1. 180-Grit Polished Finish: Uniform, directionally textured finish.
 2. 320-Grit Polished Finish: Oil-ground, uniform, fine, directionally textured finish.
 3. Polished and Buffed Finish: 320-grit finish followed by buffing **[to a high luster finish][to a mirrorlike finish][to match Architect's sample]**.
- D. Stainless Steel Sheet and Plate Finishes:
 1. Directional Satin Finish: ASTM A480/A480M, No. 4.
 2. High Luster Finish: ASTM A480/A480M, No. 7.
 3. Mirror Finish: ASTM A480/A480M, No. 8.

2.10 BRASS AND BRONZE FINISHES

- A. Buffed Finish: Mirror polished, buffed finish.
- B. Lacquered Buffed Finish: Mirror polished, buffed finish coated with lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.
- C. Lacquered Medium-Satin Finish: Directionally textured, medium satin, mechanical finish coated with lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.
- D. Statuary Conversion Coating over Satin Finish: Directionally textured, fine satin, mechanical finish with sulfide conversion coating.
 1. Color Match: Match Architect's sample.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where needed for securing fabricated metal spiral stairs to in-place construction; include threaded fasteners for concrete and masonry inserts, through bolts, lag bolts, wood screws, and other connectors as required.
- B. Assemble fabricated metal spiral stair components to comply with manufacturer's written instructions, with each component aligned and in correct relation to each other, securely anchored to supporting column and adjacent structure.
- C. Do not cut, alter, or drill stair components in the field that do not fit properly. Return components that do not fit to manufacturer for adjustment.
- D. Install fabricated metal spiral stairs accurately in location, alignment, and elevation; level and plumb; and in accordance with manufacturer's written instructions.
- E. Install fabricated metal spiral stairs by welding to steel structure or to weld plates cast into concrete unless otherwise indicated.
- F. Field Welding:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

3.2 REPAIR

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material.
- B. For galvanized surfaces, clean field welds, bolted connections, and abraded areas and repair galvanizing in accordance with ASTM A780/A780M.
 - 1. Paint repaired areas with same material used for shop painting.

3.3 PROTECTION

- A. Protect finished tread surfaces during construction by covering with **1/2-inch- (13-mm-)** thick, plywood secured with plastic strapping or another nonmarring fastening method.

END OF SECTION 05 71 13 00



Task	Specification	Specification Description
05 71 13 00	05 70 00 00	Decorative Metal
05 71 13 00	05 71 00 00	Decorative Metal Stairs



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SECTION 05 73 00 00 - DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum decorative railings.
2. Copper-alloy decorative railings.
3. Stainless steel decorative railings.
4. Steel and iron decorative railings.

B. Related Requirements:

1. Section 055213 "Pipe and Tube Railings" for nonornamental railings fabricated from pipes and tubes.
2. Section 057313 "Glazed Decorative Metal Railings."
3. Section 061000 "Rough Carpentry" for wood blocking for anchoring railings.
4. **[Section 064013 "Exterior Architectural Woodwork"]****[Section 064023 "Interior Architectural Woodwork"]** for wood railings.

1.2 COORDINATION AND SCHEDULING

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]**<Insert location>.
 1. **<Insert participants>**.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of decorative metal railings assembled from standard components.
2. Illuminated rails.
3. Stainless steel cable and cable fittings.
4. Expanded metal infill panels.
5. Perforated metal infill panels.
6. Woven-wire mesh infill panels.
7. Fasteners.
8. Post-installed anchors.

9. Handrail brackets.
10. Wood rails.
11. Lacquer for copper alloys.
12. Shop primer.
13. Intermediate coats and topcoats.
14. Bituminous paint.
15. Nonshrink, nonmetallic grout.
16. Anchoring cement.
17. Metal finishes.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings: Include plans, elevations, sections, and attachment details.

1. For illuminated railings, include wiring diagrams and roughing-in details.

D. Samples for Initial Selection: For products involving selection of color, texture, or design[, **including mechanical finishes**].

E. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters
2. Illuminated railing.
3. Fittings, end caps, and brackets.
4. Welded connections.
5. Brazed connections.
6. Cable and cable hardware and connections.
7. Assembled Sample of railing system, made from full-size components, including top rail, post, [**illuminated**] handrail, and guard infill. Sample need not be full height.

- a. Show method of [**connecting**][**and**][**finishing**] members at intersections.

F. Delegated Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For [**delegated design professional engineer**][**testing agency**].

B. Mill Certificates: Signed by manufacturers of stainless steel products, certifying that products furnished comply with requirements.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.

- F. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
- G. Preconstruction test reports.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockups as shown on Drawings.
 - 2. Build mockups for each form and finish of railing, consisting of two posts, top rail, infill area, and anchorage system components that are full height and are not less than **24 inches (600 mm)** in length.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: **[Owner will engage][Engage]** a qualified testing agency to perform preconstruction testing on laboratory mockups. Payment for these services will be made **[by Owner][from the testing and inspecting allowance, as authorized by Change Orders][by Contractor]**. Retesting of products that fail to meet specified requirements is to be done at Contractor's expense.
 - 1. Build laboratory mockups at testing agency facility; use personnel, materials, and methods of construction that will be used at Project site.
 - 2. Test railings in accordance with ASTM E894 and ASTM E935.
 - 3. Notify Architect **[seven]<Insert number>** days in advance of the dates and times when laboratory mockups will be tested.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, are to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of **50 lbf/ft. (0.73 kN/m)** applied in any direction.
 - b. Concentrated load of **200 lbf (0.89 kN)** applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of **50 lbf (0.22 kN)** applied horizontally on an area of **1 sq. ft. (0.093 sq. m)**.
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: **120 deg F (67 deg C)**, ambient; **180 deg F (100 deg C)**, material surfaces.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

2.3 ALUMINUM DECORATIVE RAILINGS

- A. Aluminum Decorative Railings:
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[American Structures & Design]**
 - b. **[Architectural Iron Designs, Inc.]**
 - c. **[ATR Technologies, Inc.]**
 - d. **[AZEK Building Products, Incorporated]**
 - e. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - f. **[CraneVeyor Corp]**
 - g. **[Feeney Inc.]**

- h. [Greco; CSW Industrials Inc.]
 - i. [HDI Railings]
 - j. [Hollaender Architectural Railing Systems; Hollaender Mfg. Co.]
 - k. [Hollaender Mfg. Co.]
 - l. [Julius Blum & Co., Inc.]
 - m. [Kane Innovations, Inc.]
 - n. [Knotwood US LLC]
 - o. [Livers Bronze Co.]
 - p. [Promenaid]
 - q. [Regal Ideas, Inc.]
 - r. [Seco South, Inc.]
 - s. [Superior Aluminum Products, Inc]
 - t. [Thompson Fabricating, LLC]
 - u. [Trex Commercial Products, Inc.]
 - v. [Tri Tech, Inc.]
 - w. [Tuttle, a Dant Clayton Division]
 - x. [VIVA Railings, LLC]
 - y. [Wagner Companies (The); R&B Wagner, Inc.]
 - z. [Wylie Metals]
 - aa. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. [American Structures & Design]
 - b. [Architectural Iron Designs, Inc.]
 - c. [ATR Technologies, Inc.]
 - d. [AZEK Building Products, Incorporated]
 - e. [C.R. Laurence Co., Inc.; CRH Americas, Inc.]
 - f. [CraneVeyor Corp]
 - g. [Feeney Inc.]
 - h. [Greco; CSW Industrials Inc.]
 - i. [HDI Railings]
 - j. [Hollaender Architectural Railing Systems; Hollaender Mfg. Co.]
 - k. [Hollaender Mfg. Co.]
 - l. [Julius Blum & Co., Inc.]
 - m. [Kane Innovations, Inc.]
 - n. [Knotwood US LLC]
 - o. [Livers Bronze Co.]
 - p. [Promenaid]
 - q. [Regal Ideas, Inc.]
 - r. [Seco South, Inc.]
 - s. [Superior Aluminum Products, Inc]
 - t. [Thompson Fabricating, LLC]
 - u. [Trex Commercial Products, Inc.]
 - v. [Tri Tech, Inc.]
 - w. [Tuttle, a Dant Clayton Division]
 - x. [VIVA Railings, LLC]
 - y. [Wagner Companies (The); R&B Wagner, Inc.]
 - z. [Wylie Metals]
 - aa. <Insert manufacturer's name>
3. Source Limitations: Obtain aluminum decorative railing components from single source from single manufacturer.

- B. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
- C. Extruded Bars and Shapes, Including Extruded Tube: **ASTM B221 (ASTM B221M)**, Alloy 6063-T5/T52.
- D. Extruded Structural Pipe and Round Tube: ASTM B429/B429M, Alloy 6063-T6.
 - 1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.
- E. Drawn Seamless Tube: ASTM B210/B210M, Alloy 6063-T832.
- F. Plate and Sheet: **ASTM B209 (ASTM B209M)**, [Alloy 5005-H32][Alloy 6061-T6].
- G. Die and Hand Forgings: **ASTM B247 (ASTM B247M)**, Alloy 6061-T6.
- H. Illuminated [Top][Hand] Rails: Provide internal illumination using concealed, internally wired, integrated LED [dimmable] lamps to illuminate walking surfaces adjacent to railings without light leaks. Make provisions for servicing and for concealed connection to electric service.
 - 1. LED Luminaires: Comply with [Section 265119 "LED Interior Lighting"] [Section 265619 "LED Exterior Lighting"] and as follows:
 - a. Lamp Type: [Linear][Point]<Insert lamp description>.
 - b. Light Illumination: White, [standard][high] output; [80 lumens/300 mm][120 lumens/300 mm][270 lumens/300 mm]<Insert value>.
 - c. Efficacy: Minimum [80]<Insert number> lm/W.
 - d. Color Rendering Index: Minimum [65][70][80]<Insert number>.
 - e. Correlated Color Temperature: [2700 K][3000 K][3500 K]<Insert value>.
 - f. Rated Lamp Life: [50,000]<Insert number> hours at 70 percent lamp illumination output.
 - g. Beam Distribution: [Symmetric][Asymmetric][10 degrees][25 degrees][55 degrees][100 degrees]<Insert angle or angle range>.
 - h. LED Diffuser: UV-stabilized acrylic, [clear][translucent], matching rail profile.
 - i. Nominal Operating Voltage: [120 V ac][277 V ac] input; [12 V dc][24 V dc] output.
 - j. Internal Driver: [100][120] W.
 - k. UL Listing: [Damp][Dry].
 - l. IP Rating: IP67.
 - m. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- I. Stainless Steel Cable and Cable Fittings for Aluminum Decorative Railings:
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Bergen Cable Technology, LLC]
 - b. [Carl Stahl DecorCable, Inc.]
 - c. [Esmet, Inc.]
 - d. [Feeney Inc.]
 - e. [Hayn Enterprises, LLC]
 - f. [Johnson, C. Sherman, Co., Inc.]
 - g. [Loos & Co. Inc.]
 - h. [Morse Industries]

- i. **[Ronstan International Inc]**
 - j. **[Seco South, Inc.]**
 - k. **[Ultra-tec; The Cable Connection]**
 - l. **[VIVA Railings, LLC]**
 - m. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Bergen Cable Technology, LLC]**
 - b. **[Carl Stahl DecorCable, Inc.]**
 - c. **[Esmet, Inc.]**
 - d. **[Feeney Inc.]**
 - e. **[Hayn Enterprises, LLC]**
 - f. **[Johnson, C. Sherman, Co., Inc]**
 - g. **[Loos & Co. Inc.]**
 - h. **[Morse Industries]**
 - i. **[Ronstan International Inc]**
 - j. **[Seco South, Inc.]**
 - k. **[Ultra-tec; The Cable Connection]**
 - l. **[VIVA Railings, LLC]**
 - m. **<Insert manufacturer's name>**
 3. Cable: **[1-by-19][7-by-7][7-by-19]<Insert configuration>** wire cable made from wire complying with ASTM A492, Type 316, **PVC jacketed**, **<Insert color>**.
 4. Cable Diameter: **[1/8 inch (3.2 mm)][5/32 inch (4 mm)][3/16 inch (5 mm)][1/4inch (6.4 mm)]**.
 5. Cable Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of cable with which they are used.
 6. Intermediate Cable Supports: Stainless steel flat bar, **1/4 by 1 inch (6.4 by 25.4 mm)**, predrilled.
 - J. Castings: ASTM B26/B26M, Alloy A356.0-T6.
 - K. Perforated Metal Infill Panels: Aluminum sheet, **ASTM B209 (ASTM B209M)**, Alloy 6061-T6, **[0.063 inch (1.60 mm)]<Insert dimension>** thick, **[with 1/4-inch (6.4-mm) holes 3/8-inch (9.5-mm) o.c. in staggered rows]<Insert description>**.
 1. Basis-of-Design Product: Provide product with perforations matching **<Insert manufacturer's name; product name or designation>**.
 - L. Woven-Wire Mesh Infill Panels: Intermediate-crimp, **[diamond][square]** pattern, **2-inch (50-mm)** woven-wire mesh, made from **0.162-inch (4.1-mm)** nominal diameter aluminum wire complying with ASTM B211/B211M, Alloy 6061-T94.
 1. Basis-of-Design Product: Provide product with crimp pattern matching **<Insert manufacturer's name; product name or designation>**.
- 2.4 COPPER-ALLOY DECORATIVE RAILINGS
- A. Copper-Alloy Decorative Railings:
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the**

following]:

- a. [Architectural Iron Designs, Inc.]
- b. [CraneVeyor Corp]
- c. [Julius Blum & Co., Inc.]
- d. [Lavi Industries]
- e. [Livers Bronze Co.]
- f. [Tri Tech, Inc.]
- g. [Wagner Companies (The); R&B Wagner, Inc.]
- h. [Wylie Metals]
- i. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Architectural Iron Designs, Inc.]
- b. [CraneVeyor Corp]
- c. [Julius Blum & Co., Inc.]
- d. [Lavi Industries]
- e. [Livers Bronze Co.]
- f. [Tri Tech, Inc.]
- g. [Wagner Companies (The); R&B Wagner, Inc.]
- h. [Wylie Metals]
- i. <Insert manufacturer's name>

3. Source Limitations: Obtain copper and copper alloy decorative metal railing components from single source from single manufacturer.

- B. Copper and Copper Alloys, General: Provide alloys indicated and with temper to suit application and forming methods, but with strength and stiffness of not less than Temper H01 (quarter hard) for plate, sheet, strip, and bars, and of not less than Temper H55 (light drawn) for tube and pipe.
- C. Bronze Extruded Shapes: ASTM B455, Alloy UNS C38500 (architectural bronze).
- D. Brass Extruded Shapes: ASTM B249/B249M, Alloy UNS C36000 (free-cutting brass).
- E. Nickel Silver Extruded Shapes: ASTM B249/B249M, Alloy UNS C79600.
- F. Bronze Seamless Pipe: ASTM B43, Alloy UNS C23000 (red brass, 85 percent copper).
- G. Bronze Seamless Tube: ASTM B135/B135M, Alloy UNS C23000 (red brass, 85 percent copper).
- H. Brass Seamless Tube: ASTM B135/B135M, Alloy UNS C26000 (cartridge brass, 70 percent copper).
- I. Copper Seamless Tube: ASTM B75/B75M, Alloy UNS C12200 (phosphorous deoxidized, high residual phosphorous copper).
- J. Bronze Castings: [Composition bronze castings complying with ASTM B62, Alloy UNS C83600 (85-5-5-5 or No. 1 composition commercial red brass)][or][sand castings complying with ASTM B584, Alloy UNS C86500 (No. 1 manganese bronze)].
- K. Brass Castings: Sand castings complying with ASTM B584, Alloy UNS C85200 (high-copper yellow brass).

- L. Copper Castings: ASTM B824, with a minimum of 99.9 percent copper.
- M. Nickel Silver Castings: ASTM B584, Alloy UNS C97300 (12 percent leaded nickel silver).
- N. Bronze Plate, Sheet, Strip, and Bars: ASTM B36/B36M, Alloy UNS C28000 (muntz metal, 60 percent copper).
- O. Brass Plate, Sheet, Strip, and Bars: ASTM B36/B36M, Alloy UNS C26000 (cartridge brass, 70 percent copper).
- P. Copper Plate, Sheet, Strip, and Bars: ASTM B152/B152M, Alloy UNS C11000 (electrolytic tough pitch copper) or Alloy UNS C12200 (phosphorous deoxidized, high-residual phosphorous copper).
- Q. Stainless Steel Cable and Cable Fittings for Copper-Alloy Decorative Railings:
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Bergen Cable Technology, LLC]**
 - b. **[Carl Stahl DecorCable, Inc.]**
 - c. **[Esmet, Inc.]**
 - d. **[Feeney Inc.]**
 - e. **[Hayn Enterprises, LLC]**
 - f. **[Johnson, C. Sherman, Co., Inc]**
 - g. **[Loos & Co. Inc.]**
 - h. **[Morse Industries]**
 - i. **[Ronstan International Inc]**
 - j. **[Seco South, Inc.]**
 - k. **[Ultra-tec; The Cable Connection]**
 - l. **[VIVA Railings, LLC]**
 - m. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Bergen Cable Technology, LLC]**
 - b. **[Carl Stahl DecorCable, Inc.]**
 - c. **[Esmet, Inc.]**
 - d. **[Feeney Inc.]**
 - e. **[Hayn Enterprises, LLC]**
 - f. **[Johnson, C. Sherman, Co., Inc]**
 - g. **[Loos & Co. Inc.]**
 - h. **[Morse Industries]**
 - i. **[Ronstan International Inc]**
 - j. **[Seco South, Inc.]**
 - k. **[Ultra-tec; The Cable Connection]**
 - l. **[VIVA Railings, LLC]**
 - m. **<Insert manufacturer's name>**
 - 3. Cable: **[1-by-19][7-by-7][7-by-19]<Insert configuration>** wire cable made from wire complying with ASTM A492, Type 316[, **PVC jacketed**], **<Insert color>**.
 - 4. Cable Diameter: **[1/8 inch (3.2 mm)][5/32 inch (4 mm)][3/16 inch (5 mm)][1/4 inch (6.4 mm)]**.
 - 5. Cable Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability

to sustain, without failure, a load equal to minimum breaking strength of cable with which they are used.

6. Intermediate Cable Supports: Stainless steel flat bar, 1/4-by-1-inch (6.4-by-25.4-mm), predrilled.

2.5 STAINLESS STEEL DECORATIVE RAILINGS

A. Stainless Steel Decorative Railings:

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[AGS Stainless Inc.]**
 - b. **[Architectural Iron Designs, Inc.]**
 - c. **[Atlantis Rail Systems]**
 - d. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - e. **[CraneVeyor Corp]**
 - f. **[Greco; CSW Industrials Inc.]**
 - g. **[HDI Railings]**
 - h. **[Hollaender Architectural Railing Systems; Hollaender Mfg. Co.]**
 - i. **[Hollaender Mfg. Co.]**
 - j. **[Julius Blum & Co., Inc.]**
 - k. **[Kane Innovations, Inc.]**
 - l. **[Lavi Industries]**
 - m. **[Livers Bronze Co.]**
 - n. **[Morse Industries]**
 - o. **[P&P Artec, Inc.]**
 - p. **[Seco South, Inc.]**
 - q. **[Trex Commercial Products, Inc.]**
 - r. **[Tri Tech, Inc.]**
 - s. **[Tuttle, a Dant Clayton Division]**
 - t. **[VIVA Railings, LLC]**
 - u. **[Wagner Companies (The); R&B Wagner, Inc.]**
 - v. **[Wylie Metals]**
 - w. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[AGS Stainless Inc.]**
 - b. **[Architectural Iron Designs, Inc.]**
 - c. **[Atlantis Rail Systems]**
 - d. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - e. **[CraneVeyor Corp]**
 - f. **[Greco; CSW Industrials Inc.]**
 - g. **[HDI Railings]**
 - h. **[Hollaender Architectural Railing Systems; Hollaender Mfg. Co.]**
 - i. **[Hollaender Mfg. Co.]**
 - j. **[Julius Blum & Co., Inc.]**
 - k. **[Kane Innovations, Inc.]**
 - l. **[Lavi Industries]**
 - m. **[Livers Bronze Co.]**

- n. **[Morse Industries]**
 - o. **[P&P Artec, Inc.]**
 - p. **[Seco South, Inc.]**
 - q. **[Trex Commercial Products, Inc.]**
 - r. **[Tri Tech, Inc.]**
 - s. **[Tuttle, a Dant Clayton Division]**
 - t. **[VIVA Railings, LLC]**
 - u. **[Wagner Companies (The); R&B Wagner, Inc.]**
 - v. **[Wylie Metals]**
 - w. **<Insert manufacturer's name>**
3. Source Limitations: Obtain stainless steel decorative railing components from single source from single manufacturer.
- B. Tubing: ASTM A554, **[Grade MT 304][Grade MT 316][Grade MT 316L]**.
- C. Pipe: ASTM A312/A312M, **[Grade TP 304][Grade TP 316][Grade TP 316L]**.
- D. Castings: ASTM A743/A743M, **[Grade CF 8 or CF 20][Grade CF 8M or CF 3M]**.
- E. Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, **[Type 304][Type 316][Type 316L]**.
- F. Flat Bar: ASTM A666, **[Type 304][Type 316][Type 316L]**.
- G. Bars and Shapes: ASTM A276/A276M, **[Type 304][Type 316][Type 316L]**.
- H. Illuminated **[Top][Hand]** Rails: Provide internal illumination using concealed, internally wired, integrated LED **[dimmable]** lamps to illuminate walking surfaces adjacent to railings without light leaks. Make provisions for servicing and for concealed connection to electric service.
1. LED Luminaires: Comply with **[Section 265119 "LED Interior Lighting"]****[Section 265619 "LED Exterior Lighting"]** and as follows:
- a. Lamp Type: **[Linear][Point]<Insert lamp description>**.
 - b. Light Illumination: White, **[standard][high]** output; **[80 lumens/300 mm][120 lumens/300 mm][270 lumens/300 mm]<Insert value>**.
 - c. Efficacy: Minimum **[80]<Insert number>** lm/W.
 - d. Color Rendering Index: Minimum **[65][70][80]<Insert number>**.
 - e. Correlated Color Temperature: **[2700 K][3000 K][3500 K]<Insert value>**.
 - f. Rated Lamp Life: **[50,000]<Insert number>** hours at 70 percent lamp illumination output.
 - g. Beam Distribution: **[Symmetric][Asymmetric][10 degrees][25 degrees][55 degrees][100 degrees]<Insert angle or angle range>**.
 - h. LED Diffuser: UV-stabilized acrylic, **[clear][translucent]**, matching rail profile.
 - i. Nominal Operating Voltage: **[120 V ac][277 V ac]** input; **[12 V dc][24 V dc]** output.
 - j. Internal Driver: **[100][120]** W.
 - k. UL Listing: **[Damp][Dry]**.
 - l. IP Rating: IP67.
 - m. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- I. Stainless Steel Cable and Cable Fittings for Stainless Steel Decorative Railings:
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. [AGS Stainless Inc.]
- b. [Bergen Cable Technology, LLC]
- c. [Carl Stahl DecorCable, Inc.]
- d. [Esmet, Inc.]
- e. [Feeney Inc.]
- f. [Hayn Enterprises, LLC]
- g. [HDI Railings]
- h. [Johnson, C. Sherman, Co., Inc]
- i. [Loos & Co. Inc.]
- j. [Morse Industries]
- k. [Ronstan International Inc]
- l. [Seco South, Inc.]
- m. [Trex Commercial Products, Inc.]
- n. [Ultra-tec; The Cable Connection]
- o. [VIVA Railings, LLC]
- p. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [AGS Stainless Inc.]
- b. [Bergen Cable Technology, LLC]
- c. [Carl Stahl DecorCable, Inc.]
- d. [Esmet, Inc.]
- e. [Feeney Inc.]
- f. [Hayn Enterprises, LLC]
- g. [HDI Railings]
- h. [Johnson, C. Sherman, Co., Inc]
- i. [Loos & Co. Inc.]
- j. [Morse Industries]
- k. [Ronstan International Inc]
- l. [Seco South, Inc.]
- m. [Trex Commercial Products, Inc.]
- n. [Ultra-tec; The Cable Connection]
- o. [VIVA Railings, LLC]
- p. <Insert manufacturer's name>

3. Cable: [1-by-19][7-by-7][7-by-19]<Insert configuration> wire cable made from wire complying with ASTM A492, Type 316[, PVC jacketed], <Insert color>.
4. Cable Diameter: [1/8 inch (3.2 mm)][5/32 inch (4 mm)][3/16 inch (5 mm)][1/4 inch (6.4 mm)].
5. Cable Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of cable with which they are used.
6. Intermediate Cable Supports: Stainless steel flat bar, 1/4-by-1-inch (6.4-by-25.4-mm), predrilled.

- J. Expanded Metal Infill Panels: ASTM F1267, [Type I (expanded)][Type II (expanded and flattened)], Class 3 (corrosion-resisting steel), made from stainless steel sheet complying with ASTM A666, [Type 304][Type 316].

1. Style Designation: [3/4 number 13][1-1/2 number 10]<Insert designation>.

- K. Perforated Metal Infill Panels: Stainless steel sheet, ASTM A240/A240M or ASTM A666, [Type 304][Type 316L], [0.062 inch (1.59 mm)]<Insert dimension> thick, [with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows]<Insert description>.

1. Basis-of-Design Product: Provide product with perforations matching **<Insert manufacturer's name; product name or designation>**.
- L. Woven-Wire Mesh Infill Panels: Intermediate-crimp, **[diamond][square]** pattern, **2-inch (50-mm)** woven-wire mesh, made from **0.135-inch (3.5-mm)** nominal diameter stainless steel wire complying with ASTM A580/A580M, **[Type 304][Type 316]**.
 1. Basis-of-Design Product: Provide product with crimp pattern matching **<Insert manufacturer's name; product name or designation>**.

2.6 STEEL AND IRON DECORATIVE RAILINGS

A. Steel and Iron Decorative Railings:

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Architectural Iron Designs, Inc.]**
 - b. **[HDI Railings]**
 - c. **[Indital USA]**
 - d. **[Lawler Foundry Corporation]**
 - e. **[Livers Bronze Co.]**
 - f. **[Olin Metal Works]**
 - g. **[Regency Railings]**
 - h. **[Trex Commercial Products, Inc.]**
 - i. **[Tri Tech, Inc.]**
 - j. **[VIVA Railings, LLC]**
 - k. **[Wagner Companies (The); R&B Wagner, Inc.]**
 - l. **[Wiemann Metalcraft]**
 - m. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Iron Designs, Inc.]**
 - b. **[HDI Railings]**
 - c. **[Indital USA]**
 - d. **[Lawler Foundry Corporation]**
 - e. **[Livers Bronze Co.]**
 - f. **[Olin Metal Works]**
 - g. **[Regency Railings]**
 - h. **[Trex Commercial Products, Inc.]**
 - i. **[Tri Tech, Inc.]**
 - j. **[VIVA Railings, LLC]**
 - k. **[Wagner Companies (The); R&B Wagner, Inc.]**
 - l. **[Wiemann Metalcraft]**
 - m. **<Insert manufacturer's name>**
3. Source Limitations: Obtain steel decorative railing components from single source from single manufacturer.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer

recycled content not less than [25]<Insert value> percent.

- C. Tubing: [ASTM A500/A500M (cold formed)][or][ASTM A513/A513M, Type 5].
- D. Bars: Hot-rolled, carbon steel complying with ASTM A29/A29M, Grade 1010.
- E. Plates, Shapes, and Bars: ASTM A36/A36M.
- F. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
- G. Illuminated [Top][Hand] Rails: Provide internal illumination using concealed, internally wired, integrated LED [dimmable] lamps to illuminate walking surfaces adjacent to railings without light leaks. Make provisions for servicing and for concealed connection to electric service.
 - 1. LED Luminaires: Comply with [Section 265119 "LED Interior Lighting"] [Section 265619 "LED Exterior Lighting"] and as follows:
 - a. Lamp Type: [Linear][Point]<Insert lamp description>.
 - b. Light Illumination: White, [standard][high] output; [80 lumens/300 mm][120 lumens/300 mm][270 lumens/300 mm]<Insert value>.
 - c. Efficacy: Minimum [80]<Insert number> lm/W.
 - d. Color Rendering Index: Minimum [65][70][80]<Insert number>.
 - e. Correlated Color Temperature: [2700 K][3000 K][3500 K]<Insert value>.
 - f. Rated Lamp Life: [50,000]<Insert number> hours at 70 percent lamp illumination output.
 - g. Beam Distribution: [Symmetric][Asymmetric][10 degrees][25 degrees][55 degrees][100 degrees]<Insert angle or angle range>.
 - h. LED Diffuser: UV-stabilized acrylic, [clear][translucent], matching rail profile.
 - i. Nominal Operating Voltage: [120 V ac][277 V ac] input; [12 V dc][24 V dc] output.
 - j. Internal Driver: [100][120] W.
 - k. UL Listing: [Damp][Dry].
 - l. IP Rating: IP67.
 - m. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Stainless Steel Cable and Cable Fittings for Steel and Iron Decorative Railings:
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Bergen Cable Technology, LLC]
 - b. [Carl Stahl DecorCable, Inc.]
 - c. [Esmet, Inc.]
 - d. [Feeney Inc.]
 - e. [Hayn Enterprises, LLC]
 - f. [Johnson, C. Sherman, Co., Inc]
 - g. [Loos & Co. Inc.]
 - h. [Morse Industries]
 - i. [Ronstan International Inc]
 - j. [Seco South, Inc.]
 - k. [Ultra-tec; The Cable Connection]
 - l. [VIVA Railings, LLC]
 - m. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Bergen Cable Technology, LLC]**
 - b. **[Carl Stahl DecorCable, Inc.]**
 - c. **[Esmet, Inc.]**
 - d. **[Feeney Inc.]**
 - e. **[Hayn Enterprises, LLC]**
 - f. **[Johnson, C. Sherman, Co., Inc]**
 - g. **[Loos & Co. Inc.]**
 - h. **[Morse Industries]**
 - i. **[Ronstan International Inc]**
 - j. **[Seco South, Inc.]**
 - k. **[Ultra-tec; The Cable Connection]**
 - l. **[VIVA Railings, LLC]**
 - m. **<Insert manufacturer's name>**
3. Cable: **[1-by-19][7-by-7][7-by-19]<Insert configuration>** wire cable made from wire complying with ASTM A492, Type 316, **[PVC jacketed]**, **<Insert color>**.
4. Cable Diameter: **[1/8 inch (3.2 mm)][5/32 inch (4 mm)][3/16 inch (5 mm)][1/4 inch (6.4 mm)]**.
5. Cable Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of cable with which they are used.
6. Intermediate Cable Supports: Stainless steel flat bar, **1/4-by-1-inch (6.4-by-25.4-mm)**, predrilled.
- I. Expanded Metal Infill Panels: ASTM F1267, **[Type I (expanded)][Type II (expanded and flattened)]**, Class 1 (uncoated).
 1. Style Designation: **[3/4 number 13][1-1/2 number 10]<Insert designation>**.
- J. Perforated Metal Infill Panels:
 1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, or hot-rolled steel sheet, ASTM A1011/A1011M, commercial steel Type B, **[0.060 inch (1.52 mm)]<Insert dimension>** thick, **[with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows]<Insert description>**.
 - a. Basis-of-Design Product: Provide product with perforations matching **<Insert manufacturer's name; product name or designation>**.
 2. Galvanized-Steel Sheet: ASTM A653/A653M, **G90 (Z275)** coating, commercial steel Type B, **[0.064 inch (1.63 mm)]<Insert dimension>** thick, **[with 1/4-inch (6.4-mm) holes 3/8 inch (9.5 mm) o.c. in staggered rows][with 1/8-by-1-inch (3.2-by-25.4-mm) round end slotted holes in staggered rows]<Insert description>**.
 - a. Basis-of-Design Product: Provide product with perforations matching **<Insert manufacturer's name; product name or designation>**.
- K. Woven-Wire Mesh Infill Panels: Intermediate-crimp, **[diamond][square]** pattern, **2-inch (50-mm)** woven-wire mesh, made from **0.135-inch (3.5-mm)** nominal diameter steel wire complying with ASTM A510/A510M.
 1. Basis-of-Design Product: Provide product with crimp pattern matching **<Insert manufacturer's name; product name or designation>**.

2.7 FASTENERS

A. Fastener Materials:

1. Aluminum Railing Components: **[Type 304][Type 316]** stainless steel fasteners.
2. Copper-Alloy (Bronze) Railing Components: Silicon bronze (Alloy 651 or Alloy 655) fasteners **[where concealed; muntz metal (Alloy 280) fasteners where exposed]**.
3. Copper-Alloy (Brass) Railing Components: Silicon bronze (Alloy 651 or Alloy 655) fasteners **[where concealed; brass (Alloy 260 or Alloy 360) fasteners where exposed]**.
4. Stainless Steel Railing Components: **[Type 304][Type 316]** stainless steel fasteners.
5. Ungalvanized-Steel Railing Components: Plated-steel fasteners complying with ASTM F1941/F1941M, Class Fe/Zn 5 for electrodeposited zinc coating where concealed; Type 304 stainless steel fasteners where exposed.
6. Hot-Dip Galvanized-Steel Railing Components: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
7. Dissimilar Metal Railing Components: **[Type 304][Type 316]** stainless steel fasteners.
8. Finish exposed fasteners to match appearance, including color and texture, of railings.

B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction **[and capable of withstanding design loads]**.

C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless **[otherwise indicated][exposed fasteners are unavoidable][exposed fasteners are the standard fastening method for railings indicated]**.

1. Provide **[Phillips][tamper-resistant][square or hex socket]** flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 **[or ICC-ES AC308]**.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy **[Group 1 (A1)][Group 2 (A4)]** stainless steel bolts, ASTM F593 and nuts, ASTM F594.

2.8 MISCELLANEOUS MATERIALS

A. Handrail Brackets: **[Cast-aluminum,][Cast-bronze,][Cast-brass,][Cast-copper,][Cast-nickel-silver,][Cast stainless steel,][Cast-iron]** center of handrail **[2-1/2 inches (63.5 mm)][3-1/8 inches (79.4 mm)]** **<Insert dimension>** from **[face of railing][wall]**.

1. Provide cast-metal brackets with flange tapped for concealed anchorage to threaded hanger bolt.
2. Provide either formed- or cast-metal brackets with predrilled hole for exposed bolt anchorage.
3. Provide extruded-aluminum brackets with interlocking pieces that conceal anchorage. Locate set screws on bottom of bracket.
4. Provide formed-steel brackets with predrilled hole for bolted anchorage and with snap-on cover that matches rail finish and conceals bracket base and bolt head.

B. Wood Rails:

1. Clear, straight-grained hardwood rails secured to **[recessed][exposed]** metal subrail.

- a. Species: [Ash][Cherry][Red oak][Teak][Walnut][White oak]<Insert species>.
 - b. Finish: [Manufacturer's standard][Transparent polyurethane][Penetrating oil][Acrylic impregnated].
 - c. Staining: [None][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert description or manufacturer's name and product designation>.
 - d. Profile: [Square, 1-3/4 by 1-3/4 inches (45 by 45 mm) with edges eased to 1/4-inch (6-mm) radius][Rectangular, 1-3/4 by 5 inches (45 by 127 mm) with edges eased to 1/4-inch (6-mm) radius][Round, 2-inch (50-mm) diameter][As indicated on Drawings]<Insert description>.
2. Certified Wood: Wood products shall be certified as "FSC Pure"[or "FSC Mixed Credit"] according to FSC STD-01-001 and FSC STD-40-004.
 3. Certified Wood: Wood products shall be certified as "FSC Pure"[or "FSC Mixed Credit"] according to FSC STD-01-001 and FSC STD-40-004.
 4. Certified Wood: Wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
 5. Certified Wood: Wood products shall [contain not less than 60 percent][be made from] certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."
 6. Certified Wood: Wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
 7. Hardwood rails complying with Section 064023 "Interior Architectural Woodwork."
- C. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
1. For [aluminum][and][stainless steel] railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- D. Brazing Rods: For copper-alloy railings, provide type and alloy as recommended by producer of metal to be brazed and as required for color match, strength, and compatibility in fabricated items.
- E. Lacquer for Copper Alloys: Clear acrylic lacquer specially developed for coating copper-alloy products.
- F. Etching Cleaner for Galvanized Metal: Compatible with coating system specified.
- G. Galvanizing Repair Paint: High-zinc-dust-content paint compatible with coating system specified.
- H. Shop Primers: Provide primers that comply with [Section 099113 "Exterior Painting."][Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."]
1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- I. Epoxy Zinc-Rich Primer: Compatible with topcoat.
- J. Shop Primer for Galvanized Steel: [Cementitious galvanized metal primer][Vinyl wash primer][Water-based galvanized metal primer].
- K. Intermediate Coats and Topcoats: Provide products that comply with [Section 099113 "Exterior Painting."][Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."]

- L. Epoxy Intermediate Coat: Compatible with primer and topcoat.
- M. Polyurethane Topcoat: Compatible with undercoat.
- N. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- O. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- P. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: **[At exterior locations][and][where indicated on Drawings]**, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.9 FABRICATION

- A. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage[, **but not less than that required to support structural loads**].
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
 - 1. Clearly mark units for reassembly and coordinated installation.
 - 2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated.
 - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water.
 - 1. Provide weep holes where water may accumulate.
 - 2. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with **[welded][or][mechanical]** connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.

4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint.
- I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
- J. Brazed Connections: Connect copper and copper-alloy railings by brazing. Cope components at connections to provide close fit, or use fittings designed for this purpose. Braze corners and seams continuously.
 1. Use materials and methods that match color of base metal, minimize distortion, and develop maximum strength and corrosion resistance.
 2. Remove flux immediately.
 3. At exposed connections, finish exposed surfaces smooth and blended, so no roughness shows after finishing and brazed surface matches contours of adjoining surfaces.
- K. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings.
 1. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 2. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- L. Form changes in direction as follows:
 1. As detailed.
 2. **[By bending][or][by inserting prefabricated elbow fittings].**
 3. **[By flush bends][or][by inserting prefabricated flush-elbow fittings].**
 4. **[By radius bends of radius indicated][or][by inserting prefabricated elbow fittings of radius indicated].**
 5. By bending to smallest radius that will not result in distortion of railing member.
- M. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- N. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
- O. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is **1/4 inch (6 mm)** or less.
- P. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, handrail brackets, miscellaneous fittings, and anchors to interconnect railing members to other Work unless otherwise indicated.
 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and to prevent bracket or fitting rotation and crushing of substrate.
- Q. Provide inserts and other anchorage devices for connecting railings to concrete or masonry Work.
 1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
 2. Coordinate anchorage devices with supporting structure.
- R. For railing posts set in concrete, provide stainless steel sleeves not less than **6 inches (150 mm)** long

with inside dimensions not less than **1/2 inch (13 mm)** greater than outside dimensions of post, with metal plate forming bottom closure.

- S. For removable railing posts, fabricate slip-fit sockets from stainless steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height.
 - 1. Provide socket covers designed and fabricated to resist being dislodged.
 - 2. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.
- T. Stainless Steel Cable Guard Infill: Fabricate cable guard infill assemblies in the shop to field-measured dimensions with fittings machine swaged.
 - 1. Minimize amount of turnbuckle take-up used for dimensional adjustment, so maximum amount is available for tensioning cable.
 - 2. Tag cable assemblies and fittings to identify installation locations and orientations for coordinated installation.
- U. Expanded-Metal Infill Panels: Fabricate infill panels from **[aluminum][stainless steel][steel]** expanded-metal sheet **[unless otherwise indicated]**.
 - 1. Edge panels with U-shaped channels made from same metal as infill; not less than **0.043 inch (1.1 mm)** thick.
 - 2. Orient expanded metal with long dimension of diamonds **[parallel to top rail][perpendicular to top rail][horizontal][vertical]**.
- V. Perforated-Metal Infill Panels: Fabricate infill panels from perforated metal made from **[aluminum][stainless steel][steel][galvanized steel][same metal as railings in which they are installed]**.
 - 1. Edge panels with U-shaped channels made from metal sheet, of same metal as perforated metal and not less than **0.043 inch (1.1 mm)** thick.
 - 2. Orient perforated metal with pattern **[parallel to top rail][perpendicular to top rail][horizontal][vertical]**.
- W. Woven-Wire Mesh Infill Panels: Fabricate infill panels from woven-wire mesh crimped into **1-by-1/2-by-1/8-inch (25-by-13-by-3-mm)** metal channel frames.
 - 1. Fabricate wire mesh and frames from **[aluminum][stainless steel][steel][unless otherwise indicated]**.
 - 2. Orient wire mesh with **[diamonds vertical][wires perpendicular and parallel to top rail][wires horizontal and vertical]**.
- X. Toe Boards: Where indicated on Drawings, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.11 ALUMINUM FINISHES

- A. Mechanical Finish: AA-M3x; sand top rails, handrails, and intermediate rails in one direction only, parallel to length of railing, with 120- and 320-grit abrasive. After installation, polish railings with No. 0 steel wool immersed in paste wax, then rub to a luster with a soft dry cloth.
- B. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**][**AA-M12C22A31, Class II, 0.010 mm**] or thicker.
- C. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**][**AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.
 - 1. Color: [**Champagne**][**Light bronze**][**Medium bronze**][**Dark bronze**][**Black**][**Match Architect's sample**][**As selected by Architect from full range of industry colors and color densities**]<Insert color>.
- D. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.
- E. Siliconized Polyester Finish: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than **0.2 mil (0.005 mm)** for primer and **0.8 mil (0.02 mm)** for topcoat.
 - 1. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.
- F. High-Performance Organic Finish, Two-Coat Polyvinylidene Fluoride (PVDF): Fluoropolymer finish complying with [**AAMA 2604**][**AAMA 2605**] and containing not less than [**50**][**70**] percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
 - 1. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.
- G. Superior-Performing Organic Finish, Three-Coat (Polyvinylidene Fluoride (PVDF): Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent polyvinylidene fluoride PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
 - 1. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.
- H. Superior-Performing Organic Finish, Four-Coat Polyvinylidene Fluoride (PVDF): Fluoropolymer finish

complying with AAMA 2605 and containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.

1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.

- I. Superior-Performing Organic Finish, Single-Coat FEVE: Fluoropolymer finish complying with AAMA 2605, containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.

- J. Superior-Performing Organic Finish, Two-Coat FEVE: Fluoropolymer finish complying with AAMA 2605, containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.

1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.

2.12 COPPER-ALLOY FINISHES

- A. Finish designations for copper alloys comply with the system for designating copper-alloy finish systems defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."

- B. Buffed Finish: M21 (Mechanical Finish: Buffed, smooth specular).

- C. Hand-Rubbed Finish: M31-M34 (Mechanical Finish: Directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed).

- D. Medium-Satin Finish: M32 (Mechanical Finish: Directionally textured, medium satin).

- E. Fine-Matte Finish: M42 (Mechanical Finish: Nondirectional finish, fine matte).

- F. Lacquered Buffed Finish: M21-O6x (Mechanical Finish: Buffed, smooth specular; Coating: Clear organic, air dried, as specified below).

1. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats in accordance with manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.

- G. Lacquered Hand-Rubbed Finish: M31-M34-O6x (Mechanical Finish: Directionally textured, fine satin; Mechanical Finish: Directionally textured, hand rubbed; Coating: Clear organic, air dried, as specified below).

1. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats in accordance with manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.

- H. Lacquered Medium-Satin Finish: M32-O6x (Mechanical Finish: Directionally textured, medium satin; Coating: Clear, organic, air dried, as specified below).
 - 1. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats in accordance with manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.
- I. Lacquered Fine-Matte Finish: M42-O6x (Mechanical Finish: Nondirectional finish, fine matte; Coating: Clear, organic, air dried, as specified below).
 - 1. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats in accordance with manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.
- J. Statuary Conversion Coating over Satin Finish: M31-C55 (Mechanical Finish: Directionally textured, fine satin; Chemical Finish: Conversion coating, sulfide)[, **with color matching Architect's sample**].
- K. Patina Conversion Coating: M36-C12-C52 (Mechanical Finish: Directionally textured, uniform; Chemical Finish: Nonetched cleaned, degreased; Chemical Finish: Conversion coating, ammonium sulfate)[, **with color matching Architect's sample**].

2.13 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces.
 - 3. Remove embedded foreign matter and leave surfaces chemically clean.
- C. Stainless Steel Tubing Finishes:
 - 1. 180-Grit Polished Finish: Uniform, directionally textured finish.
 - 2. 320-Grit Polished Finish: Oil-ground, uniform, fine, directionally textured finish.
 - 3. Polished and Buffed Finish: 320-grit finish followed by buffing [**to a high luster finish**][**to a mirrorlike finish**][**to match Architect's sample**].
- D. Stainless Steel Sheet and Plate Finishes:
 - 1. Directional Satin Finish: ASTM A480/A480M, No. 4.
 - 2. High-Luster Finish: ASTM A480/A480M, No. 7.
 - 3. Mirror Finish: ASTM A480/A480M, No. 8.

2.14 STEEL AND IRON FINISHES

- A. Galvanized Railings:
 - 1. Hot-dip galvanize[**exterior**] steel and iron railings, including hardware, after fabrication.
 - 2. Hot-dip galvanize indicated steel and iron railings, including hardware, after fabrication.
 - 3. Comply with ASTM A123/A123M for hot-dip galvanized railings.
 - 4. Comply with ASTM A153/A153M for hot-dip galvanized hardware.
 - 5. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.

6. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner[**and as follows:**]
 1. Comply with SSPC-SP 16.
- D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, hot-dip galvanize anchors to be embedded in exterior concrete or masonry.
- E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with **[SSPC-SP 6/NACE No. 3.][SSPC-SP 7/NACE No. 4.][requirements indicated below:]**
 1. Exterior Railings: SSPC-SP 6/NACE No. 3.
 2. Railings Indicated To Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3.
 3. Railings Indicated To Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3.
 4. Other Railings: SSPC-SP 7/NACE No. 4.
- F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 1. Shop prime uncoated railings with **[primers specified in Section 099113 "Exterior Painting"]****[primers specified in Section 099123 "Interior Painting"]** unless **[zinc-rich primer is]****[primers specified in Section 099600 "High-Performance Coatings" are]** indicated.
 2. Do not apply primer to galvanized surfaces.
- G. Shop-Painted Finish: Comply with **[Section 099113 "Exterior Painting."]****[Section 099600 "High-Performance Coatings."]**
 1. Color: **[As indicated by manufacturer's designations]****[Match Architect's sample]****[As selected by Architect from manufacturer's full range].**
- H. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1 for shop painting. Apply at spreading rates recommended by coating manufacturer.
 1. Color: **[As indicated by manufacturer's designations]****[Match Architect's sample]****[As selected by Architect from manufacturer's full range].**
- I. Powder-Coat Finish for Uncoated Ferrous Metal: Prepare, treat, and coat nongalvanized ferrous metal to comply with resin manufacturer's written instructions and as follows:
 1. Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3.
 2. Treat prepared metal with iron-phosphate pretreatment, rinse, and seal surfaces.
 3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness of not less than 1.5 mils (0.04 mm).
 4. Color: **[As indicated by manufacturer's designations]****[Match Architect's sample]****[As selected by Architect from manufacturer's full range].**

- J. Powder-Coat Finish for Galvanized Metal: Prepare, treat, and coat galvanized metal to comply with resin manufacturer's written instructions and as follows:
1. Prepare galvanized metal by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
 2. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
 3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness of not less than **1.5 mils (0.04 mm)**.
 4. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.
1. Fit exposed connections together to form tight, hairline joints.
 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 4. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 5. Set posts plumb within a tolerance of **1/16 inch in 3 feet (2 mm in 1 m)**.
 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed **1/4 inch in 12 feet (6 mm in 3 m)**.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
1. Coat concealed surfaces of **[aluminum][and][copper alloys]** that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws, using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply

with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.

- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending **2 inches (50 mm)** beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within **6 inches (150 mm)** of post.

3.4 ANCHORING POSTS

- A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with **[nonshrink, nonmetallic grout][or][anchoring cement]**, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than **5 inches (125 mm)** deep and **3/4 inch (20 mm)** larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with **[nonshrink, nonmetallic grout][or][anchoring cement]**, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Cover anchorage joint with flange of same metal as post, **[welded to post after placing anchoring material][attached to post with setscrews]**.
- D. Leave anchorage joint exposed with **[1/8-inch (3-mm) buildup, sloped away from post][anchoring material flush with adjacent surface]**.
- E. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For aluminum railings, attach posts as indicated, using fittings designed and engineered for this purpose.
 - 2. For copper-alloy railings, attach posts as indicated, using fittings designed and engineered for this purpose.
 - 3. For stainless steel railings, weld flanges to posts and bolt to metal-supporting surfaces.
 - 4. For steel railings, weld flanges to posts and bolt to metal-supporting surfaces.
- F. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends to concrete and masonry with **[sleeves concealed within][flanges connected to][brackets on underside of rails connected to]** railing ends and anchored to wall construction with anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and **[welded to railing ends][or][connected to railing ends, using nonwelded connections]**.
- C. Attach handrails to walls with wall brackets[, **except where end flanges are used**]. Provide brackets with **[1-1/2-inch (38-mm)]<Insert dimension>** clearance from inside face of handrail and finished wall surface.
 - 1. Use type of bracket with **[flange tapped for concealed anchorage to threaded hanger]**

- bolt**~~[[predrilled hole for exposed bolt anchorage]].~~
- 2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- D. Secure wall brackets~~[[and railing end flanges]]~~ to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
 - 4. For steel-framed partitions, use hanger or lag bolts set into~~[[fire-retardant-treated]]~~ wood backing between studs. Coordinate with stud installation to locate backing members.
 - 5. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.
 - 6. For steel-framed partitions, fasten brackets with toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 REPAIR

- A. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum **2.0-mil (0.05-mm)** dry film thickness.
 - 2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in **[Section 099113 "Exterior Painting."][Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."]**

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and to prepare test reports. Payment for these services will be made **[by Owner][from the testing and inspecting allowance, as authorized by Change Orders]**.
- B. Extent and Testing Methodology: Testing agency will randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Test railings in accordance with ASTM E894 and ASTM E935 for compliance with performance requirements.
- C. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and comply with specified requirements.
- D. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

3.8 CLEANING

- A. Clean ~~[[aluminum]]~~~~[[and]]~~~~[[stainless steel]]~~ by washing thoroughly with clean water and soap, rinsing with



clean water, and wiping dry.

- B. Clean copper alloys in accordance with metal finisher's written instructions in a manner that leaves an undamaged and uniform finish matching approved Sample.
- C. Clean **[wood rails][and][plastic handrail caps]** by wiping with a damp cloth and then wiping dry.
- D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

3.9 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 73 00 00

SECTION 05 73 00 00A - GLAZED DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glazed decorative metal railings.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood blocking for anchoring railings.

1.2 DEFINITIONS

- A. Railings:** Guards, handrails, and similar devices used for protection of occupants at open-sided floor and exterior deck areas and for pedestrian guidance and support, visual separation, or wall protection.

1.3 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for railings.** Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:** Conduct conference at **[Project site]<Insert location>**.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Metal railings assembled from standard components.
2. Glass products.
3. Glazing cement and accessories for structural glass railings.
4. Sealant and accessories for structural glass railings.
5. Fasteners.
6. Wood rails.
7. Lacquer for copper alloys.
8. Shop primer.
9. Bituminous paint.
10. Nonshrink, nonmetallic grout.
11. Anchoring cement.

B. Sustainable Design Submittals:

1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.

- C. Shop Drawings: Include plans, elevations, sections, and attachment details.
- D. Samples for Initial Selection: For products involving selection of color, texture, or design[, **including mechanical finishes**].
- E. Samples for Verification: For each type of exposed finish required.
 - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 - 2. Base channel.
 - 3. Each type of glass and glass edge required.
 - 4. Fittings and brackets.
 - 5. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, [**structural glass balusters**],[**and**][**glass-infill panels**]. Show method of finishing members at intersections. Samples need not be full height.
- F. Delegated Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For [**professional engineer**][**testing agency**].
- B. Mill Certificates: Signed by manufacturers of stainless steel products, certifying that products furnished comply with requirements.
- C. Product Test Reports: For tests performed by a qualified testing agency, in accordance with ASTM E894, ASTM E935, ASTM E2353, and ASTM E2358.
- D. Evaluation Reports: From ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
 - 1. For glazed decorative metal railings.
 - 2. For post-installed anchors.
- E. Preconstruction test reports.

1.7 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockups as indicated on Drawings.
 - 2. Build mockups for each form and finish of glass-infill panel railing consisting of two posts, top rail, handrail, glass-infill panel, and anchorage system components that are full height and are not less than **24 inches (600 mm)** in length.
 - 3. Build mockups for each form and finish of structural glass railing consisting of top rail, structural glass, base channel, and anchorage system components that are full height and are not less than **24 inches (600 mm)** in length.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: **[Owner will engage][Engage]** a qualified testing agency to perform preconstruction testing on laboratory mockups. Payment for these services will be made **[by Owner][from the testing and inspecting allowance, as authorized by Change Orders][by Contractor]**. Retesting of products that fail to meet specified requirements is to be done at Contractor's expense.
1. Build laboratory mockups at testing agency facility; use personnel, materials, and methods of construction that will be used at Project site.
 2. Test railings in accordance with ASTM E894, ASTM E935, ASTM E2353, and ASTM E2358.
 3. Notify Architect **[seven]<Insert number>** days in advance of the dates and times when laboratory mockups will be tested.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 WARRANTY

- A. Manufacturer's Special Warranty for Laminated Glass: Glazed decorative metal railing manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
1. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazed decorative metal railings, including attachment to building construction.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
1. Aluminum: The lesser of minimum yield strength divided by 1.65, or minimum ultimate tensile strength divided by 1.95.
 2. Copper Alloys: 60 percent of minimum yield strength.
 3. Stainless Steel: 60 percent of minimum yield strength.
 4. Steel: 72 percent of minimum yield strength.
 5. Glass: 25 percent of mean modulus of rupture (50 percent probability of breakage), as listed in "Mechanical Properties" in AAMA CW-12, "Structural Properties of Glass."
- C. Structural Performance: Railings, including attachment to building construction, are to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:
 - a. Uniform load of **50 lbf/ft. (0.73 kN/m)** applied in any direction.
 - b. Concentrated load of **200 lbf (0.89 kN)** applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 2. Structural Glass Railings and Glass-Infill Panels:
 - a. Concentrated load of **50 lbf (0.22 kN)** applied horizontally on an area of **1 sq. ft. (0.093 sq. m)**.
 - b. Infill load and other loads need not be assumed to act concurrently.
 3. For structural glass railings, support each section of top rail **[and handrail]** by a minimum of three glass panels or by other means so railings will remain in place if any one glass panel fails.
 - a. Support top rail **[and handrail]** ends such that railings remains in place if end glass panel fails.
- D. Wind Loads: For exterior glazed decorative metal railings, capable of withstanding the following wind loads in accordance with the IBC and ASTM E1300:
1. Wind Load: **[As indicated on Drawings]<Insert wind load>**.
- E. Windborne-Debris-Impact Resistance: Exterior glazed decorative metal railings passing ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone **[1][2][3][4]** for **[basic][enhanced]** protection.
1. Large-Missile Test: For exterior glazing located within **[30 feet (9.1 m)]<Insert dimension>** of grade.
 2. Small-Missile Test: For exterior glazing located between **30 feet (9.1 m)** and **[60 feet (18.3 m)]<Insert dimension>** above grade.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature change>**.

2.2 GLAZED DECORATIVE METAL RAILINGS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[ATR Technologies, Inc.]**
 2. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 3. **[CraneVeyor Corp]**
 4. **[Glass Vice USA]**
 5. **[Greco; CSW Industrials Inc.]**
 6. **[Hollaender Architectural Railing Systems; Hollaender Mfg. Co.]**
 7. **[Hollaender Mfg. Co.]**
 8. **[Julius Blum & Co., Inc.]**
 9. **[Livers Bronze Co.]**
 10. **[Morse Industries]**
 11. **[Southwest Metalsmiths, Inc.]**

12. [TACO Metals Inc.]
13. [Trex Commercial Products, Inc.]
14. [Tri Tech, Inc.]
15. [Tuttle, a Dant Clayton Division]
16. [VIVA Railings, LLC]
17. [Wagner Companies (The); R&B Wagner, Inc.]
18. <Insert manufacturer's name>

B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [ATR Technologies, Inc.]
2. [C.R. Laurence Co., Inc.; CRH Americas, Inc.]
3. [CraneVeyor Corp]
4. [Glass Vice USA]
5. [Greco; CSW Industrials Inc.]
6. [Hollaender Architectural Railing Systems; Hollaender Mfg. Co.]
7. [Hollaender Mfg. Co.]
8. [Julius Blum & Co., Inc.]
9. [Livers Bronze Co.]
10. [Morse Industries]
11. [Southwest Metalsmiths, Inc.]
12. [TACO Metals Inc.]
13. [Trex Commercial Products, Inc.]
14. [Tri Tech, Inc.]
15. [Tuttle, a Dant Clayton Division]
16. [VIVA Railings, LLC]
17. [Wagner Companies (The); R&B Wagner, Inc.]
18. <Insert manufacturer's name>

C. Source Limitations for Laminated Glass: Obtain from single source from single manufacturer.

D. Source Limitations for Decorative Metal Railing Components: Obtain from single source from single manufacturer for each component and installation method.

E. Product Options: Information on Drawings and in the Specifications establishes requirements for railing system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

2.3 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

2.4 ALUMINUM

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type

of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.

- B. Extruded Bars and Shapes, Including Extruded Tube: **ASTM B221 (ASTM B221M)**, Alloy 6063-T5/T52.
- C. Extruded Structural Pipe and Round Tube: ASTM B429/B429M, Alloy 6063-T6.
 - 1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.
- D. Drawn Seamless Tubing: **ASTM B210 (ASTM B210M)**, Alloy 6063-T832.
- E. Plate and Sheet: **ASTM B209 (ASTM B209M)**, [**Alloy 5005-H32**][**Alloy 6061-T6**].
- F. Die and Hand Forgings: **ASTM B247 (ASTM B247M)**, Alloy 6061-T6.
- G. Castings: ASTM B26/B26M, Alloy A356.0-T6.

2.5 STAINLESS STEEL

- A. Tubing: ASTM A554, [**Grade MT 304**][**Grade MT 316**].
- B. Pipe: ASTM A312/A312M, [**Grade TP 304**][**Grade TP 316**].
- C. Castings: ASTM A743/A743M, [**Grade CF 8 or Grade CF 20**][**Grade CF 8M or Grade CF 3M**].
- D. Sheet, Strip, Plate, and Flat Bar: ASTM A666 or ASTM A240/A240M, [**Type 304**][**Type 316**].
- E. Bars and Shapes: ASTM A276, [**Type 304**][**Type 316**].

2.6 STEEL AND IRON

- A. Tubing: [**ASTM A500/A500M (cold formed)**][**or**][**ASTM A513/A513M**].
- B. Bars: Hot-rolled, carbon steel complying with ASTM A29/A29M, Grade 1010.

2.7 COPPER ALLOYS

- A. Copper and Copper Alloys, General: Provide alloys indicated and with temper to suit application and forming methods, but with strength and stiffness not less than Temper H01 (quarter hard) for plate, sheet, strip, and bars and Temper H55 (light drawn) for tube and pipe.
- B. Bronze Extruded Shapes: ASTM B455, Alloy UNS C38500 (architectural bronze).
- C. Brass Extruded Shapes: ASTM B249/B249M, Alloy UNS C36000 (free-cutting brass).
- D. Nickel Silver Extruded Shapes: ASTM B249/B249M, Alloy UNS C79600.
- E. Bronze Seamless Pipe: ASTM B43, Alloy UNS C23000 (red brass, 85 percent copper).
- F. Bronze Seamless Tube: ASTM B135/B135M Alloy UNS C23000 (red brass, 85 percent copper).

- G. Brass Seamless Tube: ASTM B135/B135M Alloy UNS C26000 (cartridge brass, 70 percent copper).
- H. Copper Seamless Tube: ASTM B75/B75M, Alloy UNS C12200 (phosphorous deoxidized, high-residual phosphorous copper).
- I. Bronze Castings: **[Composition bronze castings complying with ASTM B62, Alloy UNS C83600 (85-5-5-5 or No. 1 composition commercial red brass)][or][sand castings complying with ASTM B584, Alloy UNS C86500 (No. 1 manganese bronze)]**.
- J. Brass Castings: Sand castings complying with ASTM B584, Alloy UNS C85200 (high-copper yellow brass).
- K. Copper Castings: ASTM B824, with a minimum of 99.9 percent copper.
- L. Nickel Silver Castings: ASTM B584, Alloy UNS C97300 (12 percent leaded nickel silver).
- M. Bronze Plate, Sheet, Strip, and Bars: ASTM B36/B36M, Alloy UNS C28000 (muntz metal, 60 percent copper).
- N. Brass Plate, Sheet, Strip, and Bars: ASTM B36/B36M, Alloy UNS C26000 (cartridge brass, 70 percent copper).
- O. Copper Plate, Sheet, Strip, and Bars: ASTM B152/B152M, Alloy UNS C11000 (electrolytic tough pitch copper) or Alloy UNS C12200 (phosphorous deoxidized, high-residual phosphorous copper).

2.8 GLASS AND GLAZING PRODUCTS, GENERAL

- A. Glazing Publications: Comply with written instructions of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. NGA/GANA Publications: **["GANA Laminated Glazing Reference Manual" and]"GANA Glazing Manual."**
- B. Safety Glazing: Glazing is to comply with 16 CFR 1201, Category II.
- C. Safety Glazing Labeling: Permanently mark glass with certification label of **[the SGCC][the SGCC or another certification agency acceptable to authorities having jurisdiction][or][manufacturer]**. Label is to indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- D. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- E. Low-Iron Float Glass: ASTM C1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent.
- F. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.
- G. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear), Class 1 and low-iron clear, or Class 2 (tinted) as indicated, Quality-Q3.
- H. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-

Q3.

- I. Ceramic-Coated Glass: Heat-strengthened float glass, Condition C; with ceramic enamel applied by silk-screened process; complying with Specification No. 95-1-31 in GANA's "Engineering Standards Manual" and with other requirements specified.
- J. Bent Glass: ASTM C1464, **[Kind BFT (bent, tempered)][Kind BHS, (bent, heat strengthened)][Kind BL, (bent, laminated)]**.
- K. Glazing Cement and Accessories for Structural Glass Railings: Glazing cement, setting blocks, shims, and related accessories as recommended or supplied by railing manufacturer for installing structural glazing in metal base channels.
- L. Sealant and Accessories for Structural Glass Railings: Sealant, gaskets, setting blocks, shims, and related accessories as recommended or supplied by railing manufacturer for installing structural glazing in metal base channels.
- M. Glazing Gaskets for Glass-Infill Panels: Glazing gaskets and related accessories as recommended or supplied by railing manufacturer for installing glass-infill panels in post-supported railings.

2.9 GLASS HANDRAILS AND GUARDS

- A. Tempered Glass Handrails and Guards: Provide products that have been tested for surface and edge compression in accordance with ASTM C1048 and for impact strength in accordance with 16 CFR 1201 for Category II materials.
 - 1. Glass Color: **[Clear][Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
 - 2. Thickness for Structural Glass Balusters: As required by structural loads, but not less than **[12.0][19.0]** mm.
 - 3. Thickness for Glass-Infill Panels: As required by structural loads, but not less than **[6.0][10.0]** mm.
 - 4. Glass Thickness: As indicated on Drawings.
- B. Laminated Glass Handrails and Guards: ASTM C1172, Type II with two plies of glass bonded together by an interlayer.
 - 1. Construction: Laminate glass with **[polyvinyl butyral interlayer][or][ionoplast polymer interlayer]** to comply with interlayer manufacturer's written instructions.
 - 2. Interlayer Thickness: **[0.030 inch (0.76 mm)][0.060 inch (1.52 mm)][0.090 inch (2.29 mm)]**.
 - 3. Kind: **[LHS (laminated heat strengthened)][LT (laminated tempered)][As indicated]**.
 - 4. Glass Color: Inner-ply **[clear][low-iron clear][blue][blue-green][bronze][green][gray]<Insert color>**; outer-ply **[clear][low-iron clear][blue][blue-green][bronze][green][gray]<Insert color>**.
 - 5. Ceramic Coating Color and Pattern: **[As selected by Architect from manufacturer's full range]<Insert manufacturer's color and pattern designation>**, applied to **[inner][outer]** glass ply.
 - 6. Interlayer Color: **[Clear][Blue-green][Bronze light][Gray]<Insert color>**.
 - 7. Interlayer Color and Pattern: **[As selected by Architect from manufacturer's full range][Match][Provide]<Insert manufacturer's color and pattern designation>**.
 - 8. Glass Plies for Structural Glass Balusters: Thickness required by structural loads, but not less than **[6.0][8.0]** mm thick each.
 - 9. Glass Plies for Glass-Infill Panels: Thickness required by structural loads, but not less than **[3.0][4.0][5.0]** mm each.
- C. Windborne-Debris-Impact-Resistant Laminated Glass Guards: ASTM C1172, Type II with two plies of glass bonded together with an interlayer.

1. Construction: Laminate glass with [polyvinyl butyral interlayer][or][ionoplast polymer interlayer] to comply with interlayer manufacturer's written instructions.
2. Interlayer Thickness: [0.060 inch (1.52 mm)][0.090 inch (2.29 mm)].
3. Kind: [LHS (laminated heat strengthened)][LT (laminated tempered)][As indicated].
4. Glass Color: Inner-ply [clear][low-iron clear][blue][blue-green][bronze][green][gray]<Insert color>; outer-ply [clear][low-iron clear][blue][blue-green][bronze][green][gray]<Insert color>.
5. Ceramic Coating Color and Pattern: [As selected by Architect from manufacturer's full range]<Insert manufacturer's color and pattern designation>, applied to [inner][outer] glass ply.
6. Interlayer Color: [Clear][Blue-green][Bronze light][Gray]<Insert color>.
7. Interlayer Color and Pattern: [As selected by Architect from manufacturer's full range][Match][Provide]<Insert manufacturer's color and pattern designation>.
8. Glass Plies for Structural Glass Balusters: Thickness required by structural loads, but not less than [6.0][8.0][10] mm thick each.
9. Glass Plies for Glass-Infill Panels: Thickness required by structural loads, but not less than [4.0][5.0] mm each.

2.10 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
 1. Aluminum Components: [Type 304][Type 316] stainless steel fasteners.
 2. Stainless Steel Components: [Type 304][Type 316] stainless steel fasteners.
 3. Copper-Alloy (Bronze) Components: Silicon bronze (Alloy 651 or Alloy 655) fasteners[where concealed; muntz metal (Alloy 280) fasteners where exposed].
 4. Copper-Alloy (Brass) Components: Silicon bronze (Alloy 651 or Alloy 655) fasteners[where concealed; brass (Alloy 260 or Alloy 360) fasteners where exposed].
 5. Dissimilar Metals: [Type 304][Type 316] stainless steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated[and capable of withstanding design loads].
- C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless [otherwise indicated][exposed fasteners are unavoidable][exposed fasteners are the standard fastening method for railings indicated].
 1. Provide [Phillips][tamper-resistant][square or hex socket] flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193[or ICC-ES AC308].
 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/ASTM F1941M, Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy [Group 1 (A1)][Group 2 (A4)] stainless steel bolts, ASTM F593, and nuts; ASTM F594 (ASTM F836M).

2.11 MISCELLANEOUS MATERIALS

- A. Handrail Brackets: [Cast aluminum,][Cast stainless steel,][Cast bronze,][Cast brass,][Cast copper,][Cast nickel-silver,] center of rail [2-1/2 inches (63.5 mm)][3-1/8 inches (79.4 mm)]<Insert dimension> from face of structural glass balusters.

B. Wood Rails:

1. Clear, straight-grained hardwood rails secured to **[recessed][exposed]** metal subrail.
 - a. Species: **[Ash][Cherry][Red oak][Walnut][White oak]<Insert species>**.
 - b. Finish: **[Manufacturer's standard][Transparent polyurethane][Penetrating oil][Acrylic impregnated]**.
 - c. Staining: **[None][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert description or manufacturer's name and product designation>**.
 - d. Profile: **[Square, 1-3/4 by 1-3/4 inches (45 by 45 mm) with edges eased to 1/4-inch (6-mm) radius][Rectangular, 1-3/4 by 5 inches (45 by 127 mm) with edges eased to 1/4-inch (6-mm) radius][Round, 2-inch (50-mm) diameter][As indicated]<Insert description>**.
 2. Hardwood rails complying with Section 064023 "Interior Architectural Woodwork."
 3. Certified Wood: Wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.
 4. Certified Wood: Wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.
 5. Certified Wood: Wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
 6. Certified Wood: Wood products shall **[contain not less than 60 percent][be made from]** certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."
 7. Certified Wood: Wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
- C. Lacquer for Copper Alloys: Clear acrylic lacquer specially developed for coating copper-alloy products.
- D. Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
1. Water-Resistant Anchoring Cement: **[At exterior locations][and][where indicated]** provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.12 FABRICATION OF METAL RAILINGS

- A. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage[, **but not less than that required to support structural loads**].
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately **1/32 inch (1 mm)** unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- H. Form changes in direction as follows:
 - 1. As detailed.
 - 2. **[By bending][or][by inserting prefabricated elbow fittings]**.
 - 3. **[By flush bends][or][by inserting prefabricated flush-elbow fittings]**.
 - 4. **[By radius bends of radius indicated][or][by inserting prefabricated elbow fittings of radius indicated]**.
 - 5. By bending to smallest radius that will not result in distortion of railing member.
- I. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- J. Close exposed ends of hollow railing members with prefabricated end fittings.
- K. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, handrail brackets, miscellaneous fittings, and anchors to interconnect railing members to other work where indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and to prevent bracket or fitting rotation and crushing of substrate.
- L. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- M. For railing posts set in concrete, provide **[steel][stainless steel]** sleeves not less than **6 inches (150 mm)** long with inside dimensions not less than **1/2 inch (13 mm)** greater than outside dimensions of post, with metal plate forming bottom closure.

2.13 FABRICATION OF GLASS PANELS AND BALUSTERS

- A. Fabricate glass to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.
- B. Glass-Infill Panels: Provide **[tempered][laminated, heat-strengthened][laminated, tempered]** glass-infill panels **[for both straight and curved sections]**.
 - 1. Edge Finish: **[Clean-cut or flat-grind edges to produce smooth, square edges with slight chamfers at junctions of edges and faces]<Insert edge finishes>**.
- C. Structural Glass Balusters: Provide **[tempered][laminated, heat-strengthened][laminated, tempered]** structural glass balusters **[for both straight and curved sections]**.
 - 1. Edge Finish: **[Grind smooth and flat polish exposed edges of glass, including those at open joints, to produce smooth, square edges with glass edge finishes]**.
 - 2. Factory-bond structural glass balusters to aluminum base and top-rail channels in railing manufacturer's plant using **[glazing cement][sealant]** to comply with manufacturer's written instructions, **[unless field glazing is standard with manufacturer]**.
 - 3. Fabricate structural glass balusters to maintain equal length glass widths and uniform spacing of **[1/2 inch (13 mm)]<Insert spacing>** between glass balusters.

2.14 METAL FINISH REQUIREMENTS, GENERAL

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.15 ALUMINUM FINISHES

- A. Mechanical Finish: AA-M3x; sand top rails, handrails, and intermediate rails in one direction only, parallel to length of railing, with 120- and 320-grit abrasive. After installation, polish railings with No. 0 steel wool immersed in paste wax, then rub to a luster with a soft dry cloth.
- B. Clear Anodic Finish: AAMA 611, **[AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm]** or thicker.
- C. Color Anodic Finish: AAMA 611, **[AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm]** or thicker.
 - 1. Color: **[Champagne][Light bronze][Medium bronze][Dark bronze][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
- D. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion

coating, and applying and baking finish.

1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- E. Siliconized Polyester Finish: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than **0.2 mil (0.005 mm)** for primer and **0.8 mil (0.02 mm)** for topcoat.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- F. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with **[AAMA 2604][AAMA 2605]** and containing not less than **[50][70]** percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- G. Superior-Performing Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- H. Superior-Performing Organic Finish, Four-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- I. Superior-Performing Organic Finish, Single-Coat FEVE: Fluoropolymer finish complying with AAMA 2605. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- J. Superior-Performing Organic Finish, Two-Coat FEVE: Fluoropolymer finish complying with AAMA 2605. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- 2.16 STAINLESS STEEL FINISHES
- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

C. Stainless Steel Tubing Finishes:

1. 180-Grit Polished Finish: Uniform, directionally textured finish.
2. 320-Grit Polished Finish: Oil-ground, uniform, fine, directionally textured finish.
3. Polished and Buffed Finish: 320-grit finish followed by buffing **[to a high luster finish][to a mirrorlike finish][to match Architect's sample]**.

D. Stainless Steel Sheet, Strip, Plate, and Bar Finishes:

1. Directional Satin Finish: ASTM A480/A480M, No. 4.
2. High Luster Finish: ASTM A480/A480M, No. 7.
3. Mirror Finish: ASTM A480/A480M, No. 8.

2.17 COPPER-ALLOY FINISHES

- A. Finish designations for copper alloys comply with the system for designating copper-alloy finish systems defined in NAAMM/NOMMA 500, "Metal Finishes Manual for Architectural and Metal Products."
- B. Buffed Finish: M21 (Mechanical Finish: buffed, smooth specular).
- C. Hand-Rubbed Finish: M31-M34 (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed).
- D. Medium-Satin Finish: M32 (Mechanical Finish: directionally textured, medium satin).
- E. Fine-Matte Finish: M42 (Mechanical Finish: nondirectional finish, fine matte).
- F. Lacquered Buffed Finish: M21-O6x (Mechanical Finish: buffed, smooth specular; Coating: clear, organic, air dried, as specified below).
 1. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.
- G. Lacquered Hand-Rubbed Finish: M31-M34-O6x (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed; Coating: clear, organic, air dried, as specified below).
 1. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.
- H. Lacquered Medium-Satin Finish: M32-O6x (Mechanical Finish: directionally textured, medium satin; Coating: clear, organic, air dried, as specified below).
 1. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.
- I. Lacquered Fine-Matte Finish: M42-O6x (Mechanical Finish: nondirectional finish, fine matte; Coating: clear, organic, air dried, as specified below).

1. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.
- J. Statuary Conversion Coating over Satin Finish: M31-C55 (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide.
 1. Color: Match Architect's sample.
- K. Patina Conversion Coating: M36-C12-C52 (Mechanical Finish: directionally textured, uniform; Chemical Finish: nonetched cleaned, degreased; Chemical Finish: conversion coating, ammonium sulfate)[, **with color matching Architect's sample**].

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with Drawings and manufacturer's written instructions for installing glazed decorative metal railings, accessories, and other components.
- B. Windborne-Debris Resistance: Anchor glazed decorative metal railings to structure using anchoring method, fastener type, and fastening frequency identical to that used in windborne-debris-resistance testing.
- C. Perform cutting, drilling, and fitting required for installing metal railings.
 1. Fit exposed connections together to form tight, hairline joints.
 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 4. Do not weld, cut, or abrade surfaces of metal railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 5. Set posts plumb within a tolerance of **1/16 inch in 3 feet (2 mm in 1 m)**.
 6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed **1/4 inch in 12 feet (5 mm in 3 m)**.
- D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 1. Coat concealed surfaces of **[aluminum][and][copper alloys]** that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with **[shop primer][bituminous paint]**.
- E. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- F. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 METAL RAILING CONNECTIONS

- A. Nonwelded Connections:
 1. Use mechanical or adhesive joints for permanently connecting railing components.

2. Use wood blocks and padding to prevent damage to railing members and fittings.
3. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

- B. Expansion Joints: Install expansion joints at locations indicated, but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending **2 inches (50 mm)** beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within **6 inches (150 mm)** of post.

3.3 METAL ANCHORING POSTS

- A. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted in sleeves, fill annular space between post and sleeve with **[nonshrink, nonmetallic grout][or][anchoring cement]**, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than **5 inches (125 mm)** deep and **3/4 inch (20 mm)** larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with **[nonshrink, nonmetallic grout][or][anchoring cement]**, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Cover anchorage joint with flange of same metal as post, **[welded to post after placing anchoring material][attached to post with setscrews]**.
- D. Leave anchorage joint exposed with **[1/8-inch (3-mm) buildup, sloped away from post][anchoring material flush with adjacent surface]**.
- E. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
1. For aluminum railings, attach posts as indicated using fittings designed and engineered for this purpose.
 2. For copper-alloy railings, attach posts as indicated using fittings designed and engineered for this purpose.
 3. For stainless steel railings, weld flanges to posts and bolt to metal-supporting surfaces.
- F. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.4 INSTALLATION OF GLASS BALUSTERS

- A. Structural Glass Railings:
1. Install assembly to comply with railing manufacturer's written instructions.
 2. Attach base channel to building structure, then insert and connect factory-fabricated and -assembled glass balusters **[if glass was bonded to base and top-rail channels in factory]**.
 3. For field-assembled balusters, attach base channel to building structure, insert glass in base channel, and bond with **[glazing cement][sealant]**.
 - a. Support glass balusters in base channel at quarter points with channel-shaped setting blocks that also act as shims to maintain uniform space for glazing cement.
 - b. Fill remaining space in base channel with **[glazing cement][sealant]** for uniform support of glass.

4. Adjust spacing of glass balusters so gaps between balusters are equal before securing in position.
5. Erect glass railings under direct supervision of manufacturer's authorized technical personnel.

B. Post-Supported Railings with Glass-Infill Panels:

1. Install assembly to comply with railing manufacturer's written instructions and with requirements in other Part 3 articles.
2. Erect posts and other metal railing components, and set factory-cut glass-infill panels.
3. Do not cut, drill, or alter glass-infill panels in field. Protect edges from damage.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and to prepare test reports. Payment for these services will be made **[by Owner][from the testing and inspecting allowance, as authorized by Change Orders]**.
- B. Extent and Testing Methodology: Testing agency will randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Test railings in accordance with ASTM E894, ASTM E935, ASTM E2353, and ASTM E2358 for compliance with performance requirements.
- C. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and comply with specified requirements.
- D. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

3.6 CLEANING

- A. Clean aluminum and stainless steel by washing thoroughly with water and soap, rinsing with clean water, and wiping dry.
- B. Clean copper alloys in accordance with metal finisher's written instructions in a manner that leaves an undamaged and uniform finish matching approved Sample.
- C. Clean and polish glass as recommended in writing by manufacturer. Wash both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion.
- D. Clean wood rails by wiping with a damp cloth and then wiping dry.

3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.



05 - Metals

END OF SECTION 05 73 00 00A



Task	Specification	Specification Description
05 73 00 00	05 70 00 00	Decorative Metal
05 73 00 00	05 75 00 00	Decorative Formed Metal
05 73 23 00	05 70 00 00	Decorative Metal
05 73 23 00	05 73 00 00	Decorative Metal Railings
05 73 23 00	05 73 00 00a	Glazed Decorative Metal Railings
05 73 23 00	05 75 00 00	Decorative Formed Metal



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SECTION 05 75 00 00 - DECORATIVE FORMED METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Beam wraps.
2. Closures and trim.
3. Decorative-metal-clad doors and frames.
4. Escalator enclosures.
5. Filler panels.
6. Lighting coves.
7. Metal base.
8. Mullion cladding.
9. Pipe system covers.
10. Pockets for window treatment.
11. Window stools.

B. Related Requirements:

1. Section 057000 "Decorative Metal" for decorative items made primarily from plate, bars, extrusions, tubes, castings, and other forms of metal, but which may include sheet metal components.
2. Section 076100 "Sheet Metal Roofing" for items made of formed metal for roofing.
3. Section 076200 "Sheet Metal Flashing and Trim" for items made of formed metal for flashings and trim.
4. Section 077100 "Roof Specialties" for items made of formed metal for parapets and copings.

1.2 COORDINATION

- A. Coordinate installation of anchorages for decorative formed metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.
- B. Coordinate installation of decorative formed metal with adjacent construction to ensure that wall assemblies, flashings, trim, and joint sealants, are protected against damage from the effects of weather, age, corrosion, and other causes of deterioration.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including finishing materials.

- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- C. Shop Drawings: Show fabrication and installation details for decorative formed metal.
 - 1. Include plans, elevations, component details, and attachment details.
 - 2. Indicate materials and profiles of each decorative formed metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.
- D. Samples for Initial Selection: For products involving selection of color, texture, or design[, **including mechanical finishes**].
- E. Samples for Verification: For each type of exposed finish required, prepared on **6-inch- (150-mm-)** square Samples of metal of same thickness and material indicated for the Work.
- F. Delegated Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For decorative formed metal elements that house items specified in other Sections. Show dimensions of housed items, including locations of housing penetrations and attachments, and necessary clearances.
- B. Qualification Data: For [**Installer**][**fabricator**][**organic-coating applicator**][**anodic finisher**][**powder-coating applicator**][**and**][**professional engineer**].
- C. Mill Certificates: Signed by stainless steel manufacturers certifying that products furnished comply with requirements.
- D. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For [**mirrorlike stainless steel finish**][**and**][**statuary conversion coating copper-alloy finish**] to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing decorative formed metal similar to that indicated for this Project and with a record of successful in-service performance as well as sufficient production capacity to produce required units.
- B. Organic-Coating Applicator Qualifications: A firm experienced in successfully applying organic coatings of type indicated to metals of types indicated and that employs competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
- C. Anodic Finisher Qualifications: A firm experienced in successfully applying anodic finishes of type

indicated and that employs competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.

- D. Powder-Coating Applicator Qualifications: A firm experienced in successfully applying powder coatings of type indicated to metals of types indicated and that employs competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
- E. Installer Qualifications: Fabricator of products.
- F. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockups for the following types of decorative formed metal:
 - a. **<Insert, in separate subparagraphs, description of each decorative metal type including mockup size>.**
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver decorative formed metal products wrapped in protective coverings and strapped together in suitable packs or in heavy-duty cartons. Remove protective coverings before they stain or bond to finished surfaces.
- B. Store products on elevated platforms in a dry location.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, columns, beams, and other construction contiguous with decorative formed metal by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. For decorative metal items, obtain each color, grade, finish, type, and variety of metal from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design decorative formed metal, including attachment to building construction.
- B. Structural Performance: Decorative formed metal items, including anchors and connections, are to withstand the effects of gravity loads and the following loads and stresses without exceeding the allowable design working stress of materials involved and without exhibiting permanent deformation in any components:

1. Wind Loads on Exterior Items: **[As indicated on Drawings][20 lbf/sq. ft. (957 Pa)][30 lbf/sq. ft. (1436 Pa)]<Insert specific loads>**.

- C. Seismic Performance: Exterior decorative formed metal items, including anchors and connections, are to withstand the effects of earthquake motions determined according to **[ASCE/SEI 7]<Insert requirement>**.

1. Component Importance Factor: 1.0.

- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: **120 deg F (67 deg C)**, ambient; **180 deg F (100 deg C)**, material surfaces.

2.3 SHEET METAL

- A. General: Fabricate products from sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- C. Aluminum Sheet: Flat sheet complying with **ASTM B209 (ASTM B209M)**, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties of not less than Alloy 5005-H32.
- D. Galvanized-Steel Sheet: ASTM A653/A653M, **G90 (Z275)** coating, either commercial steel or forming steel.
- E. Steel Sheet: **[Uncoated, cold-rolled, ASTM A1008/A1008M, commercial steel, exposed][or][electrolytic zinc-coated, ASTM A879/A879M, with steel sheet substrate complying with ASTM A1008/A1008M, commercial steel, exposed]**.
- F. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, **[Type 304][Type 316]**, stretcher-leveled standard of flatness.
- G. Bronze Sheet: ASTM B36/B36M, Alloy UNS C28000 (muntz metal, 60 percent copper) or Alloy UNS C23000 (red brass, 85 percent copper).
- H. Brass Sheet: ASTM B36/B36M, Alloy UNS C26000 (cartridge brass, 70 percent copper).
- I. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 temper.
- J. Titanium Sheet: ASTM B265, Grade 1.

2.4 MISCELLANEOUS MATERIALS

- A. Gaskets: As required to seal joints in decorative formed metal and remain **[airtight][weathertight]**; as recommended in writing by decorative formed metal manufacturer.

1. ASTM D1056, Type 1, Class A, grade as recommended by gasket manufacturer to obtain seal for

- application indicated.
 2. Closed-cell polyurethane foam, adhesive on two sides, release paper protected.
- B. Sealants, Exterior: Elastomeric sealant complying with Section 079200 "Joint Sealants" and as recommended in writing by decorative formed metal manufacturer.
- C. Sealants, Interior: Nonsag, paintable sealant complying with Section 079200 "Joint Sealants" and as recommended in writing by decorative formed metal manufacturer.
- D. Filler Metal and Electrodes: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded or brazed and as necessary for strength, corrosion resistance, and compatibility in fabricated items.
 1. Use filler metals that will match the color of metal being joined and will not cause discoloration.
- E. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated. Do not use metals that are incompatible with materials joined.
 1. Provide concealed fasteners for interconnecting decorative formed metal items and for attaching them to other work unless **[otherwise indicated][exposed fasteners are unavoidable or are the standard fastening method]**.
 2. Provide **[Phillips][tamper-resistant][square or hex socket]** flat-head machine screws for exposed fasteners unless otherwise indicated.
- F. Structural Anchors: For applications indicated to comply with certain design loads, provide fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193[**or ICC-ES AC308**].
- G. Nonstructural Anchors: For applications not indicated to comply with design loads, provide fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193[**or ICC-ES AC308**].
- H. Anchor Materials:
 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or **ASTM F1941 (ASTM F1941M)**, Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy **[Group 1 (A1)][Group 2 (A4)]** stainless steel bolts, **ASTM F593 (ASTM F738M)**, and nuts, **ASTM F594 (ASTM F836M)**.
- I. Sound-Deadening Materials:
 1. Insulation: Unfaced, mineral-fiber blanket insulation complying with ASTM C665, Type I, and passing ASTM E136 test.
 2. Mastic: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- J. Backing Materials: Provided or recommended by decorative formed metal manufacturer.
- K. Laminating Adhesive: Adhesive recommended by metal fabricator that will fully bond metal to metal, will prevent telegraphing and oil-canning, and is compatible with substrate and noncombustible after curing.
- L. Isolation Coating: Manufacturer's standard **[alkali-resistant coating][bituminous paint][epoxy coating]**.

2.5 PAINTS AND COATINGS

- A. Etching Cleaner for Galvanized Metal: Product formulated to remove grease and oil residue from metal surfaces and provide a clean, lightly etched surface to promote adhesion of coatings.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. Lacquer for Copper Alloys: Clear, acrylic lacquer specially developed for coating copper-alloy products.
- D. Shop Primers: Comply with **[Section 099113 "Exterior Painting."][Section 099123 "Interior Painting."][Section 099600 "High-Performance Coatings."]**
- E. Universal Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- F. Epoxy Zinc-Rich Primer: Compatible with topcoat.
- G. Shop Primer for Galvanized Steel: **[Cementitious galvanized metal primer][Vinyl wash primer][Water-based galvanized metal primer].**
- H. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.6 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble decorative formed metal items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Coordinate dimensions and attachment methods of decorative formed metal items with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.
- C. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a **1/2-inch- (12-mm-)** wide hem on the concealed side, or ease edges to a radius of approximately **1/32 inch (1 mm)** and support with concealed stiffeners.
- D. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use.
 - 1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.
- E. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce decorative formed metal items as needed to attach and support other construction.
- F. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install decorative formed metal items.

- G. Where welding or brazing is indicated, weld or braze joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed.
1. Use welding and brazing procedures that will blend with and not cause discoloration of metal being joined.

2.7 BEAM WRAPS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[Hi-Tech Metals, Inc]**
 2. **[Industrial Louvers Inc.]**
 3. **[Metal Sales & Service, Inc.]**
 4. **[MM Systems Corporation]**
 5. **[SAF (Southern Aluminum Finishing Company, Inc.)]**
 6. **[Southwest Metalsmiths, Inc.]**
 7. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Hi-Tech Metals, Inc]**
 2. **[Industrial Louvers Inc.]**
 3. **[Metal Sales & Service, Inc.]**
 4. **[MM Systems Corporation]**
 5. **[SAF (Southern Aluminum Finishing Company, Inc.)]**
 6. **[Southwest Metalsmiths, Inc.]**
 7. **<Insert manufacturer's name>**
- C. Form beam wraps from metal of type and thickness indicated below. Fabricate to fit tightly to adjoining construction.
1. Aluminum Sheet: **[0.063 inch (1.60 mm)][Thickness required to comply with performance requirements]<Insert thickness>**.
 - a. Finish: **[Baked enamel or powder coat][Siliconized polyester][High-performance organic coating][Mill][Clear anodic][Color anodic]**.
 2. Steel Sheet: **[0.060 inch (1.52 mm)][Thickness required to comply with performance requirements]<Insert thickness>**.
 - a. Finish: **[Factory primed][Baked enamel][Powder coat]**.
 3. Stainless Steel Sheet: **[0.050 inch (1.27 mm)][Thickness required to comply with performance requirements]<Insert thickness>**.
 - a. Finish: **[No. 2B][No. 4][No. 6][No. 7][No. 8]**.
- D. Fabricate with calk stop angle to retain backer rod and sealant.

2.8 CLOSURES AND TRIM

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[Fry Reglet Corporation]**
 2. **[Pittcon Industries]**
 3. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Fry Reglet Corporation]**
 2. **[Pittcon Industries]**
 3. **<Insert manufacturer's name>**
- C. Form closures and trim from metal of type and thickness indicated below. Fabricate to fit tightly to adjoining construction, **with weathertight joints at exterior installations**.
1. Aluminum Sheet: **[0.063 inch (1.60 mm)][Thickness required to comply with performance requirements]<Insert thickness>**.
 - a. Finish: **[Baked enamel or powder coat][Siliconized polyester][High-performance organic coating][Mill][Clear anodic][Color anodic]**.
 2. Galvanized-Steel Sheet: **[0.052 inch (1.32 mm)][Thickness required to comply with performance requirements]<Insert thickness>**.
 - a. Finish: **[Factory primed][Baked enamel][Siliconized polyester][High-performance organic coating][Powder coat]**.
 3. Steel Sheet: **[0.048 inch (1.21 mm)][Thickness required to comply with performance requirements]<Insert thickness>**.
 - a. Finish: **[Factory primed][Baked enamel][Powder coat]**.
 4. Closures and trim may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view and not exposed to weather.
- D. Conceal fasteners where possible; otherwise, locate where they are as inconspicuous as possible. Size fasteners to support closures and trim, with fasteners spaced to prevent buckling or waviness in finished surfaces.
- E. Drill and tap holes needed for securing closures and trim to other surfaces.
- F. Incorporate gaskets where indicated or needed for concealed, continuous seal at abutting surfaces.
- G. Miter or cope trim members at corners and reinforce with bent metal splice plates to form tight joints.

2.9 DECORATIVE-METAL-CLAD DOORS AND FRAMES

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide**

products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. [Dawson Metal Co., Inc]
2. [InKan Limited]
3. [Krieger Specialty Products Company]
4. <Insert manufacturer's name>

B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [Dawson Metal Co., Inc]
2. [InKan Limited]
3. [Krieger Specialty Products Company]
4. <Insert manufacturer's name>

C. Laminate metal sheets, of type and thickness indicated below, to faces of [hollow-metal doors and frames][and][elevator entrances] where indicated. Use adhesive that will fully bond metal to metal and that will prevent telegraphing and oil-canning.

1. Bronze Sheet: [0.040 inch (1.02 mm)]<Insert thickness>.
 - a. Finish: [Buffed finish, lacquered][Hand-rubbed finish, lacquered][Statuary conversion coating over satin finish, lacquered].
2. Brass Sheet: [0.040 inch (1.02 mm)]<Insert thickness>.
 - a. Finish: [Buffed][Hand-rubbed] finish lacquered.
3. Stainless Steel Sheet: [0.038 inch (0.95 mm)]<Insert thickness>.
 - a. Finish: [No. 2B][No. 4][No. 6][No. 7][No. 8].
4. Titanium Sheet: [0.025 inch (0.64 mm)]<Insert thickness>.
 - a. Finish: [Dull][Bright] matte.

2.10 ESCALATOR ENCLOSURES

A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. [Hi-Tech Metals, Inc]
2. [Metal Sales & Service, Inc.]
3. [Southwest Metalsmiths, Inc.]
4. <Insert manufacturer's name>

B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [Hi-Tech Metals, Inc]
2. [Metal Sales & Service, Inc.]
3. [Southwest Metalsmiths, Inc.]

4. <Insert manufacturer's name>

- C. Form escalator enclosures from metal of type and thickness indicated below. Coordinate size of enclosures, location of cutouts, and method of attachment to adjoining construction.

1. Stainless Steel Sheet: **[0.062 inch (1.59 mm)]****[Thickness required to comply with performance requirements]****<Insert thickness>**.
 - a. Finish: **[No. 2B]****[No. 4]****[No. 6]****[No. 7]****[No. 8]**.
2. Bronze Sheet: **[0.081 inch (2.05 mm)]****[Thickness required to comply with performance requirements]****<Insert thickness>**.
 - a. Finish: **[Buffed finish, lacquered]****[Hand-rubbed finish, lacquered]****[Statuary conversion coating over satin finish]**.

2.11 FILLER PANELS

- A. Form filler panels for closing ends of partition systems and for other applications indicated. Form from two sheets of metal of type and thickness indicated below, separated by channels formed from the same material, producing a panel of same thickness as **[partitions]****[mullions]** unless otherwise indicated. Incorporate reveals, trim, and concealed anchorages for attaching to adjacent surfaces.

1. Galvanized-Steel Sheet: **[0.064 inch (1.63 mm)]****<Insert thickness>**.
 - a. Finish: **[Factory primed]****[Baked enamel]****[Siliconized polyester]****[High-performance organic coating]****[Powder coat]**.
2. Steel Sheet: **[0.060 inch (1.52 mm)]****<Insert thickness>**.
 - a. Finish: **[Factory primed]****[Baked enamel]****[Powder coat]**.
3. Filler panels may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view.

- B. Fill interior of panel with sound-deadening insulation permanently attached to inside panel faces.
- C. Adhesively attach gaskets to filler panel edges where they abut mullions or glazing. Use **1-inch- (25-mm-)** square material, unless otherwise indicated, set approximately **1/4 inch (6 mm)** into channeled edge of filler panel.
- D. Attach gaskets to all edges of panels that abut adjacent surfaces to form a continuous seal. Use compressible gaskets or mastic sealing tape, applied to center of panel edges to be concealed from view, unless otherwise indicated.
- E. Do not mechanically fasten filler panels to mullions.

2.12 LIGHTING COVES

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following]****[provide products by one of the following]****[available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

1. [Fry Reglet Corporation]
2. [Gordon Inc.]
3. [Hi-Tech Metals, Inc]
4. [MM Systems Corporation]
5. [Pittcon Industries]
6. <Insert manufacturer's name>

B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [Fry Reglet Corporation]
2. [Gordon Inc.]
3. [Hi-Tech Metals, Inc]
4. [MM Systems Corporation]
5. [Pittcon Industries]
6. <Insert manufacturer's name>

C. Form lighting covers from metal of type and thickness indicated below. Coordinate size of covers, location of cutouts for electrical wiring, and method of attachment to adjoining construction.

1. Aluminum Sheet: [0.063 inch (1.60 mm)]<Insert thickness>.
 - a. Finish: [Baked enamel or powder coat][Siliconized polyester][High-performance organic coating][Mill][Clear anodic][Color anodic].
2. Galvanized-Steel Sheet: [0.052 inch (1.32 mm)]<Insert thickness>.
 - a. Finish: [Factory primed][Baked enamel][Siliconized polyester][High-performance organic coating][Powder coat].
3. Steel Sheet: [0.048 inch (1.21 mm)]<Insert thickness>.
 - a. Finish: [Factory primed][Baked enamel][Powder coat].
4. Fabricate light covers with [hairline butt joints][tapered edges for taping and spackling].
5. Provide [mitered corners, factory welded with backplates][factory endcaps].
6. Lighting covers may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view.

2.13 METAL BASE

A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. [Fry Reglet Corporation]
2. [Pittcon Industries]
3. <Insert manufacturer's name>

B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [Fry Reglet Corporation]
2. [Pittcon Industries]
3. <Insert manufacturer's name>

- C. Form metal base from metal of type and thickness indicated below:
1. Aluminum Sheet: **[0.063 inch (1.60 mm)]<Insert thickness>**.
 - a. Finish: **[Baked enamel or powder coat][Siliconized polyester][High-performance organic coating][Mill][Clear anodic][Color anodic]**.
 2. Stainless Steel Sheet: **[0.050 inch (1.27 mm)]<Insert thickness>**.
 - a. Finish: **[No. 2B][No. 4][No. 6][No. 7][No. 8]**.

2.14 MULLION CLADDING

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[Hi-Tech Metals, Inc]**
 2. **[Metal Sales & Service, Inc.]**
 3. **[Southwest Metalsmiths, Inc.]**
 4. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Hi-Tech Metals, Inc]**
 2. **[Metal Sales & Service, Inc.]**
 3. **[Southwest Metalsmiths, Inc.]**
 4. **<Insert manufacturer's name>**
- C. Form mullion cladding from metal of type and thickness indicated below. Fabricate to fit tightly to adjoining construction.
1. Aluminum Sheet: **[0.063 inch (1.60 mm)]<Insert thickness>**.
 - a. Finish: **[Baked enamel or powder coat][Siliconized polyester][High-performance organic coating][Mill][Clear anodic][Color anodic]**.
 2. Galvanized-Steel Sheet: **[0.052 inch (1.32 mm)]<Insert thickness>**.
 - a. Finish: **[Factory primed][Baked enamel][Siliconized polyester][High-performance organic coating][Powder coat]**.
 3. Stainless Steel Sheet: **[0.050 inch (1.27 mm)]<Insert thickness>**.
 - a. Finish: **[No. 2B][No. 4][No. 6][No. 7][No. 8]**.

2.15 PIPE SYSTEM COVERS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

1. **[ARSCO Metals LLC]**
2. **[JG Innovations, Inc.]**
3. **<Insert manufacturer's name>**

B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

1. **[ARSCO Metals LLC]**
2. **[JG Innovations, Inc.]**
3. **<Insert manufacturer's name>**

C. Form pipe system covers from metal of type and thickness indicated below. Coordinate size of covers, location of cutouts for piping, and method of attachment to adjoining construction.

1. Galvanized-Steel Sheet: **[0.052 inch (1.32 mm)]<Insert thickness>**.
 - a. Finish: **[Factory primed][Baked enamel][Siliconized polyester][High-performance organic coating][Powder coat]**.
2. Steel Sheet: **[0.048 inch (1.21 mm)]<Insert thickness>**.
 - a. Finish: **[Factory primed][Baked enamel][Powder coat]**.

2.16 POCKETS FOR WINDOW TREATMENT

A. Form pockets from metal of type and thickness indicated below, with end closures. Coordinate dimensions and attachment methods with window treatment equipment, window frames, ceiling suspension system, and other related construction to produce a coordinated, closely fitting assembly.

1. Aluminum Sheet: **[0.063 inch (1.60 mm)]<Insert thickness>**.
 - a. Finish: **[Baked enamel or powder coat][Siliconized polyester][High-performance organic coating][Mill][Clear anodic][Color anodic]**.
2. Galvanized-Steel Sheet: **[0.052 inch (1.32 mm)]**.
 - a. Finish: **[Factory primed][Baked enamel][Siliconized polyester][High-performance organic coating][Powder coat]**.
3. Steel Sheet: **[0.048 inch (1.21 mm)]<Insert thickness>**.
 - a. Finish: **[Factory primed][Baked enamel][Powder coat]**.
4. Pockets for window treatment may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view.

B. Reinforce pockets for attaching window treatment equipment and hardware, or increase metal thickness.

C. Divide continuous pockets with built-in partitions located to separate adjoining drapery and blind units, to coincide with window mullions, and to receive filler panels at ends of partitions.

2.17 WINDOW STOOLS

- A. Form window stools from metal of type and thickness indicated below, with end closures:
1. Aluminum Sheet: **[0.063 inch (1.60 mm)]<Insert thickness>**.
 - a. Finish: **[Baked enamel or powder coat][Siliconized polyester][High-performance organic coating][Mill][Clear anodic][Color anodic]**.
 2. Galvanized-Steel Sheet: **[0.052 inch (1.32 mm)]<Insert thickness>**.
 - a. Finish: **[Factory primed][Baked enamel][Siliconized polyester][High-performance organic coating][Powder coat]**.
 3. Stainless Steel Sheet: **[0.050 inch (1.27 mm)][1.3 mm]<Insert thickness>**.
 - a. Finish: **[No. 2B][No. 4][No. 6][No. 7][No. 8]**.
 4. Bronze Sheet: **[0.051 inch (1.29 mm)]<Insert thickness>**.
 - a. Finish: **[Buffed finish, lacquered][Hand-rubbed finish, lacquered][Statuary conversion coating over satin finish]**.
- B. Weld seams at end closures.
- C. Braze seams at end closures.
- D. Apply sound-deadening **[insulation][mastic]** to underside of window stools.

2.18 GENERAL FINISH REQUIREMENTS

- A. Complete mechanical finishes of flat sheet metal surfaces before fabrication where possible. After fabrication, finish all joints, bends, abrasions, and other surface blemishes to match sheet finish.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
- D. Finish **[items indicated on Drawings]<Insert product>** after assembly.
- E. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.19 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, **[AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm]** or thicker.
- B. Color Anodic Finish: AAMA 611, **[AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34,**

Class II, 0.010 mm] or thicker.

1. Color: **[Champagne][Light bronze][Medium bronze][Dark bronze][Black]<Insert color>**.
 2. **[Match Architect's sample][As selected by Architect from full range of industry colors and color densities]**.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- D. Siliconized Polyester Finish: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than **0.2 mil (0.005 mm)** for primer and **0.8 mil (0.02 mm)** for topcoat.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- E. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- F. Superior-Performing Organic Finish: **[Two][Three][Four]**-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.

2.20 GALVANIZED-STEEL SHEET FINISHES

- A. Preparing Galvanized Items for Factory Priming: Thoroughly clean galvanized decorative formed metal of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- B. Preparing Galvanized Items for Factory Finishing: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
- C. Repairing Galvanized Surfaces: Clean welds and abraded areas and repair galvanizing to comply with ASTM A780/A780M.
- D. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply shop primer to prepared surfaces of items unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
- E. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of **1 mil (0.025 mm)** for topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of **2 mils (0.05 mm)**.

1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- F. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than **1.5 mils (0.04 mm)**. Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- G. Siliconized-Polyester Coating: Immediately after cleaning and pretreating, apply manufacturer's standard epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than **0.2 mil (0.005 mm)** for primer and **0.8 mil (0.02 mm)** for topcoat.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- H. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- I. Superior-Performing Organic Finish: **[Two][Three][Four]**-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- 2.21 STEEL SHEET FINISHES
- A. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
- B. Pretreatment: Immediately after cleaning, apply a conversion coating of type suited to organic coating.
- C. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply shop primer to prepared surfaces of items unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
- D. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of **2 mils (0.05 mm)**.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

- E. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm). Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.
 - 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.

2.22 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
- C. Bright, Cold-Rolled, Unpolished Finish: No. 2B.
- D. Directional Satin Finish: No. 4.
- E. Dull Satin Finish: No. 6.
- F. Satin, Reflective, Directional Polish: No. 7.
- G. Mirrorlike Reflective, Nondirectional Polish: No. 8 finish.
- H. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.23 COPPER-ALLOY FINISHES

- A. Lacquered Buffed Finish: M21-O6x (Mechanical Finish: buffed, smooth specular; Coating: clear, organic, air dried, as specified below).
 - 1. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.
- B. Lacquered Hand-Rubbed Finish: M31-M34-O6x (Mechanical Finish: directionally textured, fine satin; Mechanical Finish: directionally textured, hand rubbed; Coating: clear, organic, air dried, as specified below).
 - 1. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.
- C. Lacquered Medium-Satin Finish: M32-O6x (Mechanical Finish: directionally textured, medium satin; Coating: clear, organic, air dried, as specified below).
 - 1. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.
- D. Lacquered Fine-Matte Finish: M42-O6x (Mechanical Finish: nondirectional finish, fine matte; Coating: clear, organic, air dried, as specified below).
 - 1. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per

manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.

- E. Statuary Conversion Coating over Satin Finish: M31-C55 (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide)[, **with color matching Architect's sample**].
- F. Statuary Conversion Coating over Satin Finish, Lacquered: M31-C55-O6x (Mechanical Finish: directionally textured, fine satin; Chemical Finish: conversion coating, sulfide; Coating: clear, organic, air dried, as specified below)[, **with color matching Architect's sample**]:
 - 1. Clear, Organic Coating: Lacquer specified for copper alloys, applied by air spray in two coats per manufacturer's written instructions, with interim drying, to a total thickness of **1 mil (0.025 mm)**.

2.24 TITANIUM FINISHES

- A. General: Fabricate items from finished titanium sheet, taking care not to damage finish during fabrication. Protect finish as needed during fabrication by applying a strippable, temporary protective covering.
- B. Dull Matte Finish: Pickled and annealed.
- C. Bright Matte Finish: Vacuum annealed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative formed metal.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Locate and place decorative formed metal items level and plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install decorative formed metal.
 - 1. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where needed to protect metal surfaces and to make a weathertight connection.
- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.
- D. Install concealed gaskets, joint fillers, insulation, sealants, and flashings, as the Work progresses, to make exterior decorative formed metal items weatherproof.
- E. Install concealed gaskets, joint fillers, sealants, and insulation, as the Work progresses, to make interior

decorative formed metal items soundproof or lightproof as applicable to type of fabrication indicated.

- F. Corrosion Protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.
- G. Install decorative-formed-metal-clad doors and frames to comply with requirements specified in Section 081113 "Hollow Metal Doors and Frames."

3.3 ADJUSTING AND CLEANING

- A. Unless otherwise indicated, clean metals by washing thoroughly with water and soap, rinsing with clean water, and drying with soft cloths.
- B. Clean copper alloys according to metal finisher's written instructions in a manner that leaves an undamaged and uniform finish matching approved Sample.
- C. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum **2.0-mil (0.05-mm)** dry film thickness.
 - 2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in [**Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."**][**Section 099600 "High-Performance Coatings."**][**Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."**]
- D. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

3.4 PROTECTION

- A. Protect finishes of decorative formed metal items from damage during construction period. Remove temporary protective coverings at time of Substantial Completion.

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Task	Specification	Specification Description
05 75 00 00	05 70 00 00	Decorative Metal



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06 - Wood, Plastics, and Composites

Task	Specification	Specification Description
06 01 40 91	08 71 00 00	Door Hardware
06 05 23 00	06 10 00 00	Rough Carpentry
06 05 23 00	06 13 00 00	Heavy Timber Construction
06 05 73 13	01 11 19 00	No Specification Required
06 05 73 33	06 10 00 00	Rough Carpentry
06 05 73 33	06 13 00 00	Heavy Timber Construction



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SECTION 06 10 00 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood products.
2. Wood-preserved-treated lumber.
3. Fire-retardant-treated lumber.
4. Dimension lumber framing.
5. Miscellaneous lumber.
6. Plywood backing panels.
7. Metal framing anchors.

B. Related Requirements:

1. Section 061533 "Wood Patio Decking" for elevated decks, including support framing.
2. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.
3. Section 061753 "Shop-Fabricated Wood Trusses" for wood trusses made from dimension lumber.
4. Section 064013 "Exterior Architectural Woodwork" for exterior wood stairs and railings.
5. Section 064023 "Interior Architectural Woodwork" for interior wood stairs and railings.
6. Section 313116 "Termite Control" for site application of borate treatment to wood framing.

1.2 DEFINITIONS

- A. Boards or Strips:** Lumber of less than **2 inches nominal (38 mm actual)** size in least dimension.
- B. Dimension Lumber:** Lumber of **2 inches nominal (38 mm actual)** size or greater but less than **5 inches nominal (114 mm actual)** size in least dimension.
- C. Exposed Framing:** Framing not concealed by other construction.
- D. SBX:** An inorganic boron used to prevent termites and fungal decay.
- E. Lumber grading agencies, and abbreviations used to reference them, include the following:**
1. NeLMA: Northeastern Lumber Manufacturers' Association.
 2. NLGA: National Lumber Grades Authority.
 3. RIS: Redwood Inspection Service.
 4. SPIB: The Southern Pine Inspection Bureau.
 5. WCLIB: West Coast Lumber Inspection Bureau.
 6. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

- A. Product Data:** For each type of product. Indicate component materials and dimensions and include construction and application details.



1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Sustainable Design Submittals:

1. Chain-of-Custody Qualification Data: For manufacturer and vendor.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.

1.5 QUALITY ASSURANCE

- A. Certified Wood: Provide an invoice, including vendor's chain-of-custody number, product cost, and entity being invoiced.
- B. Vendor Qualifications: Provide proof of use of vendors that are certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS

- A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
1. Factory mark each piece of lumber with grade stamp of grading agency.

2. For exposed lumber indicated to receive a stained or natural finish, **[mark grade stamp on end or back of each piece][or][omit grade stamp and provide certificates of grade compliance issued by grading agency]** .
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
4. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content:

1. Boards: **[15][19]** percent.
2. Dimension Lumber: **[15 percent][19 percent][15 percent for 2-inch nominal (38-mm actual) thickness or less; 19 percent for more than 2-inch nominal (38-mm actual) thickness][15 percent for 2-inch nominal (38-mm actual) thickness or less; no limit for more than 2-inch nominal (38-mm actual) thickness][19 percent for 2-inch nominal (38-mm actual) thickness or less; no limit for more than 2-inch nominal (38-mm actual) thickness]** unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Wood-Preservative-Treated Lumber by Pressure Process: AWP A U1, use categories as follows:

1. UC1, Interior/Dry: Interior construction continuously protected from weather or other sources of moisture. Include **[all rough carpentry.][the following items:]**
 - a. Wood sills, sleepers, blocking, **[furring,][stripping,]** and similar concealed members in contact with masonry or concrete.
 - b. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - c. Wood floor plates that are installed over concrete slabs-on-grade.
 - d. Wood furniture.
 - e. Wood millwork.
2. UC2, Interior/Damp: Interior construction protected from weather, but may be subject to sources of moisture. Include **[all rough carpentry.][the following items:]**
 - a. Wood sills, sleepers, blocking, **[furring,][stripping,]** and similar concealed members in contact with masonry or concrete.
 - b. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - c. Wood floor plates that are installed over concrete slabs-on-grade.
 - d. Wood millwork.
 - e. Wood flooring.
3. UC3A, Above Ground, Protected (Commodity Specification A): Coated wood products in exterior construction not in contact with ground but exposed to all weather cycles including intermittent wetting. Include **[all rough carpentry.][the following items:]**
 - a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - b. Wood framing members that are less than **18 inches (460 mm)** above the ground in crawlspaces or unexcavated areas.
 - c. Wood siding and trim.

4. UC3A, Above Ground, Protected (All Other Commodity Specifications): Wood products in exterior

construction not in contact with ground, exposed to all weather cycles but either coated and installed in a manner that prevents prolonged wetting, or fully protected from liquid water by building design and construction. Include **[all rough carpentry.]****[the following items:]**

- a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - b. Wood framing members that are less than **18 inches (460 mm)** above the ground in crawlspaces or unexcavated areas.
 - c. Wood floor plates that are installed over concrete slabs-on-grade.
 - d. Wood siding and trim.
 - e. Wood sheathing.
5. UC3B, Above Ground, Exposed (Commodity Specification A): Uncoated wood products in exterior construction not in contact with ground, exposed to all weather cycles including intermittent wetting, but with sufficient air circulation for wood to dry. Include **[all rough carpentry.]****[the following items:]**
 - a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - b. Wood framing members that are less than **18 inches (460 mm)** above the ground in crawlspaces or unexcavated areas.
 - c. Wood decking, railings, and joists and beams for decks that are not critical to the performance and safety of the entire system/construction and that are in locations easily accessible for maintenance, repair, or replacement.
6. UC3B, Above Ground, Exposed (All Other Commodity Specifications): Uncoated wood products in exterior construction not in contact with ground, exposed to all weather cycles including prolonged wetting. Include **[all rough carpentry.]****[the following items:]**
 - a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - b. Wood framing members that are less than **18 inches (460 mm)** above the ground in crawlspaces or unexcavated areas.
7. UC4A, Ground Contact, General Use (Commodity Specification A): Non-critical wood products in contact with ground and exposed to all weather cycles including continuous or prolonged wetting, and wood products not in contact with ground but with ground contact-type hazards or that are critical or hard to replace. Include **[all rough carpentry.]****[the following items:]**
 - a. Wood framing members that are less than **6 inches (152 mm)** above the ground.
 - b. Joists and beams when they are difficult to maintain, repair, or replace and are critical to the performance and safety of the entire system/construction.
8. UC4A, Ground Contact, General Use (All Other Commodity Specifications): Non-critical wood products in contact with ground and exposed to all weather cycles, normal exposure conditions. Include **[all rough carpentry.]****[the following items:]**
 - a. Wood fence, deck, and guardrail posts.
 - b. Wood utility poles.
9. UC4B, Ground Contact, Heavy Duty (Commodity Specification A): Critical or difficult-to-replace wood products in contact with ground and exposed to all weather cycles including continuous or prolonged wetting, high decay potential, and saltwater splash. Include **[all rough carpentry.]****[the following items:]**

- a. Wood foundations.
- 10. UC4C, Ground Contact, Extreme Duty (Commodity Specification A): Critical structural wood products in contact with ground and exposed to all weather cycles including continuous or prolonged wetting, severe environments, and extreme decay potential. Include **[all rough carpentry.]****[the following items:]**
 - a. Wood foundation piling.
- 11. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. **[Do not use inorganic boron (SBX) for sill plates.]**
- 12. For exposed items indicated to receive a stained or natural finish, chemical formulations are not to require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- 13. After treatment, redry **[boards]****[dimension lumber]** to 19 percent maximum moisture content.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - 1. For exposed lumber indicated to receive a stained or natural finish, **[mark end or back of each piece]****[or]****[omit marking and provide certificates of treatment compliance issued by inspection agency]** .
- D. Application: Treat **[all rough carpentry unless otherwise indicated.]****[items indicated on Drawings, and the following:]**
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, **[furring,]****[stripping,]** and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - 4. Wood framing members that are less than **18 inches (460 mm)** above the ground in crawlspaces or unexcavated areas.
 - 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED LUMBER

- A. General: Where fire-retardant-treated materials are indicated, materials are to comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than **10.5 ft. (3.2 m)** beyond the centerline of the burners at any time during the test.
 - 1. Treatment is not to promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when

tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.

4. Design Value Adjustment Factors: Treated lumber is to be tested in accordance with ASTM D5664 and design value adjustment factors are to be calculated in accordance with ASTM D6841. **[For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.]**
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. **[Kiln-dry plywood after treatment to maximum moisture content of 15 percent.]**
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency and other information required by authorities having jurisdiction.
 1. For exposed lumber indicated to receive a stained or natural finish, **[mark end or back of each piece][or][omit marking and provide certificates of treatment compliance issued by testing agency]** .
- E. For exposed items indicated to receive a stained or natural finish, chemical formulations are not to bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat **[all rough carpentry unless otherwise indicated.][items indicated on Drawings, and the following:]**
 1. Framing for raised platforms.
 2. Framing for stages.
 3. Concealed blocking.
 4. Framing for non-load-bearing partitions.
 5. Framing for non-load-bearing exterior walls.
 6. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
 7. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing Interior Partitions by Grade:
 1. Grade: **[Construction or No. 2][Construction, Stud, or No. 3][Standard, Stud, or No. 3]** .
 2. Application: **[All interior partitions][Interior partitions not indicated as load bearing]** .
 3. Species:
 - a. Hem-fir (north); NLGA.
 - b. Southern pine or mixed southern pine; SPIB.
 - c. Spruce-pine-fir; NLGA.
 - d. Hem-fir; WCLIB, or WWPA.
 - e. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 - f. Northern species; NLGA.
 - g. Eastern softwoods; NeLMA.
 - h. Western woods; WCLIB or WWPA.
- B. Load-Bearing Partitions by Grade:
 1. Grade: **[No. 2][Construction or No. 2][Construction, Stud, or No. 3]** .

2. Application: **[Exterior walls][and][interior load-bearing partitions]** .
3. Species:

- a. Hem-fir (north); NLGA.
- b. Southern pine; SPIB.
- c. Douglas fir-larch; WCLIB or WWPA.
- d. Southern pine or mixed southern pine; SPIB.
- e. Spruce-pine-fir; NLGA.
- f. Douglas fir-south; WWPA.
- g. Hem-fir; WCLIB or WWPA.
- h. Douglas fir-larch (north); NLGA.
- i. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

C. Machine Stress-Rated (MSR) Lumber Partitions:

1. Grade: Any species of MSR dimension lumber with a grade of not less than **[2400f-2.0E][2100f-1.8E][1650f-1.5E]<Insert grade>** .
2. Application: **[Exterior walls][and][interior load-bearing partitions]** .

D. Load-Bearing Partitions by Performance:

1. Performance Requirement: Any species and grade with a modulus of elasticity of at least **[1,500,000 psi (10 350 MPa)][1,300,000 psi (8970 MPa)][1,100,000 psi (7590 MPa)][1,000,000 psi (6900 MPa)][900,000 psi (6210 MPa)]** and an extreme fiber stress in bending of at least **[1000 psi (6.9 MPa)][850 psi (5.86 MPa)][700 psi (4.83 MPa)][600 psi (4.14 MPa)][500 psi (3.45 MPa)]** for 2-inch nominal (38-mm actual) thickness and 12-inch nominal (286-mm actual) width for single-member use.
2. Application: **[Exterior walls][and][interior load-bearing partitions]** .

E. Ceiling Joists:

1. Grade: **[Construction or No. 2][Construction, Stud, or No. 3][Standard, Stud, or No. 3]** .
2. Species:
 - a. Hem-fir (north); NLGA.
 - b. Southern pine; SPIB.
 - c. Douglas fir-larch; WCLIB or WWPA.
 - d. Douglas fir-larch (north); NLGA.
 - e. Southern pine or mixed southern pine; SPIB.
 - f. Spruce-pine-fir; NLGA.
 - g. Hem-fir; WCLIB or WWPA.
 - h. Douglas fir-south; WWPA.
 - i. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 - j. Northern species; NLGA.
 - k. Eastern softwoods; NeLMA.
 - l. Western woods; WCLIB or WWPA.

F. Joists, Rafters, and Other Framing by Grade:

1. Grade: **[Select Structural][No. 1][No. 2][Construction or No. 2][Construction, Stud, or No. 3]** .
2. Species:
 - a. Hem-fir (north); NLGA.
 - b. Southern pine; SPIB.
 - c. Douglas fir-larch; WCLIB or WWPA.
 - d. Southern pine or mixed southern pine; SPIB.

- e. Spruce-pine-fir; NLGA.
- f. Douglas fir-south; WWPA.
- g. Hem-fir; WCLIB or WWPA.
- h. Douglas fir-larch (north); NLGA.
- i. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

G. Joists, Rafters, and Other Framing by Performance:

- 1. Performance Requirement: Any species and grade with a modulus of elasticity of at least [1,500,000 psi (10 350 MPa)][1,300,000 psi (8970 MPa)][1,100,000 psi (7590 MPa)][1,000,000 psi (6900 MPa)][900,000 psi (6210 MPa)] and an extreme fiber stress in bending of at least [1000 psi (6.9 MPa)][850 psi (5.86 MPa)][700 psi (4.83 MPa)][600 psi (4.14 MPa)][500 psi (3.45 MPa)] for 2-inch nominal (38-mm actual) thickness and 12-inch nominal (286-mm actual) width for single-member use.

H. Exposed Framing: Hand-select material [**indicated to receive a stained or natural finish**] for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

1. Species and Grade:

- a. As indicated above for load-bearing construction of same type.
- b. Hem-fir (north); [**Select Structural**][**No. 1**] grade; NLGA.
- c. Southern pine; [**Select Structural**][**No. 1**][**No. 2**] grade; SPIB.
- d. Douglas fir-larch; [**Select Structural**][**No. 1**] grade; WCLIB or WWPA.
- e. Mixed southern pine; [**Select Structural**][**No. 1**][**No. 2**] grade; SPIB.
- f. Spruce-pine-fir; [**Select Structural**][**No. 1**] grade; NLGA.
- g. Douglas fir-south; [**Select Structural**][**No. 1**] grade; WWPA.
- h. Hem-fir; [**Select Structural**][**No. 1**] grade; WCLIB or WWPA.
- i. Douglas fir-larch (north); [**Select Structural**][**No. 1**] grade; NLGA.
- j. Spruce-pine-fir (south); [**Select Structural**][**No. 1**] grade; NeLMA, WCLIB, or WWPA.
- k. Eastern hemlock-balsam fir or eastern hemlock-tamarack; [**Select Structural**][**No. 1**] grade; NeLMA.
- l. Beech-birch-hickory; [**Select Structural**][**No. 1**] grade; NeLMA.
- m. Northern red oak; [**Select Structural**][**No. 1**] grade; NeLMA.
- n. Redwood; [**Clear Heart Structural**][**Clear Structural**][**Select Structural**][**No. 1**] grade; RIS.
- o. Mixed oak; [**Select Structural**][**No. 1**] grade; NeLMA.
- p. Mixed maple; [**Select Structural**][**No. 1**] grade; NeLMA.
- q. Western cedars; [**Select Structural**][**No. 1**] grade; WCLIB or WWPA.

2.5 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

- 1. Blocking.
- 2. Nailers.
- 3. Rooftop equipment bases and support curbs.
- 4. Cants.
- 5. Furring.
- 6. Grounds.
- 7. Utility shelving.

B. Dimension Lumber Items:

1. Grade: **[Construction or No. 2][Standard, Stud, or No. 3]** .
2. Species: **[Any species.][Any of the following species:][The following species:]**
 - a. Hem-fir (north); NLGA.
 - b. Mixed southern pine or southern pine; SPIB.
 - c. Spruce-pine-fir; NLGA.
 - d. Hem-fir; WCLIB or WWPA.
 - e. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 - f. Western woods; WCLIB or WWPA.
 - g. Northern species; NLGA.
 - h. Eastern softwoods; NeLMA.

C. Utility Shelving:

1. Lumber Moisture Content: **[15][19]** percent maximum.
2. Species and Grade:
 - a. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; **[Premium or No. 2 Common (Sterling)][Standard or No. 3 Common]** grade; NeLMA, NLGA, WCLIB, or WWPA.
 - b. Mixed southern pine or southern pine; No. **[1][2]** grade; SPIB.
 - c. Hem-fir or hem-fir (north); **[Select Merchantable or No. 1 Common][Construction or No. 2 Common]** grade; NLGA, WCLIB, or WWPA.
 - d. Spruce-pine-fir (south) or spruce-pine-fir; **[Select Merchantable or No. 1 Common][Construction or No. 2 Common]** grade; NeLMA, NLGA, WCLIB, or WWPA.

D. Concealed Boards:

1. Lumber Moisture Content: **[15][19]** percent maximum.
2. Species and Grade: **[Any of the following:][The following:]**
 - a. Mixed southern pine or southern pine; No. **[2][3]** grade; SPIB.
 - b. Hem-fir or hem-fir (north); **[Construction or No. 2 Common][Standard or No. 3 Common]** grade; NLGA, WCLIB, or WWPA.
 - c. Spruce-pine-fir (south) or spruce-pine-fir; **[Construction or No. 2 Common][Standard or No. 3 Common]** grade; NeLMA, NLGA, WCLIB, or WWPA.
 - d. Eastern softwoods; No. **[2][3]** Common grade; NeLMA.
 - e. Northern species; No. **[2][3]** Common grade; NLGA.
 - f. Western woods; **[Construction or No. 2 Common][Standard or No. 3 Common]** grade; WCLIB or WWPA.

E. Roofing Nailers: Structural- or No. 2-grade lumber or better; kiln-dried Douglas fir, southern pine, or wood having similar decay-resistant properties.

F. Wood Blocking: For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

G. Wood Furring: For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1.
1. Grade: **[Exterior, A-C][Exterior, C-C Plugged][Exposure 1, C-D Plugged][, fire-retardant treated]** .
 2. Thickness: As indicated on the drawings or, if not indicated, not less than **[1/2-inch (13-mm)][3/4-inch (19-mm)]** nominal thickness.

2.7 FASTENERS

- A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than **1-1/2 inches (38 mm)** into wood substrate.
1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners **[with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329][of Type 304 stainless steel]** .
 2. For redwood, use **[brass/bronze][stainless steel][hot-dip galvanized-steel]** fasteners.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on **[ICC-ES AC01][ICC-ES AC58][ICC-ES AC193][or][ICC-ES AC308]** as appropriate for the substrate.

2.8 ACCESSORIES

- A. Metal Framing Anchors:
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[MiTek Industries, Inc.]**
 - b. **[Simpson Strong-Tie Co., Inc.]**
 - c. **[Tamlyn]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[MiTek Industries, Inc.]**
 - b. **[Simpson Strong-Tie Co., Inc.]**
 - c. **[Tamlyn]**
 - d. **<Insert manufacturer's name>**

3. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post **1 inch (25 mm)** above base and with **2-inch- (50-mm-)** minimum side cover, socket **0.062 inch (1.6 mm)** thick, and standoff and adjustment plates **0.108 inch (2.8 mm)** thick.
4. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.
 - a. Width: **[3/4 inch (19 mm)][1-1/4 inches (32 mm)]** .
 - b. Thickness: **[0.050 inch (1.3 mm)][0.062 inch (1.6 mm)]** .
 - c. Length: **[16 inches (400 mm)][24 inches (600 mm)][As indicated]** .
5. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, **1-1/2 inches (38 mm)** wide by **0.050 inch (1.3 mm)** thick. [**Tie fastens to side of rafter or truss, face of top plates, and side of stud below.**]
6. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, **2-1/4 inches (57 mm)** wide by **0.062 inch (1.6 mm)** thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.
7. Floor-to-Floor Ties: Flat straps, with holes for fasteners, for tying upper floor wall studs to band joists and lower floor studs, **1-1/4 inches (32 mm)** wide by **0.050 inch (1.3 mm)** thick by **36 inches (914 mm)** long.
8. Hold-Downs: Brackets for bolting to wall studs and securing to foundation walls with anchor bolts or to other hold-downs with threaded rods and designed with first of two bolts placed seven bolt diameters from reinforced base.
 - a. Bolt Diameter: **[5/8 inch (15.8 mm)][3/4 inch (19 mm)]** .
 - b. Width: **[2-1/2 inches (64 mm)][3-3/16 inches (81 mm)]** .
 - c. Body Thickness: **[0.108 inch (2.8 mm)][0.138 inch (3.5 mm)]** .
 - d. Base Reinforcement Thickness: **[0.108 inch (2.8 mm)][0.239 inch (6.1 mm)]** .
9. Wall Bracing:
 - a. T-shaped bracing made for letting into studs in saw kerf, **1-1/8 inches (29 mm)** wide by **9/16 inch (14 mm)** deep by **0.034 inch (0.85 mm)** thick with hemmed edges.
 - b. Angle bracing made for letting into studs in saw kerf, **15/16 by 15/16 by 0.040 inch (24 by 24 by 1 mm)** thick with hemmed edges.
10. Materials: Unless otherwise indicated, fabricate from the following materials:
 - a. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, **G60 (Z180)** coating designation.
 - 1) Use for interior locations unless otherwise indicated.
 - b. Heavy-Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); **G185 (Z550)** coating designation; and not less than **0.036 inch (0.9 mm)** thick.
 - 1) Use for wood-preservative-treated lumber and where indicated.
 - c. Stainless steel bars and shapes complying with ASTM A276/A276M.
 - 1) Stainless Steel: Type **[304][316]** .
 - 2) Use for exterior locations and where indicated.

B. Sill-Sealer Gasket:

1. Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; **1-inch (25-mm)** nominal thickness, compressible to **1/32 inch (0.8 mm)**; selected from manufacturer's standard widths to suit width of sill members indicated.
 2. Closed-cell neoprene foam, **1/4 inch (6.4 mm)** thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- C. Sill-Sealer Gasket and Termite Barrier: Self-adhering sheet consisting of **64 mils (1.6 mm)** of rubberized asphalt laminated on one side to a **4-mil- (0.10-mm-)** thick, polyethylene-film reinforcement, and with release liner on adhesive side [; **formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction**] .
- D. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than **0.025 inch (0.6 mm)**.
1. Compound Material: [**Butyl rubber**][or][**rubberized asphalt**] .
- E. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
1. Verify adhesives have a VOC content of **[70]<Insert number>** g/L or less.
 2. Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 3. Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 4. Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.
- F. Water-Repellent Preservative: Formulation containing 3-iodo-2-propynyl butylcarbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION OF ROUGH CARPENTRY, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate [**furring,**] nailers, blocking, [**grounds,**] and similar supports to comply with requirements for attaching other construction.
- C. Plywood Backing Panels: Install backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. [**Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.**]
- D. Metal Framing Anchors: Install anchors to comply with manufacturer's written instructions. Install

fasteners through each fastener hole.

- E. Sill-Sealer Gasket: Install gasket to form continuous seal between sill plates and foundation walls.
- F. Sill-Sealer Gasket and Termite Barrier: Install gasket and termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.
- G. Do not splice structural members between supports unless otherwise indicated.
- H. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than **16 inches (406 mm)** o.c.
- I. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than **96 inches (2438 mm)** o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than **96 inches (2438 mm)** o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and **2-inch nominal (38-mm actual)** thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than **100 sq. ft. (9.3 sq. m)** and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than **20 ft. (6 m)** o.c.
- J. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- K. Field Application of Preservative Treatment: Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron (SBX) for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- L. Flexible Flashing: Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- M. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.10.1, "Fastening Schedule," in ICC's "International Building Code" (IBC).
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."
 - 3. ICC-ES evaluation report for fastener.
- N. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight

connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF ROOFING NAILERS

- A. Install roofing nailers where indicated on Drawings and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.
- C. Securely attach roofing nailers to substrate to resist the designed outward and upward wind loads indicated on Drawings and in accordance with SPRI ED-1, Tables A6 and A7.

3.3 INSTALLATION OF WOOD BLOCKING

- A. Install wood blocking where indicated on Drawings and where required for [**screeding or**] attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than **1-1/2 inches (38 mm)** wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.4 INSTALLATION OF WOOD FURRING

- A. Install wood furring level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Hardboard Paneling: Install **1-by-3-inch nominal- (19-by-63-mm actual-)** size furring [**horizontally**][**and**][**vertically**] at [**24 inches (610 mm)**][**600 mm**] o.c.
- C. Furring to Receive Gypsum Board or Plaster Lath: Install **1-by-2-inch nominal- (19-by-38-mm actual-)** size furring vertically at [**16 inches (406 mm)**][**400 mm**] o.c.

3.5 INSTALLATION OF WALL AND PARTITION FRAMING

- A. General: Provide single bottom plate and double top plates using members of **2-inch nominal (38-mm actual)** thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions [**and for load-bearing partitions where framing members bearing on partition are located directly over studs**] . Fasten plates to supporting construction unless otherwise indicated.
 - 1. For exterior walls, provide [**2-by-6-inch nominal- (38-by-140-mm actual-)**][**2-by-4-inch nominal- (38-by-89-mm actual-)**] size wood studs spaced [**24 inches (610 mm)**][**16 inches (406 mm)**][**600 mm**][**400 mm**] o.c. unless otherwise indicated.
 - 2. For interior partitions and walls, provide [**2-by-6-inch nominal- (38-by-140-mm actual-)**][**2-by-4-inch nominal- (38-by-89-mm actual-)**][**2-by-3-inch nominal- (38-by-64-mm actual-)**] size wood studs spaced [**24 inches (610 mm)**][**16 inches (406 mm)**][**600 mm**][**400 mm**] o.c. unless

- otherwise indicated.
- 3. Provide continuous horizontal blocking at midheight of partitions more than **96 inches (2438 mm)** high, using members of **2-inch nominal (38-mm actual)** thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs [, **except that two studs may be used for interior non-load-bearing partitions**] .
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
 - 1. For non-load-bearing partitions, provide double-jamb studs and headers not less than **4-inch nominal (89-mm actual)** depth for openings **48 inches (1200 mm)** and less in width, **6-inch nominal (140-mm actual)** depth for openings **48 to 72 inches (1200 to 1800 mm)** in width, **8-inch nominal (184-mm actual)** depth for openings **72 to 120 inches (1800 to 3000 mm)** in width, and not less than **10-inch nominal (235-mm actual)** depth for openings **10 to 12 ft. (3 to 3.6 m)** in width.
 - 2. For load-bearing walls, provide double-jamb studs for openings **60 inches (1500 mm)** and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated [**or, if not indicated, in accordance with Table R602.7(1) or Table R602.7(2), as applicable, in ICC's "International Residential Code for One- and Two-Family Dwellings"**] .
- D. Provide diagonal bracing in [**exterior walls, at both walls of each external corner**][**walls, at locations indicated on Drawings**] , at 45-degree angle, full-story height unless otherwise indicated. Use [**1-by-4-inch nominal- (19-by-89-mm actual-) size boards, let-in flush with faces of studs**][**metal wall bracing, let into studs in saw kerf**] .

3.6 INSTALLATION OF FLOOR JOIST FRAMING

- A. General: Install floor joists with crown edge up and support ends of each member with not less than **1-1/2 inches (38 mm)** of bearing on wood or metal, or **3 inches (76 mm)** on masonry. Attach floor joists as follows:
 - 1. Where supported on wood members, by [**toe nailing or by**] using metal framing anchors.
 - 2. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.
- B. Fire Cuts: At joists built into masonry, bevel cut ends **3 inches (76 mm)** and do not embed more than **4 inches (102 mm)**.
- C. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds **48 inches (1200 mm)**.
- D. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than one-third depth of joist; do not locate closer than **2 inches (50 mm)** from top or bottom.
- E. Provide solid blocking of **2-inch nominal (38-mm actual)** thickness by depth of joist at ends of joists unless nailed to header or band.
- F. Lap members framing from opposite sides of beams, girders, or partitions not less than **4 inches (102 mm)** or securely tie opposing members together. Provide solid blocking of **2-inch nominal (38-mm actual)** thickness by depth of joist over supports.
- G. Anchor members paralleling masonry with **1/4-by-1-1/4-inch (6.4-by-32-mm)** metal strap anchors

spaced not more than **96 inches (2438 mm)** o.c., extending over and fastening to three joists. Embed anchors at least **4 inches (102 mm)** into grouted masonry with ends bent at right angles and extending **4 inches (102 mm)** beyond bend.

- H. Provide solid blocking between joists under jamb studs for openings.
- I. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.
 - 1. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.
- J. Provide bridging of type indicated below, at intervals of **96 inches (2438 mm)** o.c., between joists.
 - 1. Diagonal wood bridging formed from bevel-cut, **1-by-3-inch nominal- (19-by-64-mm actual-)** size lumber, double-crossed and nailed at both ends to joists.
 - 2. Steel bridging installed to comply with bridging manufacturer's written instructions.

3.7 INSTALLATION OF CEILING JOIST AND RAFTER FRAMING

- A. Ceiling Joists: Install with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
 - 1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate, and nail to first joist or anchor with framing anchors or metal straps. Provide **1-by-8-inch nominal- (19-by-184-mm actual-)** size or **2-by-4-inch nominal- (38-by-89-mm actual-)** size stringers spaced **48 inches (1200 mm)** o.c. crosswise over main ceiling joists.
- B. Rafters: Notch to fit exterior wall plates and [**toe nail or**] use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
 - 1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and **2 inches (50 mm)** deeper. Bevel ends of jack rafters for full bearing against valley rafters.
 - 2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and **2 inches (50 mm)** deeper. Bevel ends of jack rafters for full bearing against hip rafter.
- C. Provide collar beams (ties) as indicated or, if not indicated, provide **1-by-6-inch nominal- (19-by-140-mm actual-)** size boards between every third pair of rafters, but not more than **48 inches (1219 mm)** o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.
- D. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

3.8 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.



END OF SECTION 06 10 00 00



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06 - Wood, Plastics, and Composites

Task	Specification	Specification Description
06 11 13 00	06 10 00 00	Rough Carpentry
06 11 16 00	01 11 19 00	No Specification Required
06 11 16 00	06 10 00 00	Rough Carpentry



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SECTION 06 13 00 00 - HEAVY TIMBER CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Timber.
2. Round wood poles.
3. Preservative-treated wood material.
4. Timber connectors.
5. Miscellaneous materials.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for dimension lumber items associated with heavy timber framing.
2. Section 061516 "Wood Roof Decking."
3. Section 061800 "Glued-Laminated Construction."

1.2 DEFINITIONS

- A. Timbers:** Lumber of **5 inches nominal (114 mm actual)** or greater in least dimension.
- B. Poles:** Round wood members, called either "poles" or "posts" in the referenced standards.
- C. Inspection agencies, and the abbreviations used to reference them, include the following:**
1. NeLMA: Northeastern Lumber Manufacturers' Association.
 2. NHLA: National Hardwood Lumber Association.
 3. NLGA: National Lumber Grades Authority.
 4. SPIB: Southern Pine Inspection Bureau (The).
 5. WCLIB: West Coast Lumber Inspection Bureau.
 6. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

A. Product Data: For **[preservative-treated wood products][and][timber connectors]**.

1. For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
2. For timber connectors. Include installation instructions.

B. Sustainable Design Submittals:

1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
2. Environmental Product Declaration (EPD): For each product.

3. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
4. Environmental Product Declaration: For each product.
5. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
6. Environmental Product Declaration: For each product.
7. Environmental Product Declaration: For each product.
8. Third-Party Certifications: For each product.
9. Third-Party Certified Life Cycle Assessment: For each product.
10. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
11. Chain-of-Custody Qualification Data: For manufacturer and vendor.

C. Shop Drawings: For heavy timber framing. Show layout, dimensions of each member, and details of connections.

D. Samples: Not less than **[5 inches (127 mm)][7 inches (178 mm)][9 inches (229 mm)]<Insert dimension>** wide by **24 inches (600 mm)** long, showing the range of variation to be expected in appearance, including surface texture, of wood products. **[Apply a coat of penetrating sealer to Samples.]**

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For timbers specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by ALSC's Board of Review.
2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained. **[For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.]**

B. Certificates of Inspection: Issued by lumber-grading agency for exposed timber not marked with grade stamp.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.
- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- D. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Schedule delivery of materials to avoid extended on-site storage and to avoid delaying the Work.
- B. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings.

PART 2 - PRODUCTS

2.1 WOOD MATERIALS, GENERAL

- A. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- B. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site.
- C. Regional Materials: Wood products shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- D. Indigenous Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- E. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- F. Certified Wood: Wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.
- G. Certified Wood: Wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.
- H. Certified Wood: Wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
- I. Certified Wood: Wood products shall [**contain not less than 60 percent**][**be made from**] certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."
- J. Certified Wood: Wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.

2.2 TIMBER

- A. Comply with DOC PS 20 and with grading rules of lumber-grading agencies certified by ALSC's Board of Review as applicable.
 - 1. Factory mark each item of timber with grade stamp of grading agency.
 - 2. For exposed timber indicated to receive a stained or natural finish, apply grade stamps to surfaces that are not exposed to view, or omit grade stamps and provide certificates of grade compliance issued by grading agency.
- B. Timber Species and Grade:
 - 1. Balsam fir, Douglas fir-larch, Douglas fir-larch (North), eastern hemlock tamarack (North), hem-fir, southern pine, western hemlock, or western hemlock (North); **[Select Structural][No. 1][No. 2]**, NeLMA, NLGA, SPIB, WCLIB, or WWPA.
 - 2. Alaska cedar; **[Select Structural][No. 1][No. 2]**, WCLIB.
 - 3. Douglas fir-larch or Douglas fir-larch (North); **[Dense Select Structural][Select Structural][No. 1 Dense][No. 1][No. 2]**, NLGA, WCLIB, or WWPA.
 - 4. Hem-fir or hem-fir (North); **[Select Structural][No. 1][No. 2]**, NLGA, WCLIB, or WWPA.
 - 5. Southern pine; **[Dense Select Structural][Select Structural][No. 1 Dense][No. 1][No. 2 Dense][No. 2]**, SPIB.
 - 6. **[Beech-birch-hickory][Mixed maple][Mixed oak][Northern red oak][Red maple][Red oak][White oak]**; **[Select Structural][No. 1][No. 2]**, NeLMA.
 - 7. **[Mixed hardwoods][Mixed oak][Red oak][White oak]<Insert species>**; **[Select Dimension][Common Dimension][Sound Square Edge]**, NHLA.
- C. Structural Properties: Provide any species and grade that, for moisture content provided, complies with required structural properties.
 - 1. Allowable Stress Ratings for 12-Inch Nominal (286-mm Actual) Depth: **[Fb 1500 psi (10.3 MPa) and E 1,500,000 psi (10 340 MPa)][Fb 1300 psi (9.0 MPa) and E 1,300,000 psi (8 960 MPa)][As indicated on Drawings]<Insert values>**.
- D. Moisture Content: Provide timber with 19 percent maximum moisture content at time of dressing **[or provide timber that is unseasoned at time of dressing but with 19 percent maximum moisture content at time of installation]**.
- E. Dressing: Provide **[dressed timber (S4S)][timber that is rough sawn (Rgh)]** unless otherwise indicated.

2.3 ROUND WOOD POLES

- A. Round Wood Poles: Clean-peeled wood poles complying with ASTM D3200; with at least 80 percent of inner bark removed and with knots and limbs cut flush with the surface.
- B. Species: **<Insert species required>**.

2.4 PRESERVATIVE-TREATED WOOD MATERIAL

- A. Pressure-treat materials with waterborne preservative according to AWPA U1; Use Category UC2 **[for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground]**.

- B. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - 1. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not contain colorants, bleed through, or otherwise adversely affect finishes.
- C. Use process that includes water-repellent treatment.
- D. Use process that does not include water repellents or other substances that might interfere with application of indicated finishes.
- E. After treatment, redry materials to 19 percent maximum moisture content.
- F. Mark treated materials with treatment quality mark of an inspection agency approved by ALSC's Board of Review.
 - 1. For exposed items indicated to receive a stained or natural finish, **[mark each piece on surface that is not exposed][or][omit marking and provide certificates of treatment compliance issued by inspection agency].**
- G. Application: **[Treat all heavy timber framing unless otherwise indicated.][Treat items indicated on Drawings and the following:]**
 - 1. Sills and similar members in contact with masonry or concrete.
 - 2. Timber framing members less than **18 inches (460 mm)** above grade.

2.5 TIMBER CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - 1. **[Halfen USA, Inc.]**
 - 2. **[Simpson Strong-Tie Co., Inc.]**
 - 3. **[USP Structural Connectors]**
 - 4. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1. **[Halfen USA, Inc.]**
 - 2. **[Simpson Strong-Tie Co., Inc.]**
 - 3. **[USP Structural Connectors]**
 - 4. **<Insert manufacturer's name>**
- C. Fabricate beam seats from **[steel][stainless steel]** with **[0.239-inch (6-mm)][3/16-inch (5-mm)][3/8-inch (9.5-mm)]** bearing plates, **3/4-inch- (19-mm-)** diameter-by-**12-inch- (300-mm-)** long deformed bar anchors, and **0.239-inch (6-mm)** side plates.
- D. Fabricate beam hangers from **[steel][stainless steel]** with **0.179-inch (4.6-mm)** stirrups and **0.239-inch (6-mm)** top plates.
- E. Fabricate strap ties from **[steel][stainless steel]**, **[2-1/2 inches (63 mm) wide by 0.179 inch (4.6 mm)][3 inches (75 mm) wide by 0.239 inch (6 mm)]** thick.

- F. Fabricate tie rods from round steel bars with upset threads connected with forged-steel turnbuckles complying with ASTM A668/A668M.
- G. Provide bolts, **3/4 inch (19 mm)** unless otherwise indicated, complying with **ASTM A307, Grade A (ASTM F568M, Property Class 4.6)**; provide nuts complying with **ASTM A563 (ASTM A563M)**; and, where indicated, provide flat washers.
- H. Provide stainless steel bolts, **3/4 inch (19 mm)** unless otherwise indicated, complying with **ASTM F593, Alloy Group 1 or 2 (ASTM F738M, Grade A1 or A4)**; provide nuts complying with **ASTM F594, Alloy Group 1 or 2 (ASTM F836M, Grade A1 or A4)**; and, where indicated, provide flat washers.
- I. Provide shear plates, **[2-5/8 inches (66.7 mm)][4 inches (102 mm)]** in diameter, complying with ASTM D5933.
- J. Materials: Unless otherwise indicated, fabricate from the following materials:
 - 1. Structural-steel shapes, plates, and flat bars complying with ASTM A36/A36M.
 - 2. Round steel bars complying with ASTM A575, Grade M 1020.
 - 3. Hot-rolled steel sheet complying with ASTM A1011/A1011M, Structural Steel, Type SS, Grade 33.
 - 4. Stainless steel plate, sheet, and strip complying with ASTM 240/A240M or ASTM A666, **[Type 304][Type 316]**.
 - 5. Stainless steel flat bars complying with ASTM A666, **[Type 304][Type 316]**.
 - 6. Stainless steel bars and shapes complying with ASTM A276, **[Type 304][Type 316]**.
- K. Finish steel assemblies and fasteners with rust-inhibitive primer, **2-mil (0.05-mm)** dry film thickness.
- L. Hot-dip galvanize steel assemblies and fasteners after fabrication to comply with ASTM A123/A123M or ASTM A153/A153M.

2.6 MISCELLANEOUS MATERIALS

- A. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
- B. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

2.7 FABRICATION

- A. Camber: Fabricate horizontal members and inclined members with a slope of less than 1:1, with natural convex bow (crown) up, to provide camber.
- B. Shop fabricate members by cutting and restoring exposed surfaces to match specified surfacing. Finish exposed surfaces to remove planing or surfacing marks, and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
- C. Predrill for fasteners and assembly of units.
- D. Where preservative-treated members are indicated, fabricate (cut, drill, surface, and sand) before treatment to greatest extent possible. Where fabrication must be done after treatment, apply a field-treatment preservative to comply with AWPA M4.

1. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.
 2. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.
- E. Coat crosscuts with end sealer.
- F. Seal Coat: After fabricating and surfacing each unit, apply a saturation coat of penetrating sealer on surfaces of each unit except for treated wood where the treatment included a water repellent.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Erect heavy timber framing true and plumb. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
1. Install horizontal and sloping members with crown edge up, and provide not less than **4 inches (102 mm)** of bearing on supports. Provide continuous members unless otherwise indicated; tie together over supports with metal strap ties if not continuous.
 2. Handle and temporarily support heavy timber framing to prevent surface damage, compression, and other effects that might interfere with indicated finish.
- B. Framing Built into Masonry: Provide **1/2-inch (13-mm)** clearance at tops, sides, and ends of members built into masonry, and bevel cut ends **3 inches (76 mm)**; do not embed more than **4 inches (102 mm)** unless otherwise indicated.
- C. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.
- D. Fitting: Fit members by cutting and restoring exposed surfaces to match specified surfacing.
1. Predrill for fasteners using timber connectors as templates.
 2. Finish exposed surfaces to remove planing or surfacing marks, and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
 3. Coat crosscuts with end sealer.
 4. Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWP A M4.
 - a. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.
 - b. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.
- E. Install timber connectors as indicated.
1. Unless otherwise indicated, install bolts with same orientation within each connection and in similar connections.
 2. Install bolts with orientation as indicated or, if not indicated, as directed by Architect.

3.2 ADJUSTING

- A. Repair damaged surfaces and finishes after completing erection. Replace damaged heavy timber framing if repairs are not approved by Architect.

END OF SECTION 06 13 00 00



06 - Wood, Plastics, and Composites

Task	Specification	Specification Description
06 13 23 00	06 13 00 00	Heavy Timber Construction



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SECTION 06 15 00 00 - WOOD ROOF DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-sawn wood roof decking.
2. Glued-laminated wood roof decking.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for dimension lumber items associated with wood roof decking.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For glued-laminated wood roof decking, include installation instructions and data on lumber, adhesives, and fabrication.
2. For preservative-treated wood products, include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

B. Sustainable Design Submittals:

1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
2. Environmental Product Declaration (EPD): For each product.
3. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
4. Environmental Product Declaration: For each product.
5. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
6. Environmental Product Declaration: For each product.
7. Environmental Product Declaration: For each product.
8. Third-Party Certifications: For each product.
9. Third-Party Certified Life Cycle Assessment: For each product.
10. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
11. Chain-of-Custody Qualification Data: For manufacturer and vendor.

C. Samples: **24 inches (600 mm)** long, showing the range of variation to be expected in appearance of wood roof decking.

1.3 INFORMATIONAL SUBMITTALS

- A. Research/Evaluation Reports: For glued-laminated wood roof decking indicated to be of diaphragm design and construction, from ICC-ES.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.
- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- D. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Schedule delivery of wood roof decking to avoid extended on-site storage and to avoid delaying the Work.
- B. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings. Stack wood roof decking with surfaces that are to be exposed in the final Work protected from exposure to sunlight.

PART 2 - PRODUCTS

2.1 WOOD ROOF DECKING, GENERAL

- A. General: Comply with DOC PS 20 and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.
- B. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- C. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site.
- D. Regional Materials: Wood products shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- E. Indigenous Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.

- F. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- G. Certified Wood: Wood products shall be certified as "FSC Pure"[**or "FSC Mixed Credit"**] according to FSC STD-01-001 and FSC STD-40-004.
- H. Certified Wood: Wood products shall be certified as "FSC Pure"[**or "FSC Mixed Credit"**] according to FSC STD-01-001 and FSC STD-40-004.
- I. Certified Wood: Wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
- J. Certified Wood: Wood products shall **[contain not less than 60 percent][be made from]** certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."
- K. Certified Wood: Wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.

2.2 SOLID-SAWN WOOD ROOF DECKING

- A. Standard for Solid-Sawn Wood Roof Decking: Comply with AITC 112.
- B. Roof Decking Species:
 - 1. Balsam fir, Douglas fir-larch, Douglas fir-larch (North), hem-fir, hem-fir (North), southern pine, spruce pine-fir (North), western hemlock, or western hemlock (North).
 - 2. **[Alaska cedar][Balsam fir][Douglas fir-larch or Douglas fir-larch (North)][Eastern spruce][Hem-fir or hem-fir (North)][Southern pine]<Insert species>**.
- C. Roof Decking Nominal Size: **[2 by 6][2 by 8][3 by 6][4 by 6]**.
- D. Roof Decking Grade:
 - 1. **[Select(ed)][Commercial]** Decking.
 - 2. **[Dense Standard][Dense Select][Select][Dense Commercial][Commercial]** Decking.
 - 3. **[Select(ed) Decking or Select Dex][Commercial Decking or Commercial Dex]**.
- E. Grade Stamps: Factory mark each item with grade stamp of grading agency. Apply grade stamp to surfaces that are not exposed to view.
- F. Moisture Content: Provide wood roof decking with **[15][19]** percent maximum moisture content at time of dressing.
- G. Face Surface: **[Rough sanded or wire brushed][Saw textured][Smooth]**.
- H. Edge Pattern: **[Beaded edge][Bullnosed][Channel grooved][Vee grooved]**.

2.3 GLUED-LAMINATED WOOD ROOF DECKING

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[Structural Wood Systems; A Division of Harrison Industries]**
 2. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Structural Wood Systems; A Division of Harrison Industries]**
 2. **<Insert manufacturer's name>**
- C. Face Species: **[Alaska cedar][Douglas fir-larch or Douglas fir-larch (North)][Ponderosa pine][Southern pine][Western cedars or western cedars (North)]<Insert species>**.
- D. Roof Decking Nominal Size: **[2 by 6][2 by 8][3 by 6][3 by 8][4 by 6][4 by 8][5 by 6][5 by 8]**.
- E. Roof Decking Configuration: For glued-laminated wood roof decking indicated to be of diaphragm design and construction, provide tongue-and-groove configuration that complies with research/evaluation report.
- F. Face Grade:
1. Custom or Supreme: Clear face is required. Occasional pieces may contain a small knot or minor characteristic that does not detract from the overall appearance.
 2. Decorative: Sound knots and natural characteristics are allowed, including chipped edge knots, short end splits, seasoning checks, and some pin holes. Face knot holes, stains, end slits, skips, roller splits, and planer burns are not allowed.
 3. Service: Face knot holes, stains, end splits, skips, roller splits, planer burns, and other nonstrength-reducing characteristics are allowed. Strength-reducing characteristics are not allowed.
- G. Moisture Content: Provide wood roof decking with 15 percent maximum moisture content at time of dressing.
- H. Face Surface: **[Rough sanded or wire brushed][Saw textured][Smooth]**.
- I. Edge Pattern: **[Beaded edge][Bullnosed][Channel grooved][Vee grooved]**.
- J. Laminating Adhesive: Wet-use type complying with ASTM D2559.

2.4 PRESERVATIVE TREATMENT

- A. Pressure treat wood roof decking in accordance with AWP A U1; Use Category UC2.
1. For laminated roof decking, treat lumber before gluing.
- B. Preservative Chemicals: **[Inorganic boron (SBX)][Acceptable to authorities having jurisdiction and containing no arsenic or chromium]**.

1. For exposed items indicated to receive a stained or natural finish, use products that do not contain colorants, bleed through, or otherwise adversely affect finishes.
- C. Use process that includes water-repellent treatment.
- D. Use process that does not include water repellents or other substances that might interfere with application of indicated finishes.
- E. After treatment, redry materials to **[15][19]** percent maximum moisture content.
- F. After dressing and fabricating roof decking, apply **[inorganic boron][copper naphthenate]** in accordance with AWPA M4 to surfaces cut to a depth of more than **1/16 inch (1.5 mm)**.

2.5 ACCESSORY MATERIALS

- A. Fasteners for Solid-Sawn Roof Decking: Provide fastener size and type complying with AITC 112 for thickness of deck used.
- B. Fasteners for Glued-Laminated Roof Decking: Provide fastener size and type complying with requirements in "Installation" Article for installing laminated roof decking.
- C. Nails: Common; complying with ASTM F1667, Type I, Style 10.
- D. Spikes: Round; complying with ASTM F1667, Type III, Style 3.
- E. Fastener Material: Hot-dip galvanized steel.
- F. Bolts for Anchoring Roof Decking to Walls: Carbon steel; complying with **ASTM A307 (ASTM F568M)** with **ASTM A563 (ASTM A563M)** hex nuts and, where indicated, flat washers[, **all hot-dip zinc coated**].
- G. Installation Adhesive: For glued-laminated wood roof decking indicated to be of diaphragm design and construction, provide adhesive that complies with research/evaluation report.
- H. Sealants: Latex, complying with applicable requirements in Section 079200 "Joint Sealants" and recommended by sealant manufacturer and manufacturer of substrates for intended application.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Bostik; Arkema]**
 - b. **[May National Associates, Inc.; a subsidiary of Sika Corporation]**
 - c. **[Pecora Corporation]**
 - d. **[Permthane; a Holcim brand]**
 - e. **[Tremco Incorporated]**
 - f. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Bostik; Arkema]**

- b. [May National Associates, Inc.; a subsidiary of Sika Corporation]
- c. [Pecora Corporation]
- d. [Permthane; a Holcim brand]
- e. [Tremco Incorporated]
- f. <Insert manufacturer's name>

- I. Penetrating Sealer: Clear sanding sealer complying with Section 099300 "Staining and Transparent Finishing" and compatible with topcoats specified for use over it.

2.6 FABRICATION

- A. Shop Fabrication: Where preservative-treated roof decking is indicated, complete cutting, trimming, surfacing, and sanding before treating.
- B. Predrill roof decking for lateral spiking to adjacent units to comply with AITC 112.
- C. Seal Coat: After fabricating and surfacing roof decking, apply a saturation coat of penetrating sealer[in fabrication shop].
- D. Apply indicated finish materials to comply with Section 099300 "Staining and Transparent Finishing" in fabrication shop.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and support framing in areas to receive wood roof decking for compliance with installation tolerances and other conditions affecting performance of wood roof decking.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install solid-sawn wood roof decking to comply with AITC 112.
 - 1. Locate end joints for [two-span continuous lay-up][combination simple and two-span continuous lay-up][controlled random lay-up][lay-up indicated].
- B. Install laminated wood roof decking to comply with manufacturer's written instructions.
 - 1. Locate end joints for [two-span continuous lay-up][combination simple and two-span continuous lay-up][controlled random lay-up][lay-up indicated].
 - 2. Nail each course of glued-laminated wood roof decking at each support with one nail slant nailed above the tongue and one nail straight nailed through the face.
 - a. Use 12d nails for 2-by-6 and 2-by-8 roof decking.
 - b. Use 30d nails for 3-by-6 and 3-by-8 roof decking.
 - c. Use 60d nails for 4-by-6 and 4-by-8 roof decking. Predrill roof decking to prevent splitting.
 - d. Use 30d tongue nails in bottom tongue and 3/8-inch (10-mm) face spikes for 5-by-6 and 5-by-8 roof decking. Predrill roof decking at spikes to prevent splitting.

3. Slant nail each course of glued-laminated wood roof decking to the tongue of the adjacent course at **30 inches (750 mm)** o.c. and within **12 inches (300 mm)** of the end of each unit. Stagger nailing **15 inches (380 mm)** in adjacent courses.
 - a. Use 6d nails for 2-by-6 and 2-by-8 roof decking.
 - b. Use 8d nails for 3-by-6 and 3-by-8 roof decking.
 - c. Use 10d nails for 4-by-6 and 4-by-8 roof decking.
 - d. Use 16d nails for 5-by-6 and 5-by-8 roof decking.
4. Glue adjoining roof decking courses together by applying a **3/8-inch (10-mm)** bead of adhesive to the top of tongues, according to research/evaluation report.
- C. Anchor wood roof decking, where supported on walls, with bolts as indicated.
- D. Where preservative-treated roof decking must be cut during erection, apply a field-treatment preservative to comply with AWPA M4.
 1. For solid-sawn roof decking, use inorganic boron (SBX).
 2. For laminated roof decking, use copper naphthenate.
- E. Apply joint sealant to seal roof decking at exterior walls at the following locations:
 1. Between roof decking and supports located at exterior walls.
 2. Between roof decking and exterior walls that butt against underside of roof decking.
 3. Between tongues and grooves of roof decking over exterior walls and supports at exterior walls.

3.3 ADJUSTING

- A. Repair damaged surfaces and finishes after completing erection. Replace damaged roof decking if repairs are not approved by Architect.

3.4 PROTECTION

- A. Provide water-resistive barrier over roof decking as the Work progresses to protect roof decking until roofing is applied.
- B. If, despite protection, **[inorganic boron (SBX)-treated]** roof decking becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 15 00 00

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SECTION 06 15 00 00A - WOOD PATIO DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood decking.
2. Wood stair treads.
3. Wood railings.
4. Wood benches.
5. Plastic decking.

B. Related Requirements:

1. Section 072500 "Weather Barriers" for flexible flashing used with patio decking.
2. Section 076200 "Sheet Metal Flashing and Trim" for sheet metal flashing used with patio decking.

1.2 DEFINITIONS

- A. Boards: Lumber of less than **2 inches nominal (38 mm actual)** in thickness and **2 inches nominal (38 mm actual)** or greater in width.
- B. Dimension Lumber: Lumber of **2 inches nominal (38 mm actual)** or greater but less than **5 inches nominal (114 mm actual)** in least dimension.
- C. Timber: Lumber of **5 inches nominal (114 mm actual)** or greater in least dimension.
- D. Lumber grading agencies, and the abbreviations used to reference them, include the following:
1. NeLMA: Northeastern Lumber Manufacturers' Association.
 2. NLGA: National Lumber Grades Authority.
 3. RIS: Redwood Inspection Service.
 4. SPIB: The Southern Pine Inspection Bureau.
 5. WCLIB: West Coast Lumber Inspection Bureau.
 6. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

A. Product Data: For **[preservative-treated wood products][plastic decking][and][metal framing anchors]**.

1. For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
2. For **[plastic decking][and][metal framing anchors]**. Include installation instructions.

B. Sustainable Design Submittals:

1. Product Certificates: For regional materials, indicating location of material manufacturer and point

of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.

2. Environmental Product Declaration (EPD): For each product.
3. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
4. Environmental Product Declaration: For each product.
5. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
6. Environmental Product Declaration: For each product.
7. Environmental Product Declaration: For each product.
8. Third-Party Certifications: For each product.
9. Third-Party Certified Life Cycle Assessment: For each product.
10. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
11. Chain-of-Custody Qualification Data: For manufacturer and vendor.

- C. Samples: For plastic decking, not less than **24 inches (600 mm)** long, showing the range of variation to be expected in appearance of decking, including surface texture.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by ALSC's Board of Review.
2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained. **[For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.]**

- B. Certificates of Inspection: Issued by lumber grading agency for exposed wood products not marked with grade stamp.

C. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood products.
2. Plastic decking.
3. Expansion anchors.
4. Metal framing anchors.
5. Decking fasteners.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

- B. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.

- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

- D. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.
- B. Handle and store plastic lumber to comply with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

- A. Comply with DOC PS 20 and with grading rules of lumber grading agencies certified by ALSC's Board of Review as applicable. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by ALSC's Board of Review.
1. Factory mark each item with grade stamp of grading agency.
 2. For items that are exposed to view in the completed Work, **[mark grade stamp on end or back of each piece][or][omit grade stamp and provide certificates of grade compliance issued by grading agency]**.
 3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
 4. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- C. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site.
- D. Regional Materials: Wood products shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- E. Indigenous Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- F. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- G. Certified Wood: Wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.
- H. Certified Wood: Wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to

FSC STD-01-001 and FSC STD-40-004.

- I. Certified Wood: Wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
- J. Certified Wood: Wood products shall **[contain not less than 60 percent][be made from]** certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."
- K. Certified Wood: Wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
- L. Maximum Moisture Content:
 - 1. Boards: **[15][19]** percent.
 - 2. Dimension Lumber: **[15 percent][19 percent][15 percent for 2-inch nominal (38-mm actual) thickness or less; 19 percent for more than 2-inch nominal (38-mm actual) thickness][15 percent for 2-inch nominal (38-mm actual) thickness or less; no limit for more than 2-inch nominal (38-mm actual) thickness][19 percent for 2-inch nominal (38-mm actual) thickness or less; no limit for more than 2-inch nominal (38-mm actual) thickness]**.
 - 3. Timber. **[19 percent][No limit]**.

2.2 WOOD DECKING

- A. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane.
- B. Dimension Lumber Decking:
 - 1. **[No. 2][Construction or No. 2]** grade and **[any of]** the following species:
 - a. Hem-fir or hem-fir (North); NLGA, WCLIB, or WWP.
 - b. Douglas fir-larch, Douglas fir-larch (North), or Douglas fir-south; NLGA, WCLIB, or WWP.
 - c. Mixed southern pine; SPIB.
 - d. Redwood; RIS.
 - 2. **[Deck Heart or Construction Heart][Deck Common or Construction Common]** redwood; RIS.
- C. Radius-Edged Board Decking: **[1-1/4-inch (32-mm)][1-inch (25-mm)][3/4-inch (19-mm)]** actual thickness of **[any of]** the following species and grades:
 - 1. Douglas fir-larch or Douglas fir-south, **[Patio 1][Patio 2]**; WWP.
 - 2. Douglas fir-larch, **[Select Dex][Commercial Dex]**; WCLIB.
 - 3. Douglas fir-larch (North), **[Select Patio][Commercial Patio]**; NLGA.
 - 4. Hem-fir, **[Patio 1][Patio 2]**; WWP.
 - 5. Hem-fir, **[Select Dex][Commercial Dex]**; WCLIB.
 - 6. Hem-fir (North), **[Select Patio][Commercial Patio]**; NLGA.
 - 7. Redwood, **[Heart Clear][Heart B or Select Heart]**; RIS.
 - 8. Southern pine, **[Premium][Standard]**; SPIB.
 - 9. Western red cedar, **[Patio 1][Patio 2]**; WWP.

10. Western red cedar, [Select Dex][Commercial Dex]; WCLIB.
 11. Western red cedar (North), [Select Patio][Commercial Patio]; NLGA.
- D. S4S Board Decking: [1-1/4-inch (32-mm)][1-inch (25-mm)][3/4-inch (19-mm)] actual thickness radius-edged, with one face free of planer skip, machine burn, and torn or chipped grain.
1. Species: [Ipe][Teak][Cumaru][Garapa][Goncalo alves]<Insert name>.
 2. Grade Characteristics:
 - a. Clear[**one face; small pin knots and worm holes allowed on back face**].
 - b. Sound; small pin knots, worm holes, and fixed knots allowed.
 - c. All heart[**one face**].
 - d. Straight grained and parallel cut.
 - e. Free of heart centers.
 - f. No decay, incipient decay, honeycomb, knot holes, shakes, splits, or wane.
 - g. No discoloration.

2.3 WOOD STAIR TREADS

- A. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane.
- B. Radius-Edged Board Stair Treads: [1-1/4-inch (32-mm)][1-inch (25-mm)][3/4-inch (19-mm)] actual thickness of[**any of**] the following species and grades:
1. Douglas fir-larch or Douglas fir-south, [Patio 1][Patio 2]; WWPA.
 2. Douglas fir-larch, [Select Dex][Commercial Dex]; WCLIB.
 3. Douglas fir-larch (North), [Select Patio][Commercial Patio]; NLGA.
 4. Hem-fir, [Patio 1][Patio 2]; WWPA.
 5. Hem-fir, [Select Dex][Commercial Dex]; WCLIB.
 6. Hem-fir (North), [Select Patio][Commercial Patio]; NLGA.
 7. Redwood, [Heart Clear][Heart B or Select Heart]; RIS.
 8. Southern pine, [Premium][Standard]; SPIB.
 9. Western red cedar, [Patio 1][Patio 2]; WWPA.
 10. Western red cedar, [Select Dex][Commercial Dex]; WCLIB.
 11. Western red cedar (North), [Select Patio][Commercial Patio]; NLGA.
- C. Half-Round or Rounded-Edged Nosing Board Stair Treads: [1-1/4-inch (32-mm)][1-inch (25-mm)][3/4-inch (19-mm)] actual thickness of[**any of**] the following species and grades:
1. Douglas fir, C & Btr VG (Vertical Grain) stepping; NLGA, WCLIB, or WWPA.
 2. Hem-fir, C & Btr VG (Vertical Grain) stepping; NLGA, WCLIB, or WWPA.
 3. Redwood, [Heart Clear][Heart B or Select Heart]; RIS.
 4. Southern pine, [Edge Grain B & B stepping][Near Rift B & B stepping][B & B stepping]; SPIB.
- D. S4S Board Stair Treads: [1-1/4-inch (32-mm)][1-inch (25-mm)][3/4-inch (19-mm)] actual thickness radius-edged, with one face free of planer skip, machine burn, and torn or chipped grain.
1. Species: [Ipe][Teak][Cumaru][Garapa][Goncalo alves]<Insert name>.
 2. Grade Characteristics:
 - a. Clear[**one face; small pin knots and worm holes allowed on back face**].
 - b. Sound; small pin knots, worm holes, and fixed knots allowed.
 - c. All heart[**one face**].
 - d. Straight grained and parallel cut.

- e. Free of heart centers.
- f. No decay, incipient decay, honeycomb, knot holes, shakes, splits, or wane.
- g. No discoloration.

2.4 WOOD RAILINGS

- A. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane.
- B. Dimension Lumber Railing Members:
 - 1. **[Select Structural][No. 1][No. 2][Construction or No. 2]** grade and **[any of]** the following species:
 - a. Hem-fir or hem-fir (North); NLGA, WCLIB, or WWPA.
 - b. Douglas fir-larch, Douglas fir-larch (North), or Douglas fir-south; NLGA, WCLIB, or WWPA.
 - c. Mixed southern pine; SPIB.
 - d. Redwood; RIS.
 - e. Spruce-pine-fir or spruce-pine-fir (South); NeLMA, NLGA, WCLIB, or WWPA.
 - 2. **[Heart Clear][Heart B or Select Heart]** redwood; RIS.
- C. Railing Boards: **[Any of the following species and grades:]**
 - 1. Douglas fir, C & Btr finish or C Select; NLGA, WCLIB, or WWPA.
 - 2. Hem-fir, C & Btr finish or C Select; NLGA, WCLIB, or WWPA.
 - 3. Redwood, **[Heart Clear][Heart B or Select Heart]**; RIS.
 - 4. Southern pine, B & B finish; SPIB.
- D. Radius-Edged Railing Boards: **[Ipe][Teak]** S4S boards, **[same grade as decking][clear][clear all heart][, straight grained and parallel cut].**

2.5 WOOD BENCHES

- A. Dimension Lumber for Benches:
 - 1. **[Select Structural][No. 1]** grade and **[any of]** the following species:
 - a. Hem-fir or hem-fir (North); NLGA, WCLIB, or WWPA.
 - b. Douglas fir-larch, Douglas fir-larch (North), or Douglas fir-south; NLGA, WCLIB, or WWPA.
 - c. Mixed southern pine; SPIB.
 - d. Redwood; RIS.
 - e. Spruce-pine-fir or spruce-pine-fir (South); NeLMA, NLGA, WCLIB, or WWPA.
 - 2. **[Heart Clear][Heart B or Select Heart]** redwood; RIS.
- B. Boards for Benches: **[Any of the following species and grades:]**
 - 1. Douglas fir, C & Btr finish or C Select; NLGA, WCLIB, or WWPA.
 - 2. Hem-fir, C & Btr finish or C Select; NLGA, WCLIB, or WWPA.
 - 3. Redwood, **[Heart Clear][Heart B or Select Heart]**; RIS.
 - 4. Southern pine, **[Edge Grain B & B finish][Near Rift B & B finish][B & B finish]**; SPIB.

- C. Radius-Edged Boards for Benches: **[Ipe][Teak]** S4S boards, **[same grade as decking][clear][clear all heart][, straight grained and parallel cut]**.

2.6 DIMENSION LUMBER FRAMING

A. Deck and Stair Framing:

1. **[Select Structural][No. 1][No. 2][Construction or No. 2][Construction, Stud, or No. 3]** grade and **[any of]** the following species:
 - a. Hem-fir (North); NLGA.
 - b. Southern pine; SPIB.
 - c. Douglas fir-larch; WCLIB or WWP.
 - d. Mixed southern pine; SPIB.
 - e. Spruce-pine-fir; NLGA.
 - f. Douglas fir-south; WWP.
 - g. Hem-fir; WCLIB or WWP.
 - h. Douglas fir-larch (North); NLGA.
 - i. Spruce-pine-fir (South); NeLMA, WCLIB, or WWP.
2. Any species and grade with a modulus of elasticity of at least **[1,500,000 psi (10 350 MPa)][1,300,000 psi (8970 MPa)][1,100,000 psi (7590 MPa)][1,000,000 psi (6900 MPa)][900,000 psi (6210 MPa)]** and an extreme fiber stress in bending of at least **[1000 psi (6.9 MPa)][850 psi (5.86 MPa)][700 psi (4.83 MPa)][600 psi (4.14 MPa)][500 psi (3.45 MPa)]** for 2-inch nominal (38-mm actual) thickness and 12-inch nominal (286-mm actual) width for single-member use.

2.7 POSTS

A. Dimension Lumber Posts: **[No. 2][Construction or No. 2][Construction, Stud, or No. 3]** grade and **[any of]** the following species:

1. Hem-fir or hem-fir (North); NLGA, WCLIB, or WWP.
2. Douglas fir-larch, Douglas fir-larch (North), or Douglas fir-south; NLGA, WCLIB, or WWP.
3. Mixed southern pine; SPIB.
4. Spruce-pine-fir or spruce-pine-fir (South); NeLMA, NLGA, WCLIB, or WWP.
5. Northern species; NLGA.
6. Eastern softwoods; NeLMA.
7. Western woods; WCLIB or WWP.

B. Timber Posts:

1. Balsam fir, Douglas fir-larch, Douglas fir-larch (North), eastern hemlock tamarack (North), hem-fir, southern pine, western hemlock, or western hemlock (North); **[No. 1][No. 2]**; NeLMA, NLGA, SPIB, WCLIB, or WWP.
2. Alaska cedar; **[No. 1][No. 2]**; WCLIB.
3. Southern pine; **[No. 1][No. 2]**; SPIB.

C. Round Wood Poles: Clean-peeled wood poles complying with ASTM D3200, with at least 80 percent of inner bark removed and with knots and limbs cut flush with the surface.

1. Species: **<Insert species required>**.

2.8 PRESERVATIVE-TREATED LUMBER

- A. Pressure treat boards and dimension lumber with waterborne preservative in accordance with AWP A U1; Use Category UC3b[**for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground**].
- B. Pressure treat timber with waterborne preservative in accordance with AWP A U1; Use Category UC4a.
- C. Pressure treat poles with waterborne preservative in accordance with AWP A U1; Use Category UC4a.
- D. Preservative Chemicals: Acceptable to authorities having jurisdiction.
 - 1. Do not use chemicals containing arsenic or chromium **[except for timber posts][except for poles]**.
- E. Use process[**for boards and dimension lumber**] that includes water-repellent treatment.
- F. Use process[**for boards and dimension lumber**] that does not include water repellents or other substances that might interfere with application of indicated finishes.
- G. After treatment, redry **[boards][dimension lumber][timber][and][poles]** to 19 percent maximum moisture content.
- H. Mark treated wood with treatment quality mark of an inspection agency approved by ALSC's Board of Review.
 - 1. For items indicated to receive a stained or natural finish, **[mark each piece on surface that will not be exposed][or][omit marking and provide certificates of treatment compliance issued by inspection agency]**.
- I. Application: **[Treat all wood unless otherwise indicated.][Treat items indicated on Drawings and the following:]**
 - 1. Framing members[**less than 18 inches (460 mm) above grade**].
 - 2. Sills and ledgers.
 - 3. Members in contact with masonry or concrete.
 - 4. Posts.
 - 5. Round wood poles.
 - 6. Decking.
 - 7. Stair treads.

2.9 PLASTIC DECKING

- A. Plastic Lumber, General: Products acceptable to authorities having jurisdiction with current model code evaluation reports that show compliance with building code in effect for Project for indicated type of construction.
 - 1. Allowable loads and spans, as documented in evaluation reports or in information referenced in evaluation reports, are not to be less than design loads and spans indicated.
- B. Composite Plastic Lumber: **[Solid][or][hollow]** shapes made from a mixture of cellulose fiber and polyethylene or polypropylene.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [CertainTeed; SAINT-GOBAIN]
 - b. [Fiberon]
 - c. [Green Bay Decking, LLC]
 - d. [Midwest Manufacturing]
 - e. [MoistureShield; Oldcastle APG, Inc., CRH Americas, Inc.]
 - f. [NewTechWood America, Inc.]
 - g. [TimberTech, AZEK Building Products; The AZEK Company LLC]
 - h. [Trex Company, Inc.]
 - i. [UFP Construction; a UFP Industries Company]
 - j. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [CertainTeed; SAINT-GOBAIN]
 - b. [Fiberon]
 - c. [Green Bay Decking, LLC]
 - d. [Midwest Manufacturing]
 - e. [MoistureShield; Oldcastle APG, Inc., CRH Americas, Inc.]
 - f. [NewTechWood America, Inc.]
 - g. [TimberTech, AZEK Building Products; The AZEK Company LLC]
 - h. [Trex Company, Inc.]
 - i. [UFP Construction; a UFP Industries Company]
 - j. <Insert manufacturer's name>

3. Decking Standard: [ICC-ES AC109][or][ICC-ES AC174].
4. Decking Size: [7/8 by 5-1/2 inches (22 by 140 mm) actual][1-1/4 by 6 nominal, 1 by 5-1/2 inches (25 by 140 mm) actual][1-1/2 by 6 nominal, 1-1/4 by 5-1/2 inches (32 by 140 mm) actual][1-1/4 by 6 inches (32 by 152 mm) actual][1-3/8 by 3-1/2 inches (35 by 89 mm) actual][1-3/8 by 5-1/2 inches (35 by 140 mm) actual][2 by 6 nominal, 1-1/2 by 5-1/2 inches (38 by 140 mm) actual]<Insert dimensions>.
5. Configuration: Provide product with grooved edges designed for fastening with concealed decking fasteners.
6. Surface Texture: [Woodgrain][Smooth][Manufacturer's standard]<Insert finish>.
7. Color: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.

- C. All-Plastic Lumber: [Solid][or][hollow] shapes made from high-density polyethylene (HDPE), PVC, polystyrene, or cellular PVC with no cellulose fiber.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [CertainTeed; SAINT-GOBAIN]
 - b. [Genova Products, Inc.]
 - c. [Interplast Group, Ltd.]
 - d. [L.B. Plastics, Inc.]
 - e. [Re-Plast Products, Inc.]

- f. **[RENEW Plastics, a division of N.E.W. Plastics Corp]**
 - g. **[Veka Inc.]**
 - h. **[Westech]**
 - i. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Genova Products, Inc.]**
 - c. **[Interplast Group, Ltd.]**
 - d. **[L.B. Plastics, Inc.]**
 - e. **[Re-Plast Products, Inc.]**
 - f. **[RENEW Plastics, a division of N.E.W. Plastics Corp]**
 - g. **[Veka Inc.]**
 - h. **[Westech]**
 - i. **<Insert manufacturer's name>**
3. Decking Standard: ICC-ES AC174.
4. Decking Size: **[1 by 6 inches (25 by 152 mm) actual][1-1/4 by 6 nominal, 1 by 5-1/2 inches (25 by 140 mm) actual][1-1/2 by 6 nominal, 1-1/4 by 5-1/2 inches (32 by 140 mm) actual][2 by 4 nominal, 1-1/2 by 3-1/2 inches (38 by 89 mm) actual][2 by 6 nominal, 1-1/2 by 5-1/2 inches (38 by 140 mm) actual][1-5/8 by 5-3/4 inches (41 by 146 mm) actual]<Insert dimensions>**.
5. Configuration: Provide product with **[grooved edges designed for fastening with concealed decking fasteners][or][tongue-and-groove edges designed for concealed fastening]**.
6. Surface Texture: **[Woodgrain][Smooth][Manufacturer's standard]<Insert finish>**.
7. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.

2.10 FASTENERS

- A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than **1-1/2 inches (38 mm)** into wood substrate.
- 1. Use **[stainless steel][fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329]** unless otherwise indicated.
 - 2. For pressure-preservative-treated wood, use stainless steel fasteners.
 - 3. For **[plastic][wood]** decking, use stainless steel fasteners **[where fasteners are exposed to view]**.
 - 4. For redwood, use **[brass/bronze][stainless steel][hot-dip galvanized-steel]** fasteners.
- B. Nails: ASTM F1667.
- C. Power-Driven Fasteners: ICC-ES AC70.
- D. Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.
- E. Carbon-Steel Bolts: **ASTM A307 (ASTM F568M)** with **ASTM A563 (ASTM A563M)** hex nuts and, where indicated, flat washers all hot-dip zinc coated.
- F. Stainless Steel Bolts: **ASTM F593, Alloy Group 1 or 2 (ASTM F738M, Grade A1 or Grade A4);** with **ASTM F594, Alloy Group 1 or 2 (ASTM F836M, Grade A1 or Grade A4)** hex nuts and, where

indicated, flat washers.

- G. Postinstalled Anchors: Stainless steel, **[chemical][or][torque-controlled expansion]** anchors with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing in accordance with ASTM E488 conducted by a qualified independent testing and inspecting agency.
 - 1. Stainless steel bolts and nuts complying with **ASTM F593 and ASTM F594, Alloy Group 1 or 2 (ASTM F738M and ASTM F836M, Grade A1 or Grade A4).**

2.11 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **[Tamlyn]**
 - 2. **[USP Structural Connectors]**
 - 3. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1. **[Tamlyn]**
 - 2. **[USP Structural Connectors]**
 - 3. **<Insert manufacturer's name>**
- C. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those **[indicated on Drawings][of basis-of-design products][of products of manufacturers listed]**. Manufacturer's published values are to be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- D. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, **[G60 (Z180)][G90 (Z270)][G185 (Z550)]** coating designation.
- E. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, **[Type 304][Type 316]**.
- F. Joist Hangers: U-shaped, with **2-inch- (50-mm-)** long seat and **1-1/4-inch- (32-mm-)** wide nailing flanges at least 85 percent of joist depth.
 - 1. Thickness: **[0.050 inch (1.3 mm)][0.062 inch (1.6 mm)]**.
- G. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
 - 1. Strap Width: **[1-1/2 inches (38 mm)][2 inches (50 mm)]**.
 - 2. Thickness: **[0.050 inch (1.3 mm)][0.062 inch (1.6 mm)]**.
- H. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post **1 inch (25 mm)** above base and with **2-inch- (50-mm-)** minimum side cover, socket **0.062 inch (1.6 mm)** thick, and standoff and adjustment plates **0.108 inch (2.8 mm)** thick.

- I. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.

1. Width: [3/4 inch (19 mm)][1-1/4 inches (32 mm)].
2. Thickness: [0.050 inch (1.3 mm)][0.062 inch (1.6 mm)].
3. Length: [16 inches (400 mm)][24 inches (600 mm)][As indicated].

2.12 CONCEALED DECKING FASTENERS

- A. Deck Splines: Corrosion-resistant metal or plastic splines that fit in grooves routed into the sides of decking material and are fastened to deck framing with screws. Splines provide uniform spacing of decking material.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Grabber Construction Products, Inc.]**
 - b. **[Ipe Clip Fastener Company Inc. (The)]**
 - c. **[M. M. Products, Inc.]**
 - d. **[Titan Metal Werks, Inc.]**
 - e. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Grabber Construction Products, Inc.]**
 - b. **[Ipe Clip Fastener Company Inc. (The)]**
 - c. **[M. M. Products, Inc.]**
 - d. **[Titan Metal Werks, Inc.]**
 - e. **<Insert manufacturer's name>**

- B. Deck Clips: Black-oxide-coated, stainless steel clips designed to be fastened to deck framing with screws, and to secure decking material with teeth that also provide uniform spacing of decking material.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[FastenMaster; a division of OMG, Inc.]**
 - b. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[FastenMaster; a division of OMG, Inc.]**
 - b. **<Insert manufacturer's name>**

- C. Deck Tracks: Formed metal strips designed to be fastened to deck framing and to secure decking material from underside with screws. Made from epoxy-powder-coated, hot-dip galvanized steel or stainless steel.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Grabber Construction Products, Inc.]**
 - b. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Grabber Construction Products, Inc.]**
 - b. **<Insert manufacturer's name>**

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Prime wood[**indicated to be painted**], including both faces and edges. Cut to required lengths and prime ends. Comply with requirements in Section 099113 "Exterior Painting."
- C. Stain wood[**indicated to be stained**], including both faces and edges. Cut to required lengths and stain ends. Comply with requirements in Section 099300 "Staining and Transparent Finishing."

3.3 INSTALLATION, GENERAL

- A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and cope as needed for accurate fit.
- B. Framing Standard: Comply with AF&PA WCD1 unless otherwise indicated.
- C. Install wood decking[**and stair treads**] with crown up (bark side down).
- D. Install plastic lumber to comply with manufacturer's written instructions.
- E. Secure decking to framing with **[deck splines][deck clips][deck tracks][or][screws]**.
- F. Install metal framing anchors to comply with manufacturer's written instructions.
- G. Do not splice structural members between supports unless otherwise indicated.

- H. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- I. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of members or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- J. Apply copper naphthenate field treatment to comply with AWPA M4, to cut surfaces of preservative-treated lumber.
- K. Securely attach exterior rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. ICC-ES AC70 for power-driven fasteners.
 - 2. "Fastening Schedule" in ICC's International Building Code.
 - 3. "Fastener Schedule for Structural Members" and "Alternate Attachments" in ICC's International Residential Code for One- and Two-Family Dwellings.
- L. Use common wire nails unless otherwise indicated. Select fasteners of size that do not fully penetrate members where opposite side is exposed to view. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads unless otherwise indicated.
- M. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced and with adjacent rows staggered.

3.4 INSTALLATION OF ELEVATED DECK JOIST FRAMING

- A. General: Install joists with crown edge up and support ends of each member with not less than **1-1/2 inches (38 mm)** of bearing on wood or metal, or **3 inches (76 mm)** on masonry. Attach floor joists where framed into wood supporting members by using wood ledgers as indicated or, if not indicated, by using metal joist hangers. Do not notch joists.
- B. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds **48 inches (1200 mm)**.
- C. Lap members framing from opposite sides of beams or girders not less than **4 inches (102 mm,)** or securely tie opposing members together. Provide solid blocking of **2-inch nominal (38-mm actual)** thickness by depth of joist over supports.
- D. Provide solid blocking of **2-inch nominal (38-mm actual)** thickness by depth of joist at intervals of **96 inches (2438 mm)** o.c., between joists.

3.5 INSTALLATION OF STAIRS

- A. Provide stair framing members of size, space, and configuration indicated or, if not indicated, to comply with the following requirements:
 - 1. Stringer Size: **2 by 12 inches nominal (38 by 286 mm actual)**, minimum.
 - 2. Notching: Notch stringers to receive treads, risers, and supports; leave at least **3-1/2 inches (89 mm)** of effective depth.
 - 3. Stringer Spacing: At least three stringers for each **36-inch (914-mm)** clear width of stair.

- B. Provide stair framing with no more than **[3/16-inch (4.7-mm) variation between adjacent treads and risers and no more than] 3/8-inch (9.5-mm)** variation between largest and smallest treads and risers within each flight.
- C. Treads and Risers: Secure by gluing and **[nailing][screwing]** to carriages. Countersink fastener heads, fill flush, and sand filler. Extend treads over carriages **[and finish with bullnose edge]**.

3.6 INSTALLATION OF RAILINGS

- A. Balusters: Fit to railings, **[glue, and][nail][screw]** in place. Countersink fastener heads, fill flush, and sand filler.
- B. Newel Posts: Secure to stringers and risers with **[through bolts][lag screws][countersunk-head wood screws and glue]**.
- C. Railings: Secure wall rails with metal brackets. Fasten freestanding railings to newel posts and to trim at walls with countersunk-head wood screws or rail bolts **[and glue]**.

END OF SECTION 06 15 00 00A

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06 - Wood, Plastics, and Composites

Task	Specification	Specification Description
06 15 13 00	06 10 00 00	Rough Carpentry
06 15 13 00	06 15 00 00	Wood Roof Decking
06 15 13 00	06 15 00 00a	Wood Patio Decking



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SECTION 06 16 00 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.
3. Parapet sheathing.
4. Composite nail base insulated roof sheathing.
5. Subflooring.
6. Underlayment.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for plywood backing panels.
2. Section 072500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.2 DEFINITIONS

- A. ABAA: The Air Barrier Association of America.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference **[at Project site][by web conference]<Insert location>** .

1. Review air-barrier and water-resistant glass-mat gypsum sheathing requirements and installation, special details, transitions, mockups, air-leakage testing, protection, and work scheduling that covers air-barrier and water-resistant glass-mat gypsum sheathing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Indicate component materials and dimensions and include construction and application details.
1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
 3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5516.
 4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

5. For air-barrier and water-resistant glass-mat gypsum sheathing, include manufacturer's technical data and tested physical and performance properties of products.

B. Shop Drawings: For air-barrier and water-resistant glass-mat gypsum sheathing assemblies.

1. Show locations and extent of sheathing, accessories, and assemblies specific to Project conditions.
2. Include details for sheathing joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

C. Sustainable Design Submittals:

1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
2. Chain-of-Custody Qualification Data: For manufacturer and vendor.
3. Laboratory Test Reports: For composite wood products, indicating compliance with the formaldehyde emissions evaluation.
4. Product Data: For installation adhesives, indicating VOC content.
5. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low-emitting materials.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer [, **including list of ABAA-certified installers and supervisors employed by Installer, who work on Project**][and][testing and inspecting agency] .
- B. Product Certificates: From air-barrier and water-resistant glass-mat gypsum sheathing manufacturer, certifying compatibility of sheathing accessory materials with Project materials that connect to or that come in contact with the sheathing.
- C. Product Test Reports: For each air-barrier and water-resistant glass-mat gypsum sheathing assembly, indicating compliance with specified requirements, for tests performed by a qualified testing agency.
- D. Evaluation Reports: For the following, from ICC-ES:
1. Preservative-treated plywood.
 2. Fire-retardant-treated plywood.
 3. Foam-plastic sheathing.
 4. Air-barrier and water-resistant glass-mat gypsum sheathing.
 5. Power-driven fasteners.
- E. Field Quality Control Reports: For specified tests and inspections.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of air-barrier and water-resistant glass-mat gypsum sheathing.
1. Installer is to be licensed by ABAA in accordance with ABAA's Quality Assurance Program and is to employ ABAA-certified installers and supervisors on Project.
- B. Testing Agency Qualifications:

1. For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
2. For testing and inspecting agency providing tests and inspections related to air-barrier and water-resistant glass-mat gypsum sheathing meeting the requirements as follows:
 - a. Independent agency, qualified in accordance with ASTM E329 for testing indicated, and certified by ABAA.
- C. Certified Wood: Provide an invoice, including vendor's chain-of-custody number, product cost, and entity being invoiced.
- D. Vendor Qualifications: Provide proof of use of vendors that are certified for chain of custody by an FSC-accredited certification body.

1.7 MOCKUPS

- A. Build mockups to set quality standards for materials and execution [**and for preconstruction testing**] .
 1. Build integrated mockups of exterior wall assembly [**as indicated on Drawings**][, 150 sq. ft. (14 sq. m)]<Insert requirement> , incorporating backup wall construction, window, storefront, door frame and sill, ties and other penetrations, and flashing to demonstrate crack and joint treatment and sealing of gaps, terminations, and penetrations of air-barrier sheathing assembly.
 - a. Coordinate construction of mockups to permit inspection and testing of sheathing before external insulation and cladding are installed.
 - b. Include junction with roofing membrane [, **building corner condition**],[and][**foundation wall intersection**] .
 - c. If Architect determines mockups do not comply with requirements, reconstruct mockups until mockups are approved.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: [**Owner will engage**][**Engage**] a qualified testing agency to perform preconstruction testing on field mockups.
- B. Mockup Testing: Air-barrier and water-resistant glass-mat gypsum sheathing assemblies are to comply with performance requirements, as evidenced by reports based on mockup testing by a qualified testing agency.
 1. Air-Leakage-Location Testing: Mockups will be tested for evidence of air leakage in accordance with [**ASTM E1186, chamber pressurization or depressurization with smoke tracers**][**ASTM E1186, chamber depressurization with detection liquids**]<Insert requirement> .
 2. Air-Leakage-Volume Testing: Mockups will be tested for air-leakage rate in accordance with [**ASTM E783**][or][**ASTM E2357**] .
 3. Notify Architect [**seven**]<Insert number> days in advance of the dates and times when mockups will be tested.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested in accordance with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- B. Air-Barrier and Water-Resistant Glass-Mat Gypsum Sheathing Performance: Air-barrier and water-resistant glass-mat gypsum sheathing assembly, and seals with adjacent construction, are to be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies are to be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations [**tie-ins to installed waterproofing**][**tie-ins to other installed air barriers**], and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

2.2 WOOD STRUCTURAL PANEL PRODUCTS

- A. General: Wood structural panels include plywood, mat-formed (nonveneer) panels such as oriented strand board, and composite panels, which are veneer-faced panels with mat-formed cores.
- B. Emissions: Products are to meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Certified Wood: Verify the following wood products are certified as "FSC Pure" [**or "FSC Mixed Credit"**] in accordance with FSC STD-01-001 and FSC STD-40-004.
 - 1. Plywood.
 - 2. Oriented strand board.
 - 3. Particleboard underlayment.
 - 4. Hardboard underlayment.
- D. Certified Wood: Verify the following wood products are labeled in accordance with the AF&PA's Sustainable Forestry Initiative, certified as "FSC Pure" in accordance with FSC STD-01-001 and FSC STD-40-004, or certified and labeled in accordance with the standards of the Programme for Endorsement of Forest Certification.
 - 1. Plywood.
 - 2. Oriented strand board.
 - 3. Particleboard underlayment.
 - 4. Hardboard underlayment.

- E. Certified Wood: Verify the following wood products are certified in accordance with the American Tree Farm System's "ATFS 2021 Standards of Sustainability," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
 - 1. Plywood.
 - 2. Oriented strand board.
 - 3. Particleboard underlayment.
 - 4. Hardboard underlayment.
- F. Thickness: As needed to comply with requirements specified, but not less than thickness indicated on Drawings.
- G. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative-Treated Plywood by Pressure Process: AWP U1, use categories as follows:
 - 1. UC2, Interior/Damp: For interior construction not in contact with ground but may be subject to moisture.
 - 2. UC3B, Above Ground, Exposed: For exterior construction not in contact with ground, exposed to all weather cycles including prolonged wetting.
 - 3. UC4A, Ground Contact: For wood panels in contact with ground and exposed to all weather cycles, normal exposure conditions.
 - 4. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: **[Treat all plywood unless otherwise indicated][Treat items indicated on Drawings][and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing]** .

2.4 Glass Fiber-Reinforced Cementitious Panels

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1. **<Insert manufacturer's name>**

2.5 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than

10.5 ft. (3.2 m) beyond the centerline of the burners at any time during the test.

1. Treatment must not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated on Drawings.
3. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber plywood is to be tested in accordance with ASTM D5516 and design value adjustment factors are to be calculated in accordance with ASTM D6305. Span ratings after treatment are to be not less than span ratings specified. [**For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F (76 deg C) are to be not less than span ratings specified.**]

- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: **[Treat all plywood unless otherwise indicated.][Treat plywood indicated on Drawings, and the following:]**
 1. Roof [**and wall**] sheathing within **48 inches (1220 mm)** of [**fire**][**party**] walls.
 2. Roof sheathing.
 3. Subflooring and underlayment for raised platforms.

2.6 Subflooring and Underlayment: Cementitious Reinforced Subfloor

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 1. **<Insert manufacturer's name>**

2.7 WALL SHEATHING

- A. Plywood Sheathing, Walls:
 1. Classification: **[DOC PS 1][Either DOC PS 1 or DOC PS 2]** , **[Exterior, Structural I][Exterior][Exposure 1, Structural I][Exposure 1]** sheathing.
 2. Span Rating: Not less than **[16/0][20/0][24/0][32/16]** .
 3. Nominal Thickness: Not less than **[11/32 inch (8.7 mm)][3/8 inch (9.5 mm)][1/2 inch (13 mm)]** .
- B. Oriented-Strand-Board Sheathing, Walls:
 1. Classification: DOC PS 2, **[Exposure 1, Structural I][Exposure 1]** sheathing.
 2. Span Rating: Not less than **[16/0][20/0][24/0][24/16][32/16]** .
 3. Nominal Thickness: Not less than **[5/16 inch (7.9 mm)][3/8 inch (9.5 mm)][1/2 inch (13 mm)]** .
- C. Paper-Surfaced Gypsum Sheathing: ASTM C1396/C1396M, gypsum sheathing; with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [American Gypsum]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [Georgia-Pacific Gypsum LLC]
 - d. [USG Corporation]
 - e. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [American Gypsum]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [Georgia-Pacific Gypsum LLC]
 - d. [USG Corporation]
 - e. <Insert manufacturer's name>
 3. Type and Thickness: [Regular, 1/2 inch (13 mm)][Type X, 5/8 inch (15.9 mm)] thick.
 4. Edge and End Configuration: [V-shaped, tongue-and-groove long edges; square ends][Square] .
 5. Size: [24 by 96 inches (610 by 2438 mm) for horizontal][48 by 96 inches (1219 by 2438 mm) for vertical][48 by 108 inches (1219 by 2743 mm) for vertical][600 by 2400 mm for horizontal][1200 by 2400 mm for vertical][1200 by 2750 mm for vertical] installation.
- D. Glass-Mat Gypsum Sheathing, Walls: ASTM C1177/C1177M.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [CertainTeed; SAINT-GOBAIN]
 - b. [Continental Building Products Inc.]
 - c. [Georgia-Pacific Gypsum LLC]
 - d. [Gold Bond Building Products, LLC provided by National Gypsum Company]
 - e. [USG Corporation]
 - f. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [CertainTeed; SAINT-GOBAIN]
 - b. [Continental Building Products Inc.]
 - c. [Georgia-Pacific Gypsum LLC]
 - d. [Gold Bond Building Products, LLC provided by National Gypsum Company]
 - e. [USG Corporation]
 - f. <Insert manufacturer's name>
 3. Type and Thickness: [Regular, 1/2 inch (13 mm)][Type X, 5/8 inch (15.9 mm)] thick.
 4. Size: [48 by 96 inches (1219 by 2438 mm)][48 by 108 inches (1219 by 2743 mm)][48 by 120 inches (1219 by 3048 mm)][1200 by 2400 mm][1200 by 2750 mm][1200 by 3050 mm] for

vertical installation.

- E. Air-Barrier and Water-Resistant Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M, Type X, coated fiberglass mat gypsum sheathing with integral weather-resistant barrier and air barrier complying with ASTM E2178.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Georgia-Pacific Gypsum LLC]**
 - b. **[Tremco Commercial Sealants and Waterproofing, part of Tremco CPG]**
 - c. **[USG Corporation]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Georgia-Pacific Gypsum LLC]**
 - b. **[Tremco Commercial Sealants and Waterproofing, part of Tremco CPG]**
 - c. **[USG Corporation]**
 - d. **<Insert manufacturer's name>**
 3. Thickness: **5/8 inch (15.9 mm)** thick.
 4. Size: **[48 by 96 inches (1219 by 2438 mm)][48 by 108 inches (1219 by 2743 mm)][48 by 120 inches (1219 by 3048 mm)][1200 by 2400 mm][1200 by 2750 mm][1200 by 3050 mm]** for vertical installation.
 5. Edges: Square.
 6. Flashing and Transitions Strips: As acceptable to sheathing manufacturer.
 7. Air Permeance: Maximum **[0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa)]<Insert value>** pressure difference when tested in accordance with ASTM E2178.
 8. Vapor Permeance: Minimum **[20 perms (580 ng/Pa x s x sq. m)]<Insert value>** when tested in accordance with ASTM E96/E96M, Desiccant Method, Procedure A.
 9. Sheathing Assembly Air Leakage: Maximum **[0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa)]<Insert value>** when tested in accordance with ASTM E2357.
 10. Fire Propagation Characteristics: Complies with NFPA 285 testing as part of an approved assembly.
 11. UV Resistance: Can be exposed to sunlight for **[30][90][180]<Insert number>** days in accordance with manufacturer's written instructions.
 12. Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by sheathing manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
- F. Cellulose Fiber-Reinforced Gypsum Sheathing: ASTM C1278/C1278M, gypsum sheathing.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the**

following] :

- a. [USG Corporation]
 - b. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [USG Corporation]
 - b. <Insert manufacturer's name>
 3. Type and Thickness: [Regular, 1/2 inch (13 mm)][Type X, 5/8 inch (15.9 mm)] thick.
 4. Size: [48 by 96 inches (1219 by 2438 mm)][48 by 108 inches (1219 by 2743 mm)][48 by 120 inches (1219 by 3048 mm)][1200 by 2400 mm][1200 by 2750 mm][1200 by 3050 mm] .
- G. Cementitious Backer Units, Walls: ASTM C1325, Type A.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [C-Cure]
 - b. [Custom Building Products]
 - c. [FinPan, Inc.]
 - d. [USG Corporation]
 - e. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [C-Cure]
 - b. [Custom Building Products]
 - c. [FinPan, Inc.]
 - d. [USG Corporation]
 - e. <Insert manufacturer's name>
 3. Thickness: [1/2 inch (12.7 mm)][5/8 inch (15.9 mm)][As indicated on Drawings] .
- H. Fiberboard Sheathing: ASTM C208, Type IV, cellulosic fiberboard sheathing with square edges.
1. Grade: [1 (Regular)][2 (Structural)] .
 2. Thickness: [1/2 inch (13 mm)][25/32 inch (20 mm)] .
- I. Extruded-Polystyrene-Foam Sheathing: ASTM C578, Type IV, in manufacturer's standard lengths and widths with tongue-and-groove or shiplap long edges as standard with manufacturer.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [DiversiFoam Products]
 - b. [HydroBlok]

- c. [Kingspan Insulation LLC]
 - d. [Owens Corning]
 - e. [The Dow Chemical Company]
 - f. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [DiversiFoam Products]
 - b. [HydroBlok]
 - c. [Kingspan Insulation LLC]
 - d. [Owens Corning]
 - e. [The Dow Chemical Company]
 - f. <Insert manufacturer's name>
 3. Thickness: [3/4 inch (19 mm)][1 inch (25 mm)][As indicated on Drawings] .
 4. Flame Propagation Test: Materials and construction are to be tested in accordance with NFPA 285.
- J. Foil-Faced, Polyisocyanurate-Foam Sheathing: ASTM C1289, Type I or Type II, Class 2, rigid, cellular, polyisocyanurate thermal insulation. Foam-plastic core and facings are to have a flame-spread index of 25 or less when tested individually.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [Carlisle Coatings & Waterproofing Inc]
 - c. [Elevate; Amrize Building Envelope LLC]
 - d. [Hunter Panels; a Carlisle Company]
 - e. [Rmax, A Business Unit of Sika Corporation]
 - f. [The Dow Chemical Company]
 - g. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [Carlisle Coatings & Waterproofing Inc]
 - c. [Elevate; Amrize Building Envelope LLC]
 - d. [Hunter Panels; a Carlisle Company]
 - e. [Rmax, A Business Unit of Sika Corporation]
 - f. [The Dow Chemical Company]
 - g. <Insert manufacturer's name>
 3. Thickness: [7/16 inch (11.1 mm)][1/2 inch (13 mm)][5/8 inch (15.9 mm)][3/4 inch (19 mm)][1 inch (25 mm)][As indicated on Drawings] .
 4. Flame Propagation Test: Materials and construction are to be tested in accordance with NFPA 285.

2.8 ROOF SHEATHING

A. Plywood Sheathing, Roofs :

1. Classification: **[DOC PS 1][Either DOC PS 1 or DOC PS 2]** , **[Exterior, Structural I][Exterior][Exposure 1, Structural I][Exposure 1]** sheathing.
2. Span Rating: Not less than **[16/0][20/0][24/0][32/16][40/20][48/24]** .
3. Nominal Thickness: Not less than **[15/32 inch (11.9 mm)][1/2 inch (13 mm)]** .

B. Oriented-Strand-Board Sheathing, Roofs :

1. Classification: DOC PS 2, **[Exposure 1, Structural I][Exposure 1]** sheathing.
2. Span Rating: Not less than **[16/0][20/0][24/0][24/16][32/16][40/20][48/24]** .
3. Nominal Thickness: Not less than **[7/16 inch (11.1 mm)][15/32 inch (11.9 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)][3/4 inch (19 mm)]** .

2.9 PARAPET SHEATHING

A. Plywood Sheathing, Parapets :

1. Classification: **[DOC PS 1][Either DOC PS 1 or DOC PS 2]** , **[Exterior, Structural I][Exterior][Exposure 1, Structural I][Exposure 1]** sheathing.
2. Span Rating: Not less than **[16/0][20/0][24/0][32/16][40/20][48/24]** .
3. Nominal Thickness: Not less than **[15/32 inch (11.9 mm)][1/2 inch (13 mm)]** .

B. Oriented-Strand-Board Sheathing, Parapets :

1. Classification: DOC PS 2, **[Exposure 1, Structural I][Exposure 1]** sheathing.
2. Span Rating: Not less than **[16/0][20/0][24/0][24/16][32/16][40/20][48/24]** .
3. Nominal Thickness: Not less than **[7/16 inch (11.1 mm)][15/32 inch (11.9 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)][3/4 inch (19 mm)]** .

C. Glass-Mat Gypsum Roof Boards, Parapets: ASTM C1177/C1177M.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**

3. Type and Thickness: **[Regular, 1/2 inch (13 mm)][Type X, 5/8 inch (15.9 mm)]** thick.
4. Size: **[48 by 96 inches (1219 by 2438 mm)][48 by 108 inches (1219 by 2743 mm)][48 by 120 inches (1219 by 3048 mm)][1200 by 2400 mm][1200 by 2750 mm][1200 by 3050 mm]** for vertical installation.

D. Cementitious Backer Units, Parapets: ASTM C1325, Type A.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[C-Cure]**
 - b. **[Custom Building Products]**
 - c. **[FinPan, Inc.]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[C-Cure]**
 - b. **[Custom Building Products]**
 - c. **[FinPan, Inc.]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
3. Thickness: **[1/2 inch (12.7 mm)][5/8 inch (15.9 mm)][As indicated on Drawings]** .

2.10 COMPOSITE NAIL BASE INSULATED ROOF SHEATHING

A. Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: ASTM C1289, Type V with DOC PS 2, Exposure 1 oriented strand board on one face.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[Cornell Performance Building Products, a Subsidiary of GAF]**
 - c. **[Hunter Panels; a Carlisle Company]**
 - d. **[Johns Manville; a Berkshire Hathaway company]**
 - e. **[Rmax, A Business Unit of Sika Corporation]**
 - f. **[The Dow Chemical Company]**
 - g. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[Cornell Performance Building Products, a Subsidiary of GAF]**

- c. **[Hunter Panels; a Carlisle Company]**
 - d. **[Johns Manville; a Berkshire Hathaway company]**
 - e. **[Rmax, A Business Unit of Sika Corporation]**
 - f. **[The Dow Chemical Company]**
 - g. **<Insert manufacturer's name>**
3. Polyisocyanurate-Foam Thickness: **[1 inch (25 mm)][1-1/2 inches (38 mm)][2 inches (50 mm)][2-1/2 inches (64 mm)][3 inches (76 mm)][3-1/2 inches (89 mm)][4 inches (102 mm)]** .
 4. Oriented-Strand-Board Nominal Thickness: **[7/16 inch (11.1 mm)][5/8 inch (15.9 mm)]** .
- B. Vented, Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: ASTM C1289, Type II, Class 1, with DOC PS 2, Exposure 1 oriented strand board adhered to spacers on one face.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[Cornell Performance Building Products, a Subsidiary of GAF]**
 - c. **[Hunter Panels; a Carlisle Company]**
 - d. **[Johns Manville; a Berkshire Hathaway company]**
 - e. **[Rmax, A Business Unit of Sika Corporation]**
 - f. **[The Dow Chemical Company]**
 - g. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[Cornell Performance Building Products, a Subsidiary of GAF]**
 - c. **[Hunter Panels; a Carlisle Company]**
 - d. **[Johns Manville; a Berkshire Hathaway company]**
 - e. **[Rmax, A Business Unit of Sika Corporation]**
 - f. **[The Dow Chemical Company]**
 - g. **<Insert manufacturer's name>**
 3. Polyisocyanurate-Foam Thickness: **[1 inch (25 mm)][1-1/2 inches (38 mm)][2 inches (50 mm)][2-1/2 inches (64 mm)][3 inches (76 mm)][3-1/2 inches (89 mm)][4 inches (102 mm)]** .
 4. Oriented-Strand-Board Nominal Thickness: **[7/16 inch (11.1 mm)][5/8 inch (15.9 mm)]** .
 5. Spacers: Wood furring strips or blocks not less than **3/4 inch (19 mm)** thick and spaced not more than **[12 inches (300 mm)][16 inches (400 mm)][24 inches (600 mm)]** o.c.

2.11 SUBFLOORING

A. Plywood Combination Subfloor-Underlayment :

1. Classification: DOC PS 1, **[Exterior, Structural I, C-C Plugged][Exterior, C-C Plugged][Exposure 1, Structural I, Underlayment][Exposure 1, Underlayment]** single-floor panels.
2. Span Rating: Not less than **[16][20][24][32][48]** .
3. Nominal Thickness: Not less than **[23/32 inch (18.3 mm)][7/8 inch (22.2 mm)][1 inch (25 mm)]** .
4. Edge Detail: **[Square][Tongue and groove]** .
5. Surface Finish: Fully sanded face.

- B. Oriented-Strand-Board Combination Subfloor-Underlayment :
 - 1. Classification: DOC PS 2, Exposure 1 single-floor panels.
 - 2. Span Rating: Not less than [16][20][24][32][48] .
 - 3. Nominal Thickness: Not less than [23/32 inch (18.3 mm)][7/8 inch (22.2 mm)][1 inch (25 mm)] .
 - 4. Edge Detail: [Square][Tongue and groove] .
 - 5. Surface Finish: [Fully sanded][Resin-impregnated overlay] face.
- C. Plywood Subflooring :
 - 1. Classification: [DOC PS 1][Either DOC PS 1 or DOC PS 2] , [Exterior, Structural I][Exterior][Exposure 1, Structural I][Exposure 1] single-floor panels or sheathing.
 - 2. Span Rating: Not less than [16][20][24][32][48][or][32/16][40/20][48/24] .
 - 3. Nominal Thickness: Not less than [23/32 inch (18.3 mm)][7/8 inch (22.2 mm)][1 inch (25 mm)] .
- D. Oriented-Strand-Board Subflooring :
 - 1. Classification: DOC PS 2, Exposure 1 [, Structural I sheathing][single-floor panels or sheathing] .
 - 2. Span Rating: Not less than [16][20][24][32][48][or][32/16][40/20][48/24][60/32] .
 - 3. Nominal Thickness: Not less than [23/32 inch (18.3 mm)][7/8 inch (22.2 mm)][1 inch (25 mm)] .

2.12 UNDERLAYMENT

- A. General: Provide underlayment in nominal thicknesses indicated or, if not indicated, not less than **1/4 inch (6.4 mm)** over smooth subfloors and not less than **3/8 inch (9.5 mm)** over board or uneven subfloors.
- B. Plywood Underlayment for Resilient Flooring :
 - 1. Classification: DOC PS 1, [Exterior A-C][Exterior B-C][Exterior, C-C Plugged][Exposure 1 Underlayment] with fully sanded face.
- C. Plywood Underlayment for Ceramic Tile :
 - 1. Classification: DOC PS 1, Exterior, C-C Plugged, not less than **5/8-inch (15.9-mm)** nominal thickness.
- D. Plywood Underlayment for Carpet :
 - 1. Classification: DOC PS 1, [Exterior, C-C Plugged][Exposure 1, Underlayment][Interior, Underlayment] .
- E. Particleboard Underlayment : ANSI A208.1, [Grade PBU][Grade M-2] .
 - 1. Verify particleboard is made without urea formaldehyde.
 - 2. Verify particleboard has formaldehyde emission rates not greater than 0.09 ppm when tested in accordance with ASTM D6007 or ASTM E1333.
- F. Hardboard Underlayment : ANSI A135.4, Class 4 (Service), Surface S1S; with back side sanded.

2.13 MISCELLANEOUS MATERIALS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacturer.
 - 1. For [roof][parapet][and][wall] sheathing, provide fasteners **[with hot-dip zinc coating complying with ASTM A153/A153M][of Type 304 stainless steel]** .
 - 2. For [roof][parapet][and][wall] sheathing, provide fasteners with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours in accordance with ASTM B117.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.
- E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended in writing by screw manufacturer for material being fastened.
- F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended in writing by sheathing manufacturer for thickness of sheathing to be attached.
 - 1. For steel framing less than **0.0329 inch (0.835 mm)** thick, use screws that comply with ASTM C1002.
 - 2. For steel framing from **0.033 to 0.112 inch (0.84 to 2.84 mm)** thick, use screws that comply with ASTM C954.
- G. Screws for Fastening Composite Nail Base Insulated Roof Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended in writing by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours in accordance with ASTM B117. Provide washers or plates if recommended by sheathing manufacturer.
- H. Sealant for Paper-Surfaced and Glass-Mat Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended in writing by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 079200 "Joint Sealants."
- I. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended in writing by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
 - 1. Sheathing Tape: Self-adhering glass-fiber tape, minimum **2 inches (50 mm)** wide, **10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m)**, of type recommended in writing by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.
- J. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended in writing by sheathing manufacturer for sealing joints and penetrations in sheathing.
- K. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with **[APA AFG-01][ASTM D3498]** that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

1. Verify adhesive has a VOC content of [50][70]<Insert number> g/L or less.
2. Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
3. Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
4. Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 1. Table 2304.10.1, "Fastening Schedule," in the ICC's "International Building Code."
 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's "International Residential Code for One- and Two-Family Dwellings."
 3. ICC-ES evaluation report for fastener.
- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate [wall][parapet][and][roof] sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 INSTALLATION OF WOOD STRUCTURAL PANELS

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Combination Subfloor-Underlayment:
 - a. **[Glue and nail][Nail]** to wood framing.
 - b. Screw to cold-formed metal framing.
 - c. Space panels **1/8 inch (3 mm)** apart at edges and ends.
2. Subflooring:
 - a. **[Glue and nail][Nail][Nail or staple]** to wood framing.
 - b. Screw to cold-formed metal framing.
 - c. Space panels **1/8 inch (3 mm)** apart at edges and ends.
3. Wall and Roof Sheathing:
 - a. **[Nail][Nail or staple]** to wood framing. [**Apply a continuous bead of glue to framing members at edges of wall sheathing panels.**]
 - b. Screw to cold-formed metal framing.
 - c. Space panels **1/8 inch (3 mm)** apart at edges and ends.
4. Underlayment:
 - a. **[Nail][Nail or staple]** to subflooring.
 - b. Space panels **1/32 inch (0.8 mm)** apart at edges and ends.
 - c. Fill and sand edge joints of underlayment receiving resilient flooring immediately before installing flooring.

3.3 INSTALLATION OF GYPSUM SHEATHING

- A. Comply with GA-253 and with manufacturer's written instructions.
1. Fasten gypsum sheathing to wood framing with **[nails][or][screws]** .
 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
 3. Install panels with a **3/8-inch (9.5-mm)** gap where non-load-bearing construction abuts structural elements.
 4. Install panels with a **1/4-inch (6.4-mm)** gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.
1. Space fasteners approximately **8 inches (200 mm)** o.c. and set back a minimum of **3/8 inch (9.5 mm)** from edges and ends of panels.
 2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately **8 inches (200 mm)** o.c. and set back a minimum of **3/8 inch (9.5 mm)** from edges and ends of panels.
2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

E. Seal sheathing joints in accordance with sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.4 INSTALLATION OF AIR-BARRIER AND WATER-RESISTANT GLASS-MAT GYPSUM SHEATHING

A. Install accessory materials in accordance with sheathing manufacturer's written instructions and details to form a seal with adjacent construction, to seal fasteners, and ensure continuity of air and water barrier.

1. Coordinate the installation of sheathing with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install transition strip on roofing membrane or base flashing, so that a minimum of **3 inches (75 mm)** of coverage is achieved over each substrate.

B. Connect and seal sheathing material continuously to air barriers specified under other Sections as well as to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

C. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

D. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply **[transition strip][preformed silicone extrusion]**, so that a minimum of **3 inches (75 mm)** of coverage is achieved over each substrate. Maintain **3 inches (75 mm)** of full contact over solid bearing to perimeter frames, with not less than **1 inch (25 mm)** of full contact.

1. Transition Strip: Roll firmly to enhance adhesion.
2. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.

E. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of sheathing material with foam sealant.

F. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

G. Seal top of through-wall flashings to sheathing with an additional **6-inch- (150-mm-)** wide transition strip.

H. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal

counterflashings or ending in reglets with termination mastic.

- I. Repair punctures, voids, and deficient lapped seams in strips and transition strips extending **6 inches (150 mm)** beyond repaired areas in strip direction.

3.5 INSTALLATION OF CEMENTITIOUS BACKER UNITS

- A. Install panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.6 INSTALLATION OF FIBERBOARD SHEATHING

- A. Comply with ASTM C846 and with manufacturer's written instructions.
- B. Fasten fiberboard sheathing panels to intermediate supports and then at edges and ends. Use galvanized roofing nails [**or galvanized staples**] ; comply with manufacturer's recommended spacing and referenced fastening schedule. Drive fasteners flush with surface of sheathing and locate perimeter fasteners at least **3/8 inch (9.5 mm)** from edges and ends.
- C. Install sheathing vertically with long edges parallel to, and centered over, studs. Install solid wood blocking where end joints do not occur over framing. Allow **1/8-inch (3-mm)** open space between edges and ends of adjacent units. Stagger horizontal joints if any.
- D. Cover sheathing as soon as practical after installation to prevent deterioration from wetting.

3.7 INSTALLATION OF FOAM-PLASTIC SHEATHING

- A. Comply with manufacturer's written instructions.
- B. Foam-Plastic Wall Sheathing: Install vapor-relief strips or equivalent for permitting escape of moisture vapor that otherwise would be trapped in stud cavity behind sheathing.
- C. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

3.8 INSTALLATION OF PARTICLEBOARD UNDERLAYMENT

- A. Comply with CPA's recommendations for type of subfloor indicated. Fill and sand gouges, gaps, and chipped edges. Sand uneven joints flush.
 1. Fastening Method: [**Glue and nail**][**Nail**][**Nail or staple**] underlayment to subflooring.

3.9 INSTALLATION OF HARDBOARD UNDERLAYMENT

- A. Comply with CPA's recommendations and hardboard manufacturer's written instructions for preparing and applying hardboard underlayment.
 1. Fastening Method: [**Nail**][**Nail or staple**] underlayment to subflooring.

3.10 FIELD QUALITY CONTROL

- A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.
- B. Testing and Inspecting Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
- C. Inspections: Air-barrier and water-resistant glass-mat gypsum sheathing, accessories, and installation are subject to inspection for compliance with requirements. **[Inspections may include the following:]**
 - 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 - 2. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 - 3. Termination mastic has been applied on cut edges.
 - 4. Strips and transition strips have been firmly adhered to substrate.
 - 5. Compatible materials have been used.
 - 6. Transitions at changes in direction and structural support at gaps have been provided.
 - 7. Connections between assemblies (sheathing and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 - 8. All penetrations have been sealed.
- D. Tests: As determined by testing agency from among the following tests:
 - 1. Air-Leakage-Location Testing: Air-barrier sheathing assemblies will be tested for evidence of air leakage in accordance with **[ASTM E1186, chamber pressurization or depressurization with smoke tracers][ASTM E1186, chamber depressurization using detection liquids]<Insert requirement>** .
 - 2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate in accordance with **[ASTM E783][or][ASTM E2357]** .
- E. Air barriers will be considered defective if they do not pass tests and inspections.
- F. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- G. Prepare test and inspection reports.

END OF SECTION 06 16 00 00



06 - Wood, Plastics, and Composites

Task	Specification	Specification Description
06 16 23 00	06 10 00 00	Rough Carpentry
06 16 23 00	06 16 00 00	Sheathing
06 16 33 00	06 10 00 00	Rough Carpentry
06 16 33 00	06 16 00 00	Sheathing
06 16 43 00	06 10 00 00	Rough Carpentry
06 16 43 00	06 16 00 00	Sheathing



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SECTION 06 17 00 00 - ENGINEERED STRUCTURAL WOOD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural composite lumber.
2. Prefabricated wood I-joists.
3. Engineered rim boards.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for dimension lumber items associated with engineered structural wood.
2. Section 061753 "Shop-Fabricated Wood Trusses" for wood trusses made from dimension lumber.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:** Conduct conference at **[Project site]<Insert location>**.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data on adhesives, fabrication, and protection.
2. For preservative-treated wood products, include manufacturer's written instructions for handling, storing, installing, and finishing treated material.
3. For connectors, include installation instructions.

B. Shop Drawings:

1. Submit wood floor and roof-framing layouts including dimension lumber, engineered wood products, and plated wood trusses. Include computer-generated design calculations for representative joist and beam types.
2. Identify location and magnitude of design loads on layouts and in member calculations.
3. Include alternate span loading design results in design calculations.
4. Identify metal connectors (joist, beam, post cap, anchors, etc.) by manufacturer and model number. Include a list of accessories required for installation at each connector (blocking, squash blocks, stiffeners, fasteners, etc.). Include allowable design loads for selected metal connectors in design calculation analysis.
5. Identify manufacturer's recommended installation details in layouts.
6. Provide documentation that allowable design stresses comply with allowable design properties of each product indicated.
7. Include large-scale details of connections.
8. Fastener Patterns: Full-size templates for fasteners in exposed framing.

C. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Environmental Product Declaration (EPD): For each product.
4. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
5. Environmental Product Declaration: For each product.
6. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
7. Environmental Product Declaration: For each product.
8. Environmental Product Declaration: For each product.
9. Third-Party Certifications: For each product.
10. Third-Party Certified Life Cycle Assessment: For each product.
11. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
12. Chain-of-Custody Qualification Data: For manufacturer and vendor.
13. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
14. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
15. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
16. Product Data: For composite wood products, indicating compliance with requirements for formaldehyde emissions.
17. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
18. Product Data: For adhesives, indicating VOC content.
19. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For preservative-treated wood products, from manufacturer. Indicate type of preservative used and net amount of preservative retained.
- B. Research Reports: For engineered structural wood, from **[ICC-ES][or][recognized third-party testing laboratory]**.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that **[participates in a recognized quality-assurance program, complies with quality-control procedures in ASTM D5055 or ASTM D5456, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction][and][is certified for chain of custody by an FSC-accredited certification body]**.
- B. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store, stack, and handle engineered wood products to comply with recommendations of APA EWS E705.
 - 1. Store wrapped or banded together until ready for installation, on level well-drained area. Do not store in direct contact with the ground. Use stickers to separate bundles, spaced as recommended in writing by manufacturer.
 - 2. Store I-joists level with the webs vertically.
- B. Do not stack other material on top of structural composite lumber or I-joists.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of engineered wood product from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
 - 1. Allowable design stresses, as published by manufacturer, are to meet or exceed those indicated. Manufacturer's published values are to be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.3 STRUCTURAL COMPOSITE LUMBER

- A. Laminated-Veneer Lumber (LVL): **[Preservative-treated, structural][Structural]** composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored in accordance with ASTM D5456, and manufactured with exterior-type adhesive complying with ASTM D2559.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Louisiana-Pacific Corporation]**
 - b. **[Pacific Woodtech Corporation]**
 - c. **[RedBuilt]**
 - d. **[Roseburg]**
 - e. **[West Fraser]**
 - f. **[Weyerhaeuser Company]**
 - g. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. [Louisiana-Pacific Corporation]
- b. [Pacific Woodtech Corporation]
- c. [RedBuilt]
- d. [Roseburg]
- e. [West Fraser]
- f. [Weyerhaeuser Company]
- g. <Insert manufacturer's name>

3. Allowable Stresses:

- a. Extreme Fiber Stress in Bending, Edgewise (Fb): [3100 psi (21.3 MPa)][2800 psi (19.3 MPa)][2750 psi (18.9 MPa)][2400 psi (16.5 MPa)][2250 psi (15.5 MPa)][1800 psi (12.4 MPa)]<Insert value> for 12-inch nominal- (286-mm actual-) depth members.
- b. Modulus of Elasticity, Edgewise (E): [2,000,000 psi (13 700 MPa)][1,800,000 psi (12 400 MPa)][1,500,000 psi (10 300 MPa)]<Insert value>.
- c. Minimum Modulus of Elasticity (Em): [1,500,000 psi (10 300 MPa)][980,000 psi (6 757 MPa)][750,000 psi (5 171 MPa)]<Insert value>.
- d. Horizontal Shear (Fv): [290 psi (2.0 MPa)][285 psi (1.97 MPa)][225 psi (1.55 MPa)]<Insert value>.
- e. Tension Parallel to Grain (Ft): [2100 psi (14.5 MPa)][1800 psi (12.4 MPa)][1500 psi (10.3 MPa)][1100 psi (7.58 MPa)]<Insert value>.
- f. Allowable Compression Stress, Parallel to the Grain (Fc): [3200 psi (22.06 MPa)][2350 psi (16.2 MPa)][1025 psi (7.07 MPa)][1800 psi (12.4 MPa)][750 psi (5.2 MPa)]<Insert value>.

4. Moisture Protection: Factory seal [face,]edge and ends with manufacturer's standard water-resistant coating.

B. Parallel-Strand Lumber (PSL): [Preservative-treated, structural][Structural] composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored in accordance with ASTM D5456, and manufactured with exterior-type adhesive complying with ASTM D2559.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Weyerhaeuser Company]
- b. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Weyerhaeuser Company]
- b. <Insert manufacturer's name>

3. Allowable Stresses:

- a. Extreme Fiber Stress in Bending, Edgewise (Fb): [2900 psi (20.0 MPa)][2700 psi (18.6 MPa)][2500 psi (17.2 MPa)]<Insert value> for 12-inch nominal- (286-mm actual-) depth members.
- b. Modulus of Elasticity, Edgewise (E): [2,000,000 psi (13 700 MPa)][1,800,000 psi (12 400 MPa)]<Insert value>.
- c. Minimum Modulus of Elasticity (Em): [1,170,000 psi (8 066 MPa)][915,000 psi (6 308

- MPa)][750,000 psi (5 171 MPa)]<Insert value>.
 - d. Horizontal Shear (Fv): [290 psi (2.0 MPa)][260 psi (1.79 MPa)][230 psi (1.6 MPa)]<Insert value>.
 - e. Tension Parallel to Grain (Ft): [2300 psi (15.86 MPa)][2150 psi (14.8 MPa)][1995 psi (13.8 MPa)]<Insert value>.
 - f. Allowable Compression Stress, Parallel to the Grain (Fc): [2900 psi (20.0 MPa)][2700 psi (18.6 MPa)][2500 psi (17.2 MPa)]<Insert value>.
 4. Moisture Protection: Factory seal [face,]edge and ends with manufacturer's standard water-resistant coating.
- C. Laminated-Strand Lumber (LSL): [**Preservative-treated, structural**][**Structural**] composite lumber made from wood flake strands with grain primarily parallel to member lengths, evaluated and monitored in accordance with ASTM D5456, and manufactured with exterior-type adhesive complying with ASTM D2559.
 1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
 - a. [Tolko Industries, LTD]
 - b. [Weyerhaeuser Company]
 - c. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Tolko Industries, LTD]
 - b. [Weyerhaeuser Company]
 - c. <Insert manufacturer's name>
 3. Allowable Stresses:
 - a. Extreme Fiber Stress in Bending, Edgewise (Fb): [2900 psi (20.0 MPa)][2360 psi (16.3 MPa)][1900 psi (13.1 MPa)]<Insert value> for 12-inch nominal- (286-mm actual-) depth members.
 - b. Modulus of Elasticity, Edgewise (E): [2,000,000 psi (13 700 MPa)][1,550,000 psi (10 686 MPa)][1,300,000 psi (8 963 MPa)]<Insert value>.
 - c. Minimum Modulus of Elasticity (Em): [1,300,000 psi (8 963 MPa)][1,067,000 psi (7 356 MPa)][915,000 psi (6 308 MPa)][661,000 psi (4 557 MPa)]<Insert value>.
 - d. Horizontal Shear (Fv): [625 psi (4.3 MPa)][525 psi (3.62 MPa)][410 psi (2.83 MPa)]<Insert value>.
 - e. Tension Parallel to Grain (Ft): [3025 psi (20.86 MPa)][2100 psi (14.5 MPa)][1750 psi (12.1 MPa)][1300 psi (9.0 MPa)]<Insert value>.
 - f. Allowable Compression Stress, Parallel to the Grain (Fc): [2505 psi (17.3 MPa)][1950 psi (13.4 MPa)][1650 psi (11.4 MPa)]<Insert value>.
 4. Moisture Protection: Factory seal [face,]edge and ends with manufacturer's standard water-resistant coating.

2.4 PREFABRICATED WOOD I-JOISTS

- A. Prefabricated Units: [**Fire-rated**]I-shaped in cross section, made with solid or structural composite

lumber flanges and wood-based structural webs, let into and bonded to flanges. Comply with material requirements of, and with structural capacities established and monitored in accordance with, ASTM D5055.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Boise Cascade Wood Products, L.L.C.]**
 - b. **[Louisiana-Pacific Corporation]**
 - c. **[Nascor Systems]**
 - d. **[Pacific Woodtech Corporation]**
 - e. **[RedBuilt]**
 - f. **[Roseburg]**
 - g. **[Stark Truss Company, Inc]**
 - h. **[Weyerhaeuser Company]**
 - i. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Boise Cascade Wood Products, L.L.C.]**
 - b. **[Louisiana-Pacific Corporation]**
 - c. **[Nascor Systems]**
 - d. **[Pacific Woodtech Corporation]**
 - e. **[RedBuilt]**
 - f. **[Roseburg]**
 - g. **[Stark Truss Company, Inc]**
 - h. **[Weyerhaeuser Company]**
 - i. **<Insert manufacturer's name>**
3. Flange Material: **[Laminated-veneer][or][machine stress-rated (MSR)]** lumber.
4. Web Material: OSB, Exposure 1 **[with factory-applied fire-resistant panels or intumescent laminate]**.
 - a. Field-applied coatings, panels, and membranes are unacceptable.
5. Structural Properties: Depths and design values not less than those indicated.
6. Identification Marks:
 - a. Comply with APA PRI-400. Factory mark I-joists with APA-EWS trademark indicating nominal joist depth, joist series, referenced standard (APA PRI-400) or APA Product Report number, and manufacturing plant number.
 - b. Factory mark I-joists with manufacturer's name, joist series, mill identification, manufacturing date and time, name of third-party inspection agency, and ICC/CCMC code report number. Repeat identification marks at minimum **12 ft. (3.66 m)** intervals.

2.5 ENGINEERED RIM BOARDS

- A. Prefabricated, structural **[fire-resistant]** panel complying with APA PRR 410, APA PRR 401, or ASTM D7672 for wood frame construction and research or evaluation report for I-joists.

1. Manufacturer: Provide products by same manufacturer as I-joists.
2. Material: **[OSB][or][LVL]**.
3. Thickness: **[1 inch (25 mm)][1-1/8 inches (28 mm)][1-1/4 inches (32 mm)][1-1/2 inches (38 mm)]**.
4. Identification Marks: Comply with APA PRR-401, **[rim board][rim board plus]** grade.
 - a. Factory mark rim board with APA-EWS trademark indicating thickness, grade, and compliance with APA-EWS standard.
 - b. Factory mark rim boards with manufacturer's name, rim board series, mill identification, manufacturing date and time, name of third-party inspection agency, and ICC/CCMC code report number. Repeat identification marks at minimum **12 ft. (3.66 m)** intervals.

2.6 PRESERVATIVE TREATMENT

- A. Description: Preservative treatment; AWPAC U1; Use Category UC2[**for interior construction not in contact with ground, Use Category UC3B for exterior construction not in contact with ground, and Use Category UC4A for items in contact with ground**].
 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. **[Do not use inorganic boron (SBX) for sill plates.]**
 2. For exposed items indicated to receive a stained or natural finish, chemical formulations must not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

2.7 FASTENERS

- A. General: Fasteners are to be of size and type indicated and to comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than **1-1/2 inches (38 mm)** into wood substrate.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.
- E. Carbon Steel Bolts: ASTM A307 with **ASTM A563 (ASTM A563M)** hex nuts and, where indicated, flat washers all hot-dip zinc coated.
- F. Stainless Steel Bolts: ASTM F593, Alloy Group 1 or 2; with **ASTM F594, Alloy Group 1 or 2 (ASTM F836M, Grade A1 or Grade A4)** hex nuts and, where indicated, flat washers.
- G. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on **[ICC-ES AC01][ICC-ES AC58][ICC-ES AC193][or][ICC-ES AC308]** as appropriate for the substrate.

2.8 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

1. [MiTek Industries, Inc.]
 2. [Tamlyn]
 3. <Insert manufacturer's name>
- B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
1. [MiTek Industries, Inc.]
 2. [Tamlyn]
 3. <Insert manufacturer's name>
- C. Allowable design loads, as published by manufacturer, are to meet or exceed those [indicated][of basis-of-design products][of products of manufacturers listed]. Manufacturer's published values are to be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by qualified independent testing agency. Framing anchors are to be punched for fasteners adequate to withstand same loads as framing anchors.
- D. I-Joist Hangers: U-shaped joist hangers with seat and nailing flanges, full depth of joist, as indicated on Drawings. Nailing flanges provide lateral support at joist top chord.
1. Thickness: [0.040 inch (1.0mm)][0.050 inch (1.3 mm)][0.062 inch (1.6 mm)]<Insert thickness>.
 2. Finish: [Galvanized][Stainless steel][Black paint][Black powder coat][Hot-dip galvanized].
- E. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
1. Strap Width: [1-1/2 inches (38 mm)][2 inches (50 mm)].
 2. Thickness: [0.050 inch (1.3 mm)][0.062 inch (1.6 mm)]<Insert thickness>.
- F. Bridging: Rigid, V-section, nailless type, 0.050 inch (1.3 mm) thick, length to suit joist size and spacing.
- G. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch (25 mm) above base and with 2-inch- (50-mm-) minimum side cover, socket 0.062 inch (1.6 mm) thick, and standoff and adjustment plates 0.108 inch (2.8 mm) thick.
- H. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.
1. Width: [3/4 inch (19 mm)][1-1/4 inches (32 mm)].
 2. Thickness: [0.050 inch (1.3 mm)][0.062 inch (1.6 mm)].
 3. Length: [16 inches (400 mm)][24 inches (600 mm)][As indicated].
- I. Materials: Unless otherwise indicated, fabricate from the following materials:
1. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 (Z180) coating designation.
 - a. Use for interior locations unless otherwise indicated.
 2. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.
 - a. Use for wood-preservative-treated lumber and where indicated.

3. Stainless steel bars and shapes complying with ASTM A276/A276M, [Type 304][Type 316].
 - a. Use for exterior locations and where indicated.

2.9 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets:

1. Glass-fiber-resilient insulation, fabricated in strip form, for use as sill sealer; **1-inch (25-mm)** nominal thickness, compressible to **1/32 inch (0.8 mm)**; selected from manufacturer's standard widths to suit width of sill members indicated.
2. Closed-cell neoprene foam, **1/4 inch (6.4 mm)** thick, selected from manufacturer's standard widths to suit width of sill members indicated.
3. Self-adhering sheet consisting of **64 mils (1.6 mm)** of rubberized asphalt laminated on one side to **4-mil- (0.10-mm-)** thick, polyethylene-film reinforcement, and with release liner on adhesive side; **formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction**.

- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of pliable, **[butyl rubber][or][rubberized-asphalt]** compound, bonded to high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce overall thickness of not less than **0.025 inch (0.6 mm)**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. Verify that joist flange widths match hanger widths.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Do not install in direct contact with concrete or masonry.
- B. Where wood-preservative-treated members are installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- C. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
1. Use treatment approved in writing by manufacturer.

3.3 INSTALLATION OF STRUCTURAL COMPOSITE LUMBER

- A. Install to comply with ESR report, manufacturer's written instructions, and applicable code.
1. Install in dry, covered conditions where average in-service moisture content of lumber is 16 percent or less.



2. Install metal framing connections in accordance with AWC's "National Design Specification (NDS) for Wood Construction." Install fasteners through each fastener hole.
 - a. Connections based on NDS or manufacturer's test or code reports.
 3. Install lumber plumb and level. Accurately fit, align, securely fasten, and install free from distortion or defects.
 4. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
- B. Cutting: Confirm size and location of field cutting, notching, and drilling with ESR report, registered design professional, and manufacturer.

3.4 INSTALLATION OF PREFABRICATED WOOD I-JOISTS

- A. Install to comply with ESR report, manufacturer's written instructions, and applicable code.
1. Install in dry, covered conditions where in-service moisture content of wood does not exceed 16 percent.
 2. Install metal framing connections in accordance with AWC's "National Design Specification (NDS) for Wood Construction." Install fasteners through each fastener hole.
 3. Install joists with top and bottom flanges within **1/2 inch (12.7 mm)** of true vertical alignment, and support ends of each member with not less than **1-3/4 inches (44.5 mm)** for end bearing and **3-1/2 inches (76 mm)** for intermediate bearings.
 4. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
 5. Provide lateral restraint at supports to prevent rotation, and along the compression flange of each joist.
 6. Completely install and properly nail hangers, rim joists, rim boards, blocking panels, and x-bracing as each joist is set.
- B. Cantilevered portions of joists must not exceed a maximum length equal to one-third the adjacent span, and support only uniform loads, unless designed by a design professional and approved by authorities having jurisdiction.
1. Temporarily secure ends of cantilevers with strut lines on both top and bottom flanges. Remove only as required to install permanent sheathing.
- C. Cutting: Do not splice structural members between supports unless otherwise indicated.
1. Do not cut, drill, or notch I-joist top and bottom flanges except for cutting to length.

3.5 INSTALLATION OF ENGINEERED RIM BOARDS

- A. Install at bearing walls perpendicular to and supported by I-joists that require full-depth blocking, or rim joists, at supports.
- B. Sill Sealer Gasket: Install to form continuous seal between sill plates and foundation walls.



3.6 PROTECTION

- A. Protect wood that has been treated with SBX from weather. If, despite protection, SBX-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 17 00 00

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06 - Wood, Plastics, and Composites

Task	Specification	Specification Description
06 17 13 00	06 10 00 00	Rough Carpentry
06 17 13 00	06 17 00 00	Engineered Structural Wood
06 17 13 00	06 18 00 00	Glued-Laminated Construction
06 17 23 00	06 10 00 00	Rough Carpentry
06 17 23 00	06 17 00 00	Engineered Structural Wood
06 17 33 00	06 17 00 00	Engineered Structural Wood
06 17 43 00	06 10 00 00	Rough Carpentry
06 17 43 00	06 17 00 00	Engineered Structural Wood
06 17 43 00	06 18 00 00	Glued-Laminated Construction



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SECTION 06 17 53 00 - SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood products.
 - 2. Preservative-treated lumber.
 - 3. Fire-retardant-treated lumber.

1.2 ALLOWANCES

- A. Provide wood truss bracing under the Metal-Plate-Connected Truss Bracing Allowance as specified in Section 012100 "Allowances."

1.3 DEFINITIONS

- A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For **[wood-preservative-treated lumber,][fire-retardant-treated lumber,]** metal-plate connectors, metal truss accessories, and fasteners.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification from treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification from treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to truss fabricator.
- B. Sustainable Design Submittals:
 - 1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 - 2. Environmental Product Declaration (EPD): For each product.
 - 3. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
 - 4. Environmental Product Declaration: For each product.

5. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
6. Environmental Product Declaration: For each product.
7. Environmental Product Declaration: For each product.
8. Third-Party Certifications: For each product.
9. Third-Party Certified Life Cycle Assessment: For each product.
10. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
11. Chain-of-Custody Qualification Data: For manufacturer and vendor.

C. Shop Drawings: Show fabrication and installation details for trusses.

1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
2. Indicate sizes, stress grades, and species of lumber.
3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
6. Show splice details and bearing details.

D. Delegated Design Submittals: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[metal connector-plate manufacturer][professional engineer][and][fabricator]**.
- B. Material Certificates: For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.
- C. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss-fabricating firm.
- D. Evaluation Reports: For the following, from ICC-ES:
 1. Wood-preservative-treated lumber.
 2. Fire-retardant-treated wood.
 3. Metal-plate connectors.
 4. Metal truss accessories.

1.6 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
 1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

- B. Fabricator Qualifications: Shop that **[participates in a recognized quality-assurance program, complies with quality-control procedures in TPI 1, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction][and][is certified for chain of custody by an FSC-accredited certification body]**.
- C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
- D. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- E. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.
- F. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- G. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."
 - 1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
 - 2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
 - 3. Provide for air circulation around stacks and under coverings.
- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal-plate-connected wood trusses.
- B. Structural Performance: Metal-plate-connected wood trusses are to be capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
 - 1. Design Loads: As indicated.
 - 2. Maximum Deflection under Design Loads:
 - a. Roof Trusses: Vertical deflection of **[1/180][1/240][1/360]** of span.
 - b. Floor Trusses: Vertical deflection of **[1/360][1/480][1/600]** of span.



- C. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.
- D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."
- E. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- F. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site.
- G. Regional Materials: Wood products shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- H. Indigenous Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- I. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- J. Certified Wood: Wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.
- K. Certified Wood: Wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.
- L. Certified Wood: Wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
- M. Certified Wood: Wood products shall [**contain not less than 60 percent**][**be made from**] certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."
- N. Certified Wood: Wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.

2.2 WOOD PRODUCTS

- A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (ALSC) Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.

3. Provide dressed lumber, S4S.
4. Provide dry lumber with **[15][19]** percent maximum moisture content at time of dressing.
- B. Minimum Chord Size for Roof Trusses: **[2 by 6 inches nominal (38 by 140 mm actual) for top chords][2 by 6 inches nominal (38 by 140 mm actual) for bottom chords][2 by 6 inches nominal (38 by 140 mm actual) for both top and bottom chords]**.
- C. Minimum Specific Gravity for Top Chords: **[0.50]<Insert value>**.
- D. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 061000 "Rough Carpentry."

2.3 PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC2**[for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground]**.
 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 2. For exposed trusses indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 1. For exposed trusses indicated to receive a stained or natural finish, **[mark end or back of each piece][or][omit marking and provide certificates of treatment compliance issued by inspection agency]**.
- D. Application: Treat **[all trusses unless otherwise indicated][trusses where indicated on Drawings]**.

2.4 FIRE-RETARDANT-TREATED LUMBER

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products according to test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than **10.5 feet (3.2 m)** beyond the centerline of the burners at any time during the test.
 1. Use treatment that does not promote corrosion of metal fasteners.
 2. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated.
 3. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201 at 92 percent relative humidity. Use for interior locations

where exterior type is not indicated.

4. Design Value Adjustment Factors: Treated lumber is to be tested in accordance with ASTM D5664, and design value adjustment factors is to be calculated in accordance with ASTM D6841. **For enclosed roof framing and framing in attic spaces, and where high-temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.]**

- C. Kiln-dry lumber after treatment to a maximum moisture content of **[15][19]** percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
 1. For exposed trusses and bracing indicated to receive a stained or natural finish, **[mark end or back of each piece][or][omit marking and provide certificates of treatment compliance issued by inspection agency].**
- E. For exposed trusses indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat **[all trusses unless otherwise indicated.][items indicated on Drawings, and the following:]**
 1. Floor trusses.
 2. Roof trusses.
 3. **<Insert category of trusses required to be treated>.**

2.5 METAL CONNECTOR PLATES

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:]**
 1. **[Alpine, a division of ITW Inc.]**
 2. **[Cherokee Metal Products, Inc.; Masengill Machinery Company]**
 3. **[Eagle Metal Products]**
 4. **[MiTek Industries, Inc.]**
 5. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 1. **[Alpine, a division of ITW Inc.]**
 2. **[Cherokee Metal Products, Inc.; Masengill Machinery Company]**
 3. **[Eagle Metal Products]**
 4. **[MiTek Industries, Inc.]**
 5. **<Insert manufacturer's name>**
- C. Fabricate connector plates to comply with TPI 1.
- D. Hot-Dip Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); **G60 (Z180)** coating designation; and not less than **0.036 inch (0.9 mm)** thick.

1. Use for interior locations unless otherwise indicated.
- E. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); **G185 (Z550)** coating designation; and not less than **0.036 inch (0.9 mm)** thick.
 1. Use for wood-preservative-treated lumber and where indicated.
- F. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, **[Type 304][Type 316]**, and not less than **0.035 inch (0.88 mm)** thick.
 1. Use for exterior locations[, **wood-preservative-treated lumber,**][**fire-retardant treated lumber,**] and where indicated.

2.6 FASTENERS

- A. Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
 2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners **[with hot-dip zinc coating complying with ASTM A153/A153M][of Type 304 stainless steel]**.
- B. Nails, Brads, and Staples: ASTM F1667.

2.7 METAL FRAMING ANCHORS AND ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 1. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 1. **<Insert manufacturer's name>**
- C. Allowable design loads, as published by manufacturer, are to comply with or exceed those **[indicated][of basis-of-design products][of products of manufacturers listed]**. Manufacturer's published values are to be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors are to be punched for fasteners adequate to withstand same loads as framing anchors.
- D. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, **G60 (Z180)** coating designation.
 1. Use for interior locations unless otherwise indicated.
- E. Hot-Dip Heavy-Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); **G185**

(Z550) coating designation; and not less than **0.036 inch (0.9 mm)** thick.

1. Use for wood-preserved-treated lumber and where indicated.

F. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, **[Type 304][Type 316]**.

1. Use for exterior locations and where indicated.

G. Truss Tie-Downs: Bent strap tie for fastening roof trusses to wall studs below, **1-1/2 inches (38 mm)** wide by **0.050 inch (1.3 mm)** thick. **[Tie fastens to one side of truss, top plates, and side of stud below.]**

H. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, **2-1/4 inches (57 mm)** wide by **0.062 inch (1.6 mm)** thick. Tie fits over top of truss and fastens to both sides of truss, top plates, and one side of stud below.

I. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, **1-1/4 inches (32 mm)** wide by **0.050 inch (1.3 mm)** thick. Clip is fastened to truss through slotted holes to allow for truss deflection.

J. Floor Truss Hangers: U-shaped hangers, full depth of floor truss, with **1-3/4-inch- (44-mm-)** long seat; formed from metal strap **0.062 inch (1.6 mm)** thick with tabs bent to extend over and be fastened to supporting member.

K. Roof Truss Bracing/Spacers: U-shaped channels, **1-1/2 inches (38 mm)** wide by **1 inch (25 mm)** deep by **0.040 inch (1.0 mm)** thick, made to fit between two adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses.

L. Drag Strut Connectors: Angle clip with one leg extended for fastening to the side of girder truss.

1. Angle clip is **3 by 3 by 0.179 by 8 inches (76 by 76 by 4.55 by 203 mm)** with extended leg **8 inches (203 mm)** long. Connector has galvanized finish.
2. Angle clip is **3 by 3 by 0.239 by 10-1/2 inches (76 by 76 by 6.07 by 267 mm)** with extended leg **10-1/2 inches (267 mm)** long. Connector has painted finish.

2.8 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 92 percent zinc dust by weight.

2.9 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

- D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

2.10 SOURCE QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections.
 - 1. Provide special inspector with access to fabricator's documentation of detailed fabrication and quality-control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards.
 - 2. Provide special inspector with access to places where wood trusses are being fabricated to perform inspections.
- B. Correct deficiencies in Work that special inspections indicate do not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- F. Space trusses [**16 inches (406 mm) o.c.**][**24 inches (610 mm) o.c.**][**as indicated**]; adjust and align trusses in location before permanently fastening.
- G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.
- H. Securely connect each truss ply required for forming built-up girder trusses.
 - 1. Anchor trusses to girder trusses as indicated.
- I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 - 1. Install bracing to comply with Section 061000 "Rough Carpentry."
 - 2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- J. Install wood trusses within installation tolerances in TPI 1.
- K. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.

- L. Replace wood trusses that are damaged or do not comply with requirements.
 - 1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

3.2 REPAIRS AND PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- C. Repair damaged galvanized coatings on exposed surfaces in accordance with ASTM A780/A780M and manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections to verify that temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

END OF SECTION 06 17 53 00



06 - Wood, Plastics, and Composites

Task	Specification	Specification Description
06 17 53 00	06 17 00 00	Engineered Structural Wood



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SECTION 06 18 00 00 - GLUED-LAMINATED CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural glued-laminated timber.
2. Timber connectors.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for dimension lumber items associated with structural glued-laminated timber.
2. Section 061300 "Heavy Timber Construction" for framing using **[timbers][and][round wood poles]**.
3. Section 061516 "Wood Roof Decking" for glued-laminated wood roof decking.

1.2 DEFINITIONS

- A. Structural Glued-Laminated (Glulam) Timber: An engineered, stress-rated timber product assembled from selected and prepared wood laminations bonded together with adhesives and with the grain of the laminations approximately parallel longitudinally.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data on lumber, adhesives, fabrication, and protection.
2. For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
3. For connectors. Include installation instructions.

B. Sustainable Design Submittals:

1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
2. Chain-of-Custody Qualification Data: For manufacturer and vendor.
3. Product Data: For laminating adhesives, indicating that product contains no urea formaldehyde.
4. Laboratory Test Reports: For laminating adhesives, indicating compliance with requirements for low-emitting materials.
5. Laboratory Test Reports: For laminating adhesives, indicating compliance with requirements for low-emitting materials.
6. Product Data: For laminating adhesives, indicating that product contains no urea formaldehyde.
7. Product Data: For laminating adhesives, indicating that product contains no urea formaldehyde.

C. Shop Drawings:

1. Show layout of structural glued-laminated timber system and full dimensions of each member.
2. Indicate species and laminating combination.

3. Include large-scale details of connections.

D. Samples: Full width and depth, **24 inches (600 mm)** long, showing the range of variation to be expected in appearance of structural glued-laminated timber[**including variations due to specified treatment**].

1. Apply specified factory finish to three sides of half length of each Sample.

E. Delegated Design Submittal: For structural glued-laminated timber and timber connectors.

1.4 INFORMATIONAL SUBMITTALS

A. Certificates of Conformance: Issued by a qualified testing and inspecting agency indicating that structural glued-laminated timber complies with requirements in ANSI A190.1.

B. Material Certificates: For preservative-treated wood products, from manufacturer. Indicate type of preservative used and net amount of preservative retained.

C. Research/Evaluation Reports: For **[structural glued-laminated timber][and][timber connectors]**, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: **[An AITC- or APA-EWS-licensed firm][certified for chain of custody by an FSC-accredited certification body]**.

B. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

C. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.

D. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

E. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with provisions in AITC 111.

B. Individually wrap members using plastic-coated paper covering with water-resistant seams.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01 Section "Quality

Requirements," to design structural glued-laminated timber and connectors.

- B. Structural Performance: Structural glued-laminated timber and connectors are to withstand the effects of structural loads shown on Drawings without exceeding allowable design working stresses listed in ANSI 117 or determined according to ASTM D3737 and acceptable to authorities having jurisdiction.
- C. Seismic Performance: Structural glued-laminated timber and connectors are to withstand the effects of earthquake motions determined according to [ASCE/SEI 7]<Insert requirement>.

2.2 STRUCTURAL GLUED-LAMINATED TIMBER

- A. General: Provide structural glued-laminated timber that complies with ANSI A190.1 and ANSI 117 or research/evaluation reports acceptable to authorities having jurisdiction.
 - 1. Factory mark each piece of structural glued-laminated timber with AITC Quality Mark or APA-EWS trademark. Place mark on surfaces that are not exposed in the completed Work.
 - 2. Provide structural glued-laminated timber made from single species.
 - 3. Provide structural glued-laminated timber made from solid lumber laminations; do not use laminated veneer lumber.
 - 4. Provide structural glued-laminated timber made with wet-use adhesive complying with ANSI A190.1.
 - 5. Adhesives: Do not use adhesives that contain urea formaldehyde.
 - 6. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 7. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 8. Adhesives: Do not use adhesives that contain urea formaldehyde.
 - 9. Adhesives: Do not use adhesives that contain urea formaldehyde.
- B. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- C. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site.
- D. Regional Materials: Wood products shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- E. Indigenous Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- F. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- G. Certified Wood: Wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.
- H. Certified Wood: Wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to

FSC STD-01-001 and FSC STD-40-004.

- I. Certified Wood: Wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
- J. Certified Wood: Wood products shall **[contain not less than 60 percent][be made from]** certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."
- K. Certified Wood: Wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
- L. Species and Grades for Structural Glued-Laminated Timber:
 1. **[Alaska cedar][Douglas fir-larch][Southern pine][Any species]<Insert species>** in grades needed to comply with "Performance Requirements" Article.
 2. **[Alaska cedar][Douglas fir-larch][Southern pine][Any species]<Insert species>** that complies with **[structural properties][combination symbols][beam stress classifications]** indicated.
- M. Species and Grades: For **[beams][and][purlins]**.
 1. Species and Beam Stress Classification: **[Ponderosa pine, 16F-1.3E][Alaska cedar, 20F-1.5E][Eastern spruce, 20F-1.5E][Any species, 20F-1.5E][Any species, 24F-1.7E][Douglas fir-larch, 24F-1.8E][Southern pine, 24F-1.8E][Douglas fir-larch or southern pine, 24F-1.8E][Southern pine, 30F-2.1E]<Insert species and beam stress classification>**.
 2. Lay-up: **[Balanced][Either balanced or unbalanced]**.
 3. Species and Combination Symbol: **<Insert species and combination symbol>**.
- N. Species and Grades for Arches:
 1. Species and Beam Stress Classification: **[Alaska cedar, 20F-1.5E][Eastern spruce, 20F-1.5E][Any species, 20F-1.5E][Any species, 24F-1.7E][Douglas fir-larch, 24F-1.8E][Southern pine, 24F-1.8E][Douglas fir-larch or southern pine, 24F-1.8E]<Insert species and beam stress classification>**.
 2. Lay-up: **[Balanced][Either balanced or unbalanced]**.
 3. Species and Combination Symbol: **[Alaska cedar, 20F-V13 WS][Douglas fir-larch, 24F-V8 WS][Southern pine, 24F-V5 SP][Alaska cedar, 20F-V12 WS][Douglas fir-larch, 24F-V4 WS][Southern pine, 24F-V3 SP]<Insert species and combination symbol>**.
- O. Species and Grades for **[Columns][and][Truss Members]**:
 1. Species and Combination Symbol: **[Alaska cedar, 70][Douglas fir-larch, 1][Douglas fir-larch, 3][Southern pine, 47][Southern pine, 50]<Insert species and combination symbol>**.
- P. Appearance Grade: **[Premium][Architectural][Industrial][Framing]**, complying with AITC 110.
 1. For Premium and Architectural appearance grades, fill voids as required by AITC 110.**[For Premium appearance grade, use clear wood inserts, of matching grain and color, for filling voids and knot holes more than 1/4 inch (6 mm) wide.]**

2.3 PRESERVATIVE TREATMENT

- A. Preservative Treatment: Where preservative-treated structural glued-laminated timber is indicated, comply with AWP A U1, Use **[Category 1][Category 2][Category 3A][Category 3B][Category 4A]**.
 - 1. Use preservative solution without **[water repellents or]** substances that might interfere with application of indicated finishes.
 - 2. Do not incise structural glued-laminated timber or wood used to produce structural glued-laminated timber.
- B. Preservative: **[One of the following:]**
 - 1. Oxine copper (copper-8-quinolinolate) in a light petroleum solvent.
 - 2. Pentachlorophenol in light petroleum solvent.
 - 3. Copper naphthenate in a light petroleum solvent.
 - 4. Ammoniacal zinc copper arsenate (ACZA) in a water solution.
 - 5. Chromated copper arsenate (CCA) in a water solution.
 - 6. Ammoniacal copper quat Type A (ACQ-C) in a water solution.
 - 7. Propiconazole tebuconazole imidacloprid (PTI) in a water emulsion.
- C. After dressing members, apply a copper naphthenate field-treatment preservative to comply with AWP A M4 to surfaces cut to a depth of more than **1/16 inch (1.5 mm)**.

2.4 TIMBER CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **[Simpson Strong-Tie Co., Inc.]**
 - 2. **[USP Structural Connectors]**
 - 3. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1. **[Simpson Strong-Tie Co., Inc.]**
 - 2. **[USP Structural Connectors]**
 - 3. **<Insert manufacturer's name>**
- C. Fabricate beam seats from **[steel][stainless steel]** with **[0.239-inch (6-mm)][3/16-inch (5-mm)][3/8-inch (9.5-mm)]** bearing plates, **3/4-inch- (19-mm-)** diameter-by-**12-inch- (300-mm-)** long deformed bar anchors, and **0.239-inch (6-mm)** side plates.
- D. Fabricate arch base shoes from **[steel][stainless steel]** with **1-inch (25-mm)** baseplates and **3/8-inch (9.5-mm)** side plates.
- E. Fabricate beam hangers from **[steel][stainless steel]** with **0.179-inch (4.6-mm)** stirrups and **0.239-inch (6-mm)** top plates.
- F. Fabricate hinge connectors from **[steel][stainless steel]** with **0.179-inch (4.6-mm)** side plates and **[3/4-inch (19-mm)][1-inch (25-mm)]** top and bottom plates.
- G. Fabricate strap ties from **[steel][stainless steel]**, **[2-1/2 inches (63 mm) wide by 0.179 inch (4.6 mm)][3 inches (75 mm) wide by 0.239 inch (6 mm)]** thick.

- H. Fabricate tie rods from round steel bars with upset threads connected with forged-steel turnbuckles complying with ASTM A668/A668M.
- I. Provide bolts, **3/4 inch (19 mm)** unless otherwise indicated, complying with **ASTM A307, Grade A (ASTM F568M, Property Class 4.6)**; nuts complying with **ASTM A563 (ASTM A563M)**; and, where indicated, flat washers.
- J. Provide shear plates, **[2-5/8 inches (66.7 mm)][4 inches (102 mm)]** in diameter, complying with ASTM D5933.
- K. Materials: Unless otherwise indicated, fabricate from the following materials:
 - 1. Structural-steel shapes, plates, and flat bars complying with ASTM A36/A36M.
 - 2. Round steel bars complying with ASTM A575, Grade M 1020.
 - 3. Hot-rolled steel sheet complying with ASTM A1011/A1011M, Structural Steel, Type SS, Grade 33.
 - 4. Stainless steel flat bars complying with ASTM A666, **[Type 304][Type 316]**.
 - 5. Stainless steel bars and shapes complying with ASTM A276, **[Type 304][Type 316]**.
 - 6. Stainless steel plate, sheet, and strip complying with ASTM A240/A240M or ASTM A666, **[Type 304][Type 316]**.
- L. Finish steel assemblies and fasteners with rust-inhibitive primer, **2-mil (0.05-mm)** dry film thickness.
- M. Hot-dip galvanize steel assemblies and fasteners after fabrication to comply with ASTM A123/A123M or ASTM A153/A153M.

2.5 MISCELLANEOUS MATERIALS

- A. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.
- B. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

2.6 FABRICATION

- A. Shop fabricate for connections to greatest extent possible, including cutting to length and drilling bolt holes.
 - 1. Dress exposed surfaces as needed to remove planing and surfacing marks.
- B. Camber: Fabricate horizontal and inclined members of less than 1:1 slope with either circular or parabolic camber equal to 1/500 of span.
- C. Where preservative-treated members are indicated, fabricate (cut, drill, surface, and sand) before treatment to greatest extent possible. Where fabrication must be done after treatment, apply a field-treatment preservative to comply with AWPA M4.
 - 1. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.
 - 2. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.

- D. End-Cut Sealing: Immediately after end cutting each member to final length[**and after preservative treatment**], apply a saturation coat of end sealer to ends and other cross-cut surfaces, keeping surfaces flood coated for not less than 10 minutes.
- E. Seal Coat: After fabricating, sanding, and end-coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit[**except for preservative-treated wood where treatment included a water repellent**].

2.7 FACTORY FINISHING

- A. Clear Finish: Manufacturer's standard, resistant to mildew and fungus.
 - 1. Water repellent.
 - 2. Film-forming two-coat, [varnish][urethane].
- B. Semitransparent Stain Finish: Manufacturer's standard oil-based stain, resistant to mold and fungus.
 - 1. Color: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.
- C. Solid-Color Stain Finish: Manufacturer's standard [oil-based][latex] penetrating stain, resistant to mildew and fungus.
 - 1. Color: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.
- D. Painted Finish: Acrylic latex system.
 - 1. Prime Coat: Stain blocking primer as recommended by topcoat manufacturer.
 - 2. Intermediate Coat: Matching topcoat.
 - 3. Topcoat: High-performance architectural coating, [low sheen][eggshell][satin][semigloss].
 - 4. Color: [Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates in areas to receive structural glued-laminated timber, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Erect structural glued-laminated timber true and plumb and with uniform, close-fitting joints. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
 - 1. Handle and temporarily support glued-laminated timber to prevent surface damage, compression,

and other effects that might interfere with indicated finish.

- B. Framing Built into Masonry: Provide **1/2-inch (13-mm)** clearance at tops, sides, and ends of members built into masonry; bevel cut ends **3 inches (76 mm)**; and do not embed more than **4 inches (102 mm)** unless otherwise indicated.
- C. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.
- D. Fit structural glued-laminated timber by cutting and restoring exposed surfaces to match specified surfacing[**and finishing**].
 - 1. Predrill for fasteners using timber connectors as templates.
 - 2. Finish exposed surfaces to remove planing or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
 - 3. Coat cross cuts with end sealer.
 - 4. Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWP A M4.
 - a. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.
 - b. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.
- E. Install timber connectors as indicated.
 - 1. Unless otherwise indicated, install bolts with same orientation within each connection and in similar connections.
 - 2. Install bolts with orientation as indicated or, if not indicated, as directed by Architect.

3.3 ADJUSTING

- A. Repair damaged surfaces[**and finishes**] after completing erection. Replace damaged structural glued-laminated timber if repairs are not approved by Architect.

3.4 PROTECTION

- A. Do not remove wrappings on individually wrapped members until they no longer serve a useful purpose, including protection from weather, sunlight, soiling, and damage from work of other trades.
 - 1. Coordinate wrapping removal with finishing work. Retain wrapping where it can serve as a painting shield.
 - 2. Slit underside of wrapping to prevent accumulation of moisture inside the wrapping.

END OF SECTION 06 18 00 00



06 - Wood, Plastics, and Composites

Task	Specification	Specification Description
06 18 13 00	06 18 00 00	Glued-Laminated Construction
06 18 16 00	06 10 00 00	Rough Carpentry
06 18 16 00	06 18 00 00	Glued-Laminated Construction



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SECTION 06 20 00 00 - EXTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior trim.
2. Lumber siding.
3. Plywood siding.
4. Engineered wood siding.
5. Lumber soffits.
6. Plywood soffits.
7. Engineered wood soffits.

1.2 DEFINITIONS

- A. MDO:** Plywood with a medium-density overlay on the face.
- B. PVC:** Polyvinyl chloride.

1.3 ACTION SUBMITTALS

- A. Product Data:** For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
- B. Sustainable Design Submittals:**
1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 2. Environmental Product Declaration (EPD): For each product.
 3. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
 4. Environmental Product Declaration: For each product.
 5. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
 6. Environmental Product Declaration: For each product.
 7. Environmental Product Declaration: For each product.
 8. Third-Party Certifications: For each product.

9. Third-Party Certified Life Cycle Assessment: For each product.
10. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
11. Chain-of-Custody Qualification Data: For manufacturer and vendor.

- C. Samples: For each exposed product and for each color and texture specified.
- D. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.
- E. Samples for Verification:
1. For each species and cut of lumber and panel products, with half of exposed surface finished; **50 sq. in. (300 sq. cm)** for lumber and **8 by 10 inches (200 by 250 mm)** for panels.
 2. For engineered wood [siding][and][soffits], **50 sq. in. (300 sq. cm)** for board types and **8 by 10 inches (200 by 250 mm)** for panels.
 3. For cellular PVC trim, with half of exposed surface finished; **50 sq. in. (300 sq. cm)**.
 4. For foam-plastic moldings, with half of exposed surface finished; **50 sq. in. (300 sq. cm)**.

1.4 INFORMATIONAL SUBMITTALS

- A. Compliance Certificates:
1. For lumber that is not marked with grade stamp.
 2. For preservative-treated wood that is not marked with treatment-quality mark.
- B. Evaluation Reports: For the following, from ICC-ES:
1. Wood-preservative-treated wood.
 2. Cellular PVC trim.
 3. Foam-plastic moldings.
- C. Sample Warranties: For manufacturer's warranties.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.
- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- D. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.

1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
2. Provide for air circulation around stacks and under coverings.

1.7 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.8 WARRANTY

- A. Engineered Wood Manufacturer's Warranty: Manufacturer agrees to repair or replace components of engineered wood siding [soffits][and][trim] that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, deformation or deterioration beyond normal weathering.
 2. Warranty Period for Factory-Applied Finish: [Five]<Insert number> years from date of Substantial Completion.
 3. Warranty Period: Siding [Soffits][and][Trim] (Excluding Finish), [25]<Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Regional Materials: The following wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
 1. Exterior trim.
 2. Exterior [lumber][plywood][hardboard] siding.
 3. Exterior [plywood][hardboard] soffits.
 4. Exterior [stairs][and][railings].
- B. Regional Materials: The following wood products shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
 1. Exterior trim.
 2. Exterior [lumber][plywood][hardboard] siding.
 3. Exterior [plywood][hardboard] soffits.
 4. Exterior [stairs][and][railings].
- C. Indigenous Materials: The following wood products shall be manufactured within **500 miles (800 km)** of



Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.

1. Exterior trim.
2. Exterior **[lumber][plywood][hardboard]** siding.
3. Exterior **[plywood][hardboard]** soffits.
4. Exterior **[stairs][and][railings]**.

D. Regional Materials: The following wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.

1. Exterior trim.
2. Exterior **[lumber][plywood][hardboard]** siding.
3. Exterior **[plywood][hardboard]** soffits.
4. Exterior **[stairs][and][railings]**.

E. Certified Wood: The following wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-00 and FSC STD-40-004.

1. Exterior trim.
2. Exterior **[lumber][plywood][hardboard]** siding.
3. Exterior **[plywood][hardboard]** soffits.
4. Exterior **[stairs][and][railings]**.

F. Certified Wood: The following wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.

1. Exterior trim.
2. Exterior **[lumber][plywood][hardboard]** siding.
3. Exterior **[plywood][hardboard]** soffits.
4. Exterior **[stairs][and][railings]**.

G. Certified Wood: The following wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.

1. Exterior trim.
2. Exterior **[lumber][plywood][hardboard]** siding.
3. Exterior **[plywood][hardboard]** soffits.
4. Exterior **[stairs][and][railings]**.

H. Certified Wood: The following wood products shall **[contain not less than 60 percent][be made from]** certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "Technical Barriers to Trade."

1. Exterior trim.
2. Exterior **[lumber][plywood][hardboard]** siding.
3. Exterior **[plywood][hardboard]** soffits.
4. Exterior **[stairs][and][railings]**.

- I. Certified Wood: The following wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
 1. Exterior trim.
 2. Exterior [lumber][plywood][hardboard] siding.
 3. Exterior [plywood][hardboard] soffits.
 4. Exterior [stairs][and][railings].
- J. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.
 1. Factory mark each piece of lumber with grade stamp of inspection agency, indicating grade, species, moisture content at time of surfacing, and mill.
 2. For exposed lumber, mark grade stamp on end or back of each piece[, or omit grade stamp and provide certificates of grade compliance issued by inspection agency].
- K. Softwood Plywood: DOC PS 1.
- L. Hardboard: ANSI A135.4.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Water-Repellent Preservative Treatment by Nonpressure Process: AWWA N1; dip, spray, flood, or vacuum-pressure treatment.
 1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC)[, combined with an insecticide containing chlorpyrifos (CPF)]<Insert requirement>.
 2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
 3. Application: [Items not required to be pressure-preservative treated][Exterior trim][and][wood siding]<Insert application>.
- B. Preservative Treatment by Pressure Process: AWWA U1; Use Category [UC3a][UC3b].
 1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent, respectively.
 2. Preservative Chemicals: Acceptable to authorities having jurisdiction[and containing no arsenic or chromium].
 3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
 4. Do not use material that is warped or does not comply with requirements for untreated material.
 5. Mark lumber with treatment-quality mark of an inspection agency approved by the ALSC's Board of Review.
 - a. For exposed lumber indicated to receive a stained or natural finish, [mark end or back of each piece][or][omit marking and provide certificates of treatment compliance issued by inspection agency].
 6. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
 - a. For exposed plywood indicated to receive a stained or natural finish, mark back of each

piece.

7. Application: **[Where indicated on Drawings][All exterior lumber and plywood]<Insert application>.**

2.3 EXTERIOR TRIM

A. Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade:
 - a. Redwood; RIS **[Clear All Heart][Heart B][Clear][Grade B]**.
 - b. Western red cedar; NLGA, WCLIB, or WWPA **[Clear Heart VG (Vertical Grain)][Clear Heart][Grade A][Grade B]**.
 - c. Hem-fir; pressure-preservative treated; NLGA, WCLIB, or WWPA **[1 Common][2 Common]**.
 - d. Southern pine; pressure-preservative treated; SPIB **[B & B][C & Btr][D]**.
2. Maximum Moisture Content: **[19][15] percent[with at least 85 percent of shipment at 12 percent or less].**
3. Finger Jointing: **[Not allowed][Allowed if made with wet-use adhesive complying with ASTM D5572].**
4. Face Surface: **[Surfaced (smooth)][Saw textured].**

B. Lumber Trim for Opaque Finish (Painted Finish):

1. Species and Grade:
 - a. Redwood; RIS **[Clear][Grade B]**.
 - b. Western red cedar; NLGA, WCLIB, or WWPA **[Grade A][Grade B]**.
 - c. Hem-fir; NLGA, WCLIB, or WWPA **[Prime or D finish][1 Common][2 Common]**.
 - d. Eastern white pine, eastern hemlock-balsam fir-tamarack, eastern spruce, or white woods; NeLMA, NLGA, WCLIB, or WWPA **[D Select (Quality)][Finish or 1 Common (Colonial)][Premium or 2 Common (Sterling)]**.
 - e. Northern white cedar; NeLMA or NLGA **[D Select][1 Common][2 Common]**.
2. Maximum Moisture Content: **[19][15] percent[with at least 85 percent of shipment at 12 percent or less].**
3. Finger Jointing: **[Not allowed][Allowed if made with wet-use adhesive complying with ASTM D5572].**
4. Face Surface: **[Surfaced (smooth)][Saw textured].**
5. Factory Priming: Factory coated on both faces and all edges, with exterior primer compatible with topcoats specified.

C. Moldings for Transparent Finish (Stain or Clear Finish): MMPA WM 4, N-grade wood moldings, without finger jointing, made from kiln-dried stock to patterns included in MMPA's "WM/Series Softwood Moulding Patterns."

1. Species: **[Redwood][Western red cedar][Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine]<Insert species>.**
2. Brick-Mold Pattern: WWMPA WM 180, 1-1/4 by 2 inches (32 by 51 mm).
3. Drip-Cap Pattern: WWMPA WM 197, 11/16 by 1-5/8 inches (17 by 41 mm).
4. Bed-Mold Pattern: WWMPA WM 75, 9/16 by 1-5/8 inches (14 by 41 mm).
5. Screen-Bead Pattern: WWMPA WM 144, 1/4 by 3/4 inch (6 by 19 mm).

- D. Moldings for Opaque Finish (Painted Finish): MMPA WM 4, P-grade wood moldings, made from kiln-dried stock to patterns included in MMPA's "WM/Series Softwood Moulding Patterns."
1. Species: **[Redwood][Western red cedar][Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine]<Insert species>**.
 2. Finger Jointing: **[Not allowed][Allowed if made with wet-use adhesive complying with ASTM D5572]**.
 3. Factory Priming: Factory coated on both faces and all edges, with exterior primer compatible with topcoats specified.
 4. Brick-Mold Pattern: WWMPA WM 180, **1-1/4 by 2 inches (32 by 51 mm)**.
 5. Drip-Cap Pattern: WWMPA WM 197, **11/16 by 1-5/8 inches (17 by 41 mm)**.
 6. Bed-Mold Pattern: WWMPA WM 75, **9/16 by 1-5/8 inches (14 by 41 mm)**.
 7. Screen-Bead Pattern: WWMPA WM 144, **1/4 by 3/4 inch (6 by 19 mm)**.
- E. MDO Trim: Exterior Grade B-B MDO plywood.
- F. Primed Hardboard Trim: ANSI A135.6, primed with manufacturer's standard exterior primer. Recommended by manufacturer for exterior use.
- G. Cellular PVC Trim: Extruded, expanded PVC with a small-cell microstructure, recommended by manufacturer for exterior use, made from UV- and heat-stabilized rigid material.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[AZEK Building Products, Incorporated]**
 - b. **[CertainTeed; SAINT-GOBAIN]**
 - c. **[Kleer Lumber]**
 - d. **[Kommerling USA]**
 - e. **[Plasticlad, LLC]**
 - f. **[Ply-Trim, Inc.]**
 - g. **[VERSATEX Building Products, LLC]**
 - h. **[Vi-Lux Building Products Inc.]**
 - i. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[AZEK Building Products, Incorporated]**
 - b. **[CertainTeed; SAINT-GOBAIN]**
 - c. **[Kleer Lumber]**
 - d. **[Kommerling USA]**
 - e. **[Plasticlad, LLC]**
 - f. **[Ply-Trim, Inc.]**
 - g. **[VERSATEX Building Products, LLC]**
 - h. **[Vi-Lux Building Products Inc.]**
 - i. **<Insert manufacturer's name>**
 3. Density: Not less than **31 lb/cu. ft. (500 kg/cu. m)**.
 4. Heat Deflection Temperature: Not less than **130 deg F (54 deg C)**, in accordance with ASTM D648.
 5. Coefficient of Thermal Expansion: Not more than **4.5 x 10⁽⁻⁵⁾ inches/inch x deg F (8.1 x 10⁽⁻⁵⁾ mm/mm x deg C)**.

6. Water Absorption: Not more than 1 percent, in accordance with ASTM D570.
7. Flame-Spread Index: 75 or less, in accordance with ASTM E84.

H. Foam-Plastic Moldings: Molded product of shapes indicated, recommended by manufacturer for exterior use, with a tough outer skin on exposed surfaces; factory primed. Exposed surfaces are not to be shaped after molding.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Architectural Mall, Inc]**
 - b. **[Carter Millwork]**
 - c. **[Chemcrest Inc.; a division of Foamcore]**
 - d. **[Diamond Mfg., Inc.]**
 - e. **[Focal Point Products]**
 - f. **[Fypon LLC]**
 - g. **[Melton Classics Inc.]**
 - h. **[Vintage Mouldings Manufacturing Ltd.]**
 - i. **[Worthington Millwork, LLC.]**
 - j. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Mall, Inc]**
 - b. **[Carter Millwork]**
 - c. **[Chemcrest Inc.; a division of Foamcore]**
 - d. **[Diamond Mfg., Inc.]**
 - e. **[Focal Point Products]**
 - f. **[Fypon LLC]**
 - g. **[Melton Classics Inc.]**
 - h. **[Vintage Mouldings Manufacturing Ltd.]**
 - i. **[Worthington Millwork, LLC.]**
 - j. **<Insert manufacturer's name>**
3. Density: Not less than **20 lb/cu. ft. (320 kg/cu. m)**.
4. Flame-Spread Index: Not more than **[75]<Insert number>** when tested in accordance with ASTM E84.
5. Thickness: Not more than **1/2 inch (12.7 mm)**.
6. Width: Not more than **8 inches (204 mm)**.
7. Patterns: **[As indicated by manufacturer's designations][Match Architect's samples]**.

2.4 LUMBER SIDING

- A. Provide kiln-dried lumber siding complying with DOC PS 20[, **factory coated with exterior primer compatible with topcoats specified**].
- B. Species and Grade:
 1. Redwood; RIS **[Clear All Heart VG][Clear All Heart][Clear VG (Vertical Grain)][Clear][Grade B]**.

2. Western red cedar; NLGA, WCLIB, or WWPB [Clear VG (Vertical Grain) Heart][Grade A][Grade B].
3. Spruce-pine-fir; NeLMA, NLGA, WCLIB, or WWPB [1 Common][2 Common].
4. Pressure-preservative-treated hem-fir; NLGA, WCLIB, or WWPB [Prime or D finish][1 Common][2 Common].
5. Eastern white pine, eastern hemlock-balsam fir-tamarack, eastern spruce, or white woods; NeLMA, NLGA, WCLIB, or WWPB [D Select (Quality)][Finish or 1 Common (Colonial)][Premium or 2 Common (Sterling)].
6. Northern white cedar; NeLMA or NLGA [D Select][1 Common][2 Common].
7. Pressure-preservative-treated southern pine; SPIB [B & B][C & Btr][D][1 Common][2 Common].

C. Pattern:

1. Bevel siding, S1S2E, actual overall dimensions of [5-1/2 by 11/16 inch (140 by 17 mm)][5-1/2 by 3/4 inch (140 by 19 mm)][7-1/4 by 3/4 inch (184 by 19 mm)][9-1/4 by 3/4 inch (235 by 19 mm)][9-1/4 by 1-3/32 inches (235 by 28 mm)], measured on the face and thick edge.
2. Drop siding, SPIB or WWPB pattern No. 105, actual face width (coverage) and thickness of [4-7/8 by 9/16 inch (124 by 14 mm)][4-7/8 by 23/32 inch (124 by 18 mm)][6-5/8 by 23/32 inch (168 by 18 mm)][8-5/8 by 23/32 inch (219 by 18 mm)].
3. V-edge, smooth-faced tongue and groove, actual face width (coverage) and thickness of [3-1/8 by 9/16 inch (79 by 14 mm)][3-1/8 by 23/32 inch (79 by 18 mm)][5-1/8 by 23/32 inch (130 by 18 mm)][6-7/8 by 23/32 inch (175 by 18 mm)].

2.5 PLYWOOD SIDING

A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. [Georgia-Pacific Gypsum LLC]
2. [Hardel Mutual Plywood Corporation]
3. [Hood Industries]
4. [Pacific Wood Laminates, Inc]
5. [Roseburg]
6. [RoyOMartin]
7. [SDS Lumber Company]
8. [Stimson Lumber Company]
9. [Swanson Group]
10. [Weyerhaeuser Company]
11. <Insert manufacturer's name>

B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [Georgia-Pacific Gypsum LLC]
2. [Hardel Mutual Plywood Corporation]
3. [Hood Industries]
4. [Pacific Wood Laminates, Inc]
5. [Roseburg]
6. [RoyOMartin]
7. [SDS Lumber Company]
8. [Stimson Lumber Company]
9. [Swanson Group]
10. [Weyerhaeuser Company]
11. <Insert manufacturer's name>

- C. Plywood Type: APA-rated siding[, **pressure-preservative treated**,][, **factory coated with exterior acrylic latex stain**,] in panel sizes indicated.
 - 1. Face Grade, Surface: 303-[OC][OL][NR][SR].
 - 2. Face Grade, Patches: 303-[6][18][30]-[S][W][S/W].
- D. Thickness: [11/32 inch (8.7 mm)][3/8 inch (9.5 mm)][15/32 inch (11.9 mm)][1/2 inch (12.7 mm)][19/32 inch (15.1 mm)][5/8 inch (15.9 mm)][**As indicated**].
- E. Face Species: [**Southern pine**][**Douglas fir**][**Western red cedar**][**Redwood**].
- F. Pattern: [**Plain**][**Channel groove; grooves 4 inches (101.6 mm) o.c.**][**Texture 1-11; grooves 4 inches (101.6 mm) o.c.**][**Reverse board and batten; grooves 12 inches (304.8 mm) o.c.**]
- G. Surface: [**Smooth**][**Rough sawn**].

2.6 ENGINEERED WOOD SIDING

- A. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
 - 1. [**Collins Products LLC**]
 - 2. [**Georgia-Pacific Gypsum LLC**]
 - 3. [**Louisiana-Pacific Corporation**]
 - 4. <Insert manufacturer's name>
- B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - 1. [**Collins Products LLC**]
 - 2. [**Georgia-Pacific Gypsum LLC**]
 - 3. [**Louisiana-Pacific Corporation**]
 - 4. <Insert manufacturer's name>
- C. Engineered Wood Siding: ANSI A135.6, primed with manufacturer's standard exterior primer.
 - 1. Type:
 - a. **7/16-inch- (11-mm-) thick by [6-inch- (152-mm-)][8-inch- (203-mm-)] wide lap siding.**
 - b. **1/2-inch- (12.7-mm-) thick by 8-inch- (203-mm-) wide, beaded-edge lap siding.**
 - c. **7/16-inch- (11-mm-) thick, shiplap-edge panels; with grooves 3-5/8 inches (92 mm) o.c., simulating wood drop siding.**
 - d. **1/2-inch- (12.7-mm-) thick, shiplap-edge panels; with grooves 5-1/2 inches (140 mm) o.c., simulating wood drop siding.**
 - e. **7/16-inch- (11-mm-) thick, square-edge flat panels; without grooves.**
 - f. **7/16-inch- (11-mm-) thick, shiplap-edge panels; channel grooved with grooves 8 inches (203 mm) o.c.**
 - 2. Texture: [**Smooth**][**Wood grain**][**Shingle**][**Stucco**].
- D. Colors, Textures, and Patterns: [**As indicated by manufacturer's designations**][**Match Architect's samples**][**As selected by Architect from manufacturer's full range**].

2.7 LUMBER SOFFITS

- A. Provide kiln-dried lumber siding complying with DOC PS 20[, **factory coated with exterior primer compatible with topcoats specified**].
- B. Species and Grade:
1. Redwood; RIS [**Clear All Heart**][**Clear**][**Grade B**].
 2. Western red cedar; NLGA, WCLIB, or WWPA [**Grade A**][**Grade B**].
 3. Spruce-pine-fir; NeLMA, NLGA, WCLIB, or WWPA [**1 Common**][**2 Common**].
 4. Hem-fir; NLGA, WCLIB, or WWPA [**Prime or D finish**][**1 Common**][**2 Common**].
 5. Eastern white pine, eastern hemlock-balsam fir-tamarack, eastern spruce, or white woods; NeLMA, NLGA, WCLIB, or WWPA [**D Select (Quality)**][**Finish or 1 Common (Colonial)**][**Premium or 2 Common (Sterling)**].
 6. Northern white cedar; NeLMA or NLGA [**D Select**][**1 Common**][**2 Common**].
 7. Southern pine; SPIB [**B & B**][**C & Btr**][**D**][**1 Common**][**2 Common**].
- C. Pattern:
1. V-edge, smooth-faced tongue and groove, actual face width (coverage) and thickness of [**3-1/8 by 9/16 inch (79 by 14 mm)**][**3-1/8 by 23/32 inch (79 by 18 mm)**][**5-1/8 by 23/32 inch (130 by 18 mm)**][**6-7/8 by 23/32 inch (175 by 18 mm)**].
 2. Rounded-edge channel groove, tongue and groove, actual face width (coverage) and thickness of [**3-1/8 by 9/16 inch (79 by 14 mm)**][**3-1/8 by 23/32 inch (79 by 18 mm)**][**5-1/8 by 23/32 inch (130 by 18 mm)**][**6-7/8 by 23/32 inch (175 by 18 mm)**].
 3. Edge and center bead, tongue and groove, actual face width (coverage) and thickness of [**3-1/8 by 9/16 inch (79 by 14 mm)**][**3-1/8 by 23/32 inch (79 by 18 mm)**][**5-1/8 by 23/32 inch (130 by 18 mm)**][**6-7/8 by 23/32 inch (175 by 18 mm)**], measured at 19 percent moisture content.
 4. Beaded ceiling, tongue and groove, actual face width (coverage) and thickness of [**3-1/8 by 3/8 inch (79 by 9.5 mm)**][**3-1/8 by 7/16 inch (79 by 11 mm)**].

2.8 PLYWOOD SOFFITS

- A. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
1. [**Georgia-Pacific Gypsum LLC**]
 2. [**Hardel Mutual Plywood Corporation**]
 3. [**Hood Industries**]
 4. [**Pacific Wood Laminates, Inc**]
 5. [**Roseburg**]
 6. [**RoyOMartin**]
 7. [**SDS Lumber Company**]
 8. [**Stimson Lumber Comapny**]
 9. [**Swanson Group**]
 10. [**Weyerhaeuser Company**]
 11. <Insert manufacturer's name>
- B. Basis-of-Design Product: Subject to compliance with requirements, provide <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:
1. [**Georgia-Pacific Gypsum LLC**]
 2. [**Hardel Mutual Plywood Corporation**]
 3. [**Hood Industries**]

4. [Pacific Wood Laminates, Inc]
5. [Roseburg]
6. [RoyOMartin]
7. [SDS Lumber Company]
8. [Stimson Lumber Company]
9. [Swanson Group]
10. [Weyerhaeuser Company]
11. <Insert manufacturer's name>

C. Plywood Type: Exterior, [Grade A-C][Grade B-C][Grade C-C, plugged and touch sanded][APA-rated siding].

1. Face Grade, Surface: 303-[OC][OL][NR][SR].
2. Face Grade, Patches: 303-[6][18][30]-[S][W][S/W].

D. Thickness: [11/32 inch (8.7 mm)][3/8 inch (9.5 mm)][15/32 inch (11.9 mm)][1/2 inch (12.7 mm)][19/32 inch (15.1 mm)][As indicated].

E. Face Species: [Southern pine][Douglas fir][Western red cedar][Redwood].

F. Pattern: [Plain][Channel groove; grooves 4 inches (101.6 mm) o.c.][Texture 1-11; grooves 4 inches (101.6 mm) o.c.]

G. Surface: [Smooth][Rough sawn].

2.9 ENGINEERED WOOD SOFFITS

A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. [Collins Products LLC]
2. [Georgia-Pacific Gypsum LLC]
3. [Louisiana-Pacific Corporation]
4. <Insert manufacturer's name>

B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [Collins Products LLC]
2. [Georgia-Pacific Gypsum LLC]
3. [Louisiana-Pacific Corporation]
4. <Insert manufacturer's name>

C. Engineered Wood Soffits: ANSI A135.6, primed with manufacturer's standard exterior primer.

1. Type: [7/16-inch- (11-mm-)][1/2-inch- (12.7-mm-)] thick flat panels.
2. Texture: [Smooth][Wood grain][Stucco].
3. Colors, Textures, and Patterns: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range].

2.10 MISCELLANEOUS MATERIALS

- A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than **1-1/2 inches (38 mm)** into wood substrate.
 - 1. For face-fastening siding, provide ringed-shank siding nails[**or hot-dip galvanized-steel siding nails**][**unless otherwise indicated**].
 - 2. For redwood, provide [**stainless steel**][**hot-dip galvanized-steel**] fasteners.
 - 3. For prefinished items, provide matching prefinished aluminum fasteners where face fastening is required.
 - 4. For pressure-preservative-treated wood, provide [**stainless steel**][**hot-dip galvanized-steel**] fasteners.
 - 5. For applications not otherwise indicated, provide [**stainless steel**][**hot-dip galvanized-steel**][**or**][**aluminum**] fasteners.
- B. Wood Glue: Waterproof resorcinol glue recommended by manufacturer for exterior carpentry use.
- C. Adhesive for Cellular PVC Trim: Product recommended by trim manufacturer.
- D. Flashing: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim" for flashing materials installed in exterior finish carpentry.
 - 1. Horizontal Joint Flashing for Panel Siding: Preformed, [**galvanized-steel**][**aluminum**][**prefinished-aluminum**][**stainless steel**], Z-shaped flashing.
- E. Insect Screening for Soffit Vents: [**Aluminum, 18-by-16-inch (1.6-by-1.4-mm) black mesh**][**PVC-coated glass-fiber black fabric, 18-by-14-inch (1.8-by-1.4-mm) or 18-by-16-inch (1.6-by-1.4-mm) mesh**][**Stainless steel, 18-by-18-inch (1.4-by-1.4-mm) mesh**].
- F. Continuous Soffit Vents: Aluminum hat channel shape with [**stamped louvers**][**perforations**], **2 inches (51 mm)** wide and in lengths not less than **96 inches (2438 mm)**.
 - 1. Net-Free Area: [**4 sq. in./linear ft. (280 sq. cm/m)**][**6 sq. in./linear ft. (420 sq. cm/m)**][**8 sq. in./linear ft. (560 sq. cm/m)**] <Insert value>.
 - 2. Finish: [**Mill finish**][**White paint**][**Brown paint**] <Insert description>.
- G. Round Soffit Vents:
 - 1. Stamped aluminum louvered vents, [**2 inches (51 mm)**][**2-1/2 inches (64 mm)**][**3 inches (76 mm)**][**4 inches (102 mm)**] <Insert dimension> in diameter, made to be inserted in round holes cut in soffit.
 - a. Finish: [**Mill finish**][**White paint**][**Brown paint**] <Insert description>.
 - 2. Molded-plastic louvered vents, [**2 inches (51 mm)**][**2-1/2 inches (64 mm)**][**3 inches (76 mm)**][**4 inches (102 mm)**] <Insert dimension> in diameter, made to be inserted in round holes cut in soffit.
- H. Sealants: Latex, complying with ASTM C834 [**Type OP, Grade NF**] <Insert type and grade> and applicable requirements in Section 079200 "Joint Sealants," and recommended by sealant and substrate manufacturers for intended application.
 - 1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

- a. [Bostik; Arkema]
- b. [Franklin International]
- c. [Pecora Corporation]
- d. [Permthane; a Holcim brand]
- e. [Tremco Incorporated]
- f. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Bostik; Arkema]
- b. [Franklin International]
- c. [Pecora Corporation]
- d. [Permthane; a Holcim brand]
- e. [Tremco Incorporated]
- f. <Insert manufacturer's name>

2.11 FABRICATION

- A. Back out or kerf backs of standing and running trim wider than **5 inches (125 mm)**, except members with ends exposed in finished work.
- B. Ease edges of lumber less than **1 inch (25 mm)** in nominal thickness to **1/16-inch (1.5-mm)** radius and edges of lumber **1 inch (25 mm)** or more in nominal thickness to **1/8-inch (3-mm)** radius.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Prime lumber and moldings to be painted, including both faces and edges, unless factory primed.
 - 1. Cut to required lengths and prime ends.
 - 2. Comply with requirements in Section 099113 "Exterior Painting."

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
 - 1. Do not use manufactured units with defective surfaces, sizes, or patterns.
- B. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials.
 - 1. Use concealed shims where necessary for alignment.
 - 2. Scribe and cut exterior finish carpentry to fit adjoining work.
 - 3. Refinish and seal cuts as recommended by manufacturer.
 - 4. Install to tolerance of **1/8 inch in 96 inches (3 mm in 2438 mm)** for level and plumb. Install adjoining exterior finish carpentry with **1/32-inch (0.8-mm)** maximum offset for flush installation and **1/16-inch (1.5-mm)** maximum offset for reveal installation.
 - 5. Coordinate exterior finish carpentry with materials and systems in or adjacent to it.
 - 6. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

3.4 INSTALLATION OF STANDING AND RUNNING TRIM

- A. Install flat-grain lumber with bark side exposed to weather.
- B. Install cellular PVC trim to comply with manufacturer's written instructions.
- C. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than **24 inches (610 mm)** long, except where necessary.
 - 1. Use scarf joints for end-to-end joints.
 - 2. Stagger end joints in adjacent and related members.
- D. Fit exterior joints to exclude water.
 - 1. Cope at returns and miter at corners to produce tight-fitting joints, with full-surface contact throughout length of joint.
 - 2. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.
- E. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

3.5 INSTALLATION OF SIDING

- A. Install siding to comply with manufacturer's written instructions[**and warranty requirements**].
- B. Horizontal Lumber Siding:
 - 1. Apply starter strip along bottom edge of sheathing or sill.
 - 2. Install first course of siding, with lower edge at least **1/8 inch (3 mm)** below starter strip and subsequent courses lapped **1 inch (25 mm)** over course below.
 - a. Nail at each stud.
 - b. Do not allow nails to penetrate more than one thickness of siding.

3. Leave **1/8-inch (3-mm)** gap at trim and corners unless otherwise recommended by manufacturer, and apply sealant.
4. Butt joints only over framing or blocking, nailing top and bottom on each side and staggering joints in subsequent courses.
5. Install prefabricated outside corners as recommended by manufacturer of siding materials.

C. Diagonal Lumber Siding:

1. Begin application at corner, with tongue edge up.
2. Install subsequent courses with tongue-and-groove edges tightly fitted together.
 - a. Nail at each stud.
3. Leave **1/8-inch (3-mm)** gap at trim and corners unless otherwise recommended by manufacturer, and apply sealant.
4. Butt joints only over framing or blocking, nailing top and bottom on each side and staggering joints in subsequent courses.
5. Install prefabricated outside corners as recommended by manufacturer of siding materials.

D. Plywood Siding:

1. Install panels with edges over framing or blocking.
2. Nail at **6 inches (150 mm)** o.c. at panel perimeter and **12 inches (300 mm)** o.c. at intermediate supports unless manufacturer recommends closer spacing.
3. Leave **1/16-inch (1.5-mm)** gap between adjacent panels and **1/8-inch (3-mm)** gap at perimeter, openings, and horizontal joints unless otherwise recommended by panel manufacturer.
4. Seal butt joints at inside and outside corners and at trim locations.
5. Install continuous metal flashing at horizontal panel joints.
6. Apply battens and corner trim as indicated. [**Countersink nail heads, fill flush, and sand filler.**]
7. Conceal fasteners to greatest practical extent[**by countersinking and filling,**] by placing in grooves of siding pattern or by concealing with applied trim or battens as detailed.
 - a. Do not nail through overlapping pieces.

E. Engineered Wood Siding:

1. Install engineered wood siding to comply with manufacturer's written instructions.
2. Install panels with edges over framing or blocking.
3. Leave **3/16-inch (5-mm)** gap at perimeter, openings, and horizontal panel joints unless otherwise recommended by panel manufacturer.
4. Seal butt joints at inside and outside corners and at trim locations.
5. Install continuous metal flashing at horizontal panel joints.
6. Apply battens and corner trim as indicated.
7. Conceal fasteners to greatest practical extent by placing in grooves of siding pattern or by concealing with applied trim or battens as detailed.

F. Flashing: Install metal flashing as indicated on Drawings and as recommended by siding manufacturer.

G. Finish: Apply finish within two weeks of installation.

3.6 ADJUSTING

- A. Replace exterior finish carpentry that is damaged or does not comply with requirements.



1. Exterior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

B. Adjust joinery for uniform appearance.

3.7 CLEANING

A. Clean exterior finish carpentry on exposed and semiexposed surfaces.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

3.8 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 06 20 00 00



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SECTION 06 20 00 00A - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior trim.
2. Paneling.
3. Shelving and clothes rods.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view[**and for framing exposed to view**].
2. Section 064023 "Interior Architectural Woodwork" for shop-fabricated carpentry.
3. Section 099123 "Interior Painting" for priming and backpriming of interior finish carpentry.

1.2 DEFINITIONS

- A. MDF:** Medium-density fiberboard.
- B. MDO:** Plywood with a medium-density overlay on the face.
- C. PVC:** Polyvinyl chloride.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Interior trim.
2. Paneling.
3. Shelving and clothes rods.

B. Product Data Submittals: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.

C. Sustainable Design Submittals:

1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.

2. Environmental Product Declaration (EPD): For each product.
3. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
4. Environmental Product Declaration: For each product.
5. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
6. Environmental Product Declaration: For each product.
7. Environmental Product Declaration: For each product.
8. Third-Party Certifications: For each product.
9. Third-Party Certified Life Cycle Assessment: For each product.
10. Environmental Product Declaration (EPD): Provide one of the following EPDs: critically reviewed life-cycle assessment complying with ISO 14044; internally reviewed, product-specific Type III EPD; third-party-verified, industrywide Type III EPD.
11. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
12. Chain-of-Custody Qualification Data: For manufacturer and vendor.
13. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
14. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
15. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
16. Product Data: For composite wood products, indicating compliance with requirements for formaldehyde emissions.
17. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
18. Product Data: For installation adhesives, indicating VOC content.
19. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low-emitting materials.

D. Samples: For each exposed product and for each color and texture specified.

E. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

F. Samples for Verification:

1. For each species and cut of lumber and panel products with nonfactory-applied finish, with half of exposed surface finished; **50 sq. in. (300 sq. cm)** for lumber and **8 by 10 inches (200 by 250 mm)** for panels.
2. For foam-plastic moldings, with half of exposed surface finished; **50 sq. in. (300 sq. cm)**.
3. For each finish system and color of lumber and panel products with factory-applied finish, **50 sq. in. (300 sq. cm)** for lumber and **8 by 10 inches (200 by 250 mm)** for panels.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.
- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

- D. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.
 - 1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
 - 2. Provide for air circulation around stacks and under coverings.
- B. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet-work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Regional Materials: The following wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
 - 1. Interior trim.
 - 2. Fire-rated interior door[**and sidelight**] frames.
 - 3. Interior [**plywood**][**hardboard**][**board**] paneling.
 - 4. Shelving[**and clothes rods**].
 - 5. Interior [**stairs**][**and**][**railings**].
- B. Regional Materials: The following wood products shall be manufactured within **500 miles (800 km)** of Project site.
 - 1. Interior trim.
 - 2. Fire-rated interior door[**and sidelight**] frames.
 - 3. Interior [**plywood**][**hardboard**][**board**] paneling.
 - 4. Shelving[**and clothes rods**].

-
5. Interior **[stairs][and][railings]**.
- C. Regional Materials: The following wood products shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
1. Interior trim.
 2. Fire-rated interior door **[and sidelight]** frames.
 3. Interior **[plywood][hardboard][board]** paneling.
 4. Shelving **[and clothes rods]**.
 5. Interior **[stairs][and][railings]**.
- D. Indigenous Materials: The following wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
1. Interior trim.
 2. Fire-rated interior door **[and sidelight]** frames.
 3. Interior **[plywood][hardboard][board]** paneling.
 4. Shelving **[and clothes rods]**.
 5. Interior **[stairs][and][railings]**.
- E. Regional Materials: The following wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
1. Interior trim.
 2. Fire-rated interior door **[and sidelight]** frames.
 3. Interior **[plywood][hardboard][board]** paneling.
 4. Shelving **[and clothes rods]**.
 5. Interior **[stairs][and][railings]**.
- F. Certified Wood: The following wood products shall be certified as "FSC Pure" **[or "FSC Mixed Credit"]** according to FSC STD-01-00 and FSC STD-40-004.
1. Interior trim.
 2. Fire-rated interior door **[and sidelight]** frames.
 3. Interior **[plywood][hardboard][board]** paneling.
 4. Shelving **[and clothes rods]**.
 5. Interior **[stairs][and][railings]**.
- G. Certified Wood: The following wood products shall be certified as "FSC Pure" **[or "FSC Mixed Credit"]** according to FSC STD-01-001 and FSC STD-40-004.
1. Interior trim.
 2. Fire-rated interior door **[and sidelight]** frames.
 3. Interior **[plywood][hardboard][board]** paneling.
 4. Shelving **[and clothes rods]**.
 5. Interior **[stairs][and][railings]**.
- H. Certified Wood: The following wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest

Certification.

1. Interior trim.
 2. Fire-rated interior door[**and sidelight**] frames.
 3. Interior [**plywood**][**hardboard**][**board**] paneling.
 4. Shelving[**and clothes rods**].
 5. Interior [**stairs**][**and**][**railings**].
- I. Certified Wood: The following wood products shall **[contain not less than 60 percent][be made from]** certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."
1. Interior trim.
 2. Fire-rated interior door[**and sidelight**] frames.
 3. Interior [**plywood**][**hardboard**][**board**] paneling.
 4. Shelving[**and clothes rods**].
 5. Interior [**stairs**][**and**][**railings**].
- J. Certified Wood: The following wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
1. Interior trim.
 2. Fire-rated interior door[**and sidelight**] frames.
 3. Interior [**plywood**][**hardboard**][**board**] paneling.
 4. Shelving[**and clothes rods**].
 5. Interior [**stairs**][**and**][**railings**].
- K. Composite Wood Products: Products shall be made without urea formaldehyde.
- L. Composite Wood Products: Products shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- M. Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
- N. Composite Wood Products: Formaldehyde emission rates shall not be greater than the following when tested according to ASTM D6007 or ASTM E1333:
1. Hardwood Plywood: 0.05 ppm.
 2. Particleboard: 0.09 ppm.
 3. MDF More Than **5/16 Inch (8 mm)** Thick: 0.11 ppm.
 4. MDF **5/16 Inch (8 mm)** or Less in Thickness: 0.13 ppm.
- O. Composite Wood Products: Products shall be made without urea formaldehyde.
- P. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's Board of Review to inspect and grade lumber under the rules indicated.



1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber, mark grade stamp on end or back of each piece[, **or omit grade stamp and provide certificates of grade compliance issued by grading agency**].

Q. Softwood Plywood: DOC PS 1.

R. Hardboard: ANSI A135.4.

S. MDF: ANSI A208.2, [**Grade 130**]**<Insert grade>**.

T. Particleboard: ANSI A208.1, [**Grade M-2**]**[Grade M-2-Exterior Glue]**.

U. Melamine-Faced Particleboard: Particleboard complying with ANSI A208.1, Grade M-2, finished on both faces with thermally fused, melamine-impregnated decorative paper and complying with ISO 4586-3, Grade VGS.

1. Color: [**White**]**[Black]****[Gray]****[As indicated by manufacturer's designations]****[Match Architect's samples]****[As selected by Architect from manufacturer's full range]****<Insert color>**.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWP U1; Use Category [**UC1**]**[UC2]**.

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent, respectively.
2. Preservative Chemicals: Acceptable to authorities having jurisdiction[**and containing no arsenic or chromium**].
3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
4. Do not use material that is warped or does not comply with requirements for untreated material.
5. Mark lumber with treatment-quality mark of an inspection agency approved by the ALSC's Board of Review.
 - a. For exposed lumber indicated to receive a stained or natural finish, [**mark end or back of each piece**]**[or]****[omit marking and provide certificates of treatment compliance issued by inspection agency]**.
6. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
 - a. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.
7. Application: [**Where indicated on Drawings**]**[All interior lumber and plywood]****<Insert application>**.

2.3 INTERIOR TRIM

A. Softwood Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade:

- a. Eastern white pine; NeLMA or NLGA [C Select][D Select][Finish or 1 Common][Premium or 2 Common].
 - b. Idaho white, lodgepole, ponderosa, radiata, or sugar pine; NLGA or WWPA [C Select (Choice)][D Select (Quality)][1 Common (Colonial)][2 Common (Sterling)].
 - c. Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine; NeLMA, NLGA, or WWPA [C Select (Choice)][D Select (Quality)][Finish or 1 Common (Colonial)][Premium or 2 Common (Sterling)].
 - d. White woods; WWPA [C Select][D Select][1 Common][2 Common].
 - e. Douglas fir-larch or Douglas fir south; NLGA, WCLIB, or WWPA [Superior or C & Btr][Prime or D] finish.
 - f. Southern pine; SPIB [B & B][C & Btr] finish.
 - g. Western red cedar; NLGA, WCLIB, or WWPA [Clear Heart][Grade A][Grade B].
2. Maximum Moisture Content: [19][15] percent[with at least 85 percent of shipment at 12 percent or less].
 3. Finger Jointing: [Allowed][Not allowed].
 4. Face Surface: [Surfaced (smooth)][Saw textured].
- B. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish):
1. Species and Grade: [Red oak][White maple][Alder][Aspen, basswood, cottonwood, sap gum, sycamore, white maple, or yellow poplar]<Insert species>; NHLA [Clear][A Finish][B Finish].
 2. Maximum Moisture Content: [13][10][9]<Insert number> percent.
 3. Finger Jointing: Not allowed.
 4. Gluing for Width: [Allowed][Not allowed][Use for lumber trim wider than 6 inches (150 mm)].
 5. Veneered Material: [Allowed][Not allowed][Use for lumber trim wider than 6 inches (150 mm)].
 6. Face Surface: [Surfaced (smooth)][Saw textured].
 7. Matching: Selected for compatible grain and color.
- C. Lumber Trim for Opaque Finish (Painted Finish):
1. Species and Grade:
 - a. Eastern white pine; NeLMA or NLGA [D Select][Finish or 1 Common][Premium or 2 Common].
 - b. Idaho white, lodgepole, ponderosa, radiata, or sugar pine; NLGA or WWPA [D Select (Quality)][1 Common (Colonial)][2 Common (Sterling)].
 - c. Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine; NeLMA, NLGA, or WWPA [D Select (Quality)][Finish or 1 Common (Colonial)][Premium or 2 Common (Sterling)].
 - d. White woods; WWPA [D Select][1 Common][2 Common].
 - e. Douglas fir-larch or Douglas fir south; NLGA, WCLIB, or WWPA [Superior or C & Btr][Prime or D] finish.
 - f. Spruce-pine-fir; NeLMA, NLGA, WCLIB, or WWPA [1 Common][2 Common].
 - g. Alder, aspen, basswood, cottonwood, gum, magnolia, soft maple, sycamore, tupelo, or yellow poplar; NHLA [A Finish][B Finish].
 2. Maximum Moisture Content for Softwoods: [19][15] percent[with at least 85 percent of shipment at 12 percent or less].
 3. Maximum Moisture Content for Hardwoods: [13][10][9]<Insert number> percent.
 4. Finger Jointing: [Allowed][Not allowed].
 5. Face Surface: [Surfaced (smooth)][Saw textured].
 6. Optional Material: Primed MDF of same actual dimensions as lumber indicated may be used in lieu of lumber.

- D. Softwood Moldings for Transparent Finish (Stain or Clear Finish): MMPA WM 4, N-grade wood moldings. Made to patterns included in MMPA's "WM/Series Softwood Moulding Patterns."
- Species: **[Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine][Southern pine][Western red cedar][Douglas fir]<Insert species>**.
 - Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
 - Finger Jointing: Not allowed.
 - Matching: Selected for compatible grain and color.
 - Base Pattern: **[WM 623, 9/16-by-3-1/4-inch (14-by-83-mm) ogee][WM 713, 9/16-by-3-1/4-inch (14-by-83-mm) ranch][WM 753, 9/16-by-3-1/4-inch (14-by-83-mm) beaded-edge][WM 620, 9/16-by-4-1/4-inch (14-by-108-mm) ogee][WM 750, 9/16-by-4-1/4-inch (14-by-108-mm) beaded-edge]** base.
 - Shoe-Mold Pattern: **[WM 129, 7/16-by-11/16-inch (11-by-17-mm) quarter-round][WM 126, 1/2-by-3/4-inch (13-by-19-mm) quarter-round][WM 131, 1/2-by-3/4-inch (13-by-19-mm) ogee]** shoe mold.
 - Casing Pattern: **[WM 327, 11/16-by-2-1/4-inch (17-by-57-mm) clamshell][WM 366, 11/16-by-2-1/4-inch (17-by-57-mm) featheredge][WM 376, 11/16-by-2-1/4-inch (17-by-57-mm) beaded-edge]** casing.
 - Mull-Casing Pattern: **[WM 957, 3/8-by-1-3/4-inch (9.5-by-44-mm) beaded-edge][WM 973, 3/8-by-1-3/4-inch (9.5-by-44-mm) bullnose][WM 983, 3/8-by-1-3/4-inch (9.5-by-44-mm) featheredge]** casing.
 - Stop Pattern: **[WM 856, 3/8-by-1-3/8-inch (9.5-by-35-mm) ranch][WM 946, 3/8-by-1-3/8-inch (9.5-by-35-mm) ogee][WM 886, 3/8-by-1-3/8-inch (9.5-by-35-mm) bullnose]** stop.
 - Chair-Rail Pattern: **WM 297, 11/16-by-3-inch (17-by-76-mm)** chair rail.
- E. Hardwood Moldings for Transparent Finish (Stain or Clear Finish): MMPA WM 4, N-grade wood moldings made to patterns included in MMPA's "HWM/Series Hardwood Moulding Patterns."
- Species: **[Red oak][White maple][Aspen, basswood, cottonwood, sap gum, sycamore, white maple, or yellow poplar]<Insert species>**.
 - Maximum Moisture Content: 9 percent.
 - Finger Jointing: Not allowed.
 - Matching: Selected for compatible grain and color.
 - Optional Material: Kiln-dried softwood or MDF, with exposed surfaces veneered with species indicated, may be used in lieu of solid wood.
 - Base Pattern: **[HWM 633, 7/16-by-3-1/4-inch (11-by-83-mm) ogee][HWM 713, 7/16-by-3-1/4-inch (11-by-83-mm) ranch][HWM 753, 7/16-by-3-1/4-inch (11-by-83-mm) beaded-edge][WM 620, 7/16-by-4-1/4-inch (11-by-108-mm) ogee]** base.
 - Shoe-Mold Pattern: **[HWM 129, 7/16-by-11/16-inch (11-by-17-mm) quarter-round][HWM 126, 1/2-by-3/4-inch (13-by-19-mm) quarter-round][HWM 131, 1/2-by-3/4-inch (13-by-19-mm) ogee]** shoe mold.
 - Casing Pattern: **[HWM 328, 1/2-by-2-1/4-inch (13-by-57-mm) clamshell][HWM 366, 1/2-by-2-1/4-inch (13-by-57-mm) featheredge][HWM 376, 1/2-by-2-1/4-inch (13-by-57-mm) beaded-edge]** casing.
 - Mull-Casing Pattern: **[HWM 989, 3/16-by-2-inch (5-by-51-mm) square-edge][HWM 988, 3/8-by-1-1/2-inch (9.5-by-38-mm) featheredge][HWM 987, 3/8-by-2-inch (9.5-by-51-mm) featheredge]** casing.
 - Stop Pattern: **[HWM 856, 3/8-by-1-3/8-inch (9.5-by-35-mm) ranch][HWM 946, 3/8-by-1-3/8-inch (9.5-by-35-mm) ogee][HWM 886, 3/8-by-1-3/8-inch (9.5-by-35-mm) bullnose]** stop.
 - Chair-Rail Pattern: **HWM 297, 11/16-by-3-inch (17-by-76-mm)** chair rail.
- F. Moldings for Opaque Finish (Painted Finish): Made to patterns included in MMPA's "WM/Series Softwood Moulding Patterns."
- Softwood Moldings: MMPA WM 4, P grade.

- a. Species: **[Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine]<Insert species>**.
 - b. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
 2. Hardwood Moldings: MMPA WM 4, P-grade.
 - a. Species: **[Aspen, basswood, cottonwood, gum, magnolia, soft maple, tupelo, or yellow poplar]<Insert species>**.
 - b. Maximum Moisture Content: 9 percent.
 3. Finger Jointing: **[Allowed][Not allowed]**.
 4. Optional Material: Primed MDF.
 5. Base Pattern: **[WM 623, 9/16-by-3-1/4-inch (14-by-83-mm) ogee][WM 713, 9/16-by-3-1/4-inch (14-by-83-mm) ranch][WM 753, 9/16-by-3-1/4-inch (14-by-83-mm) beaded-edge][WM 620, 9/16-by-4-1/4-inch (14-by-108-mm) ogee][WM 750, 9/16-by-4-1/4-inch (14-by-108-mm) beaded-edge]** base.
 6. Shoe-Mold Pattern: **[WM 129, 7/16-by-11/16-inch (11-by-17-mm) quarter-round][WM 126, 1/2-by-3/4-inch (13-by-19-mm) quarter-round][WM 131, 1/2-by-3/4-inch (13-by-19-mm) ogee]** shoe mold.
 7. Casing Pattern: **[WM 327, 11/16-by-2-1/4-inch (17-by-57-mm) clamshell][WM 366, 11/16-by-2-1/4-inch (17-by-57-mm) featheredge][WM 376, 11/16-by-2-1/4-inch (17-by-57-mm) beaded-edge]** casing.
 8. Mull-Casing Pattern: **[WM 957, 3/8-by-1-3/4-inch (9.5-by-44-mm) beaded-edge][WM 973, 3/8-by-1-3/4-inch (9.5-by-44-mm) bullnose][WM 983, 3/8-by-1-3/4-inch (9.5-by-44-mm) featheredge]** casing.
 9. Stop Pattern: **[WM 856, 3/8-by-1-3/8-inch (9.5-by-35-mm) ranch][WM 946, 3/8-by-1-3/8-inch (9.5-by-35-mm) ogee][WM 886, 3/8-by-1-3/8-inch (9.5-by-35-mm) bullnose]** stop.
 10. Chair-Rail Pattern: WM 297, 11/16-by-3-inch (17-by-76-mm) chair rail.
- G. PVC-Wrapped Moldings: MMPA WM 2 and made to patterns included in MMPA's "WM/Series Softwood Moulding Patterns."
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Nickell Moulding Company, Inc.]**
 - b. **[Zamma Corporation]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Nickell Moulding Company, Inc.]**
 - b. **[Zamma Corporation]**
 - c. **<Insert manufacturer's name>**
 3. Base Pattern: **[WM 623, 9/16-by-3-1/4-inch (14-by-83-mm) ogee][WM 713, 9/16-by-3-1/4-inch (14-by-83-mm) ranch]** base.
 4. Shoe-Mold Pattern: **[WM 129, 7/16-by-11/16-inch (11-by-17-mm) quarter-round][WM 126, 1/2-by-3/4-inch (13-by-19-mm) quarter-round]** shoe mold.
 5. Casing Pattern: **[WM 327, 11/16-by-2-1/4-inch (17-by-57-mm) clamshell][WM 366, 11/16-by-2-1/4-inch (17-by-57-mm) featheredge]** casing.

6. Mull-Casing Pattern: **[WM 973, 3/8-by-1-3/4-inch (9.5-by-44-mm) bullnose][WM 983, 3/8-by-1-3/4-inch (9.5-by-44-mm) featheredge]** casing.
7. Stop Pattern: **[WM 856, 3/8-by-1-3/8-inch (9.5-by-35-mm) ranch][WM 886, 3/8-by-1-3/8-inch (9.5-by-35-mm) bullnose]** stop.
8. Chair-Rail Pattern: **WM 297, 11/16-by-3-inch (17-by-76-mm)** chair rail.
9. Colors, Textures, and Grain Patterns: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]**.

H. Foam-Plastic Moldings: Molded product of shapes indicated, with a tough outer skin on exposed surfaces; factory primed. Exposed surfaces are not to be shaped after molding.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Architectural Mall, Inc]**
 - b. **[Carter Millwork]**
 - c. **[Chemcrest Inc.; a division of Foamcore]**
 - d. **[Diamond Mfg., Inc.]**
 - e. **[Focal Point Products]**
 - f. **[Fypon LLC]**
 - g. **[Melton Classics Inc.]**
 - h. **[Vintage Mouldings Manufacturing Ltd.]**
 - i. **[Worthington Millwork, LLC.]**
 - j. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Mall, Inc]**
 - b. **[Carter Millwork]**
 - c. **[Chemcrest Inc.; a division of Foamcore]**
 - d. **[Diamond Mfg., Inc.]**
 - e. **[Focal Point Products]**
 - f. **[Fypon LLC]**
 - g. **[Melton Classics Inc.]**
 - h. **[Vintage Mouldings Manufacturing Ltd.]**
 - i. **[Worthington Millwork, LLC.]**
 - j. **<Insert manufacturer's name>**
3. Density: Not less than **20 lb/cu. ft. (320 kg/cu. m)**.
4. Flame-Spread Index: Not more than **[75]<Insert number>** when tested according to ASTM E84.
5. Thickness: Not more than **1/2 inch (12.7 mm)**.
6. Width: Not more than **8 inches (204 mm)**.
7. Patterns: **[As indicated by manufacturer's designations][Match Architect's samples]**.

2.4 PANELING

- A. Hardwood Veneer Plywood Paneling: Manufacturer's stock hardwood plywood panels complying with HPVA HP-1.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the**

following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Chesapeake Plywood LLC]
 - b. [Holland Southwest International]
 - c. [Houston Plywood Industry, Inc.]
 - d. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Chesapeake Plywood LLC]
 - b. [Holland Southwest International]
 - c. [Houston Plywood Industry, Inc.]
 - d. <Insert manufacturer's name>
 3. Face Veneer Species and Cut: [Rotary-cut white birch][Plain-sliced red oak][Plain-sliced hickory]<Insert species and cut>.
 4. Veneer Matching: [Random match][Selected for similar color and grain].
 5. Backing Veneer Species: [Same species as face veneer][Any hardwood compatible with face species].
 6. Construction: Veneer core.
 7. Thickness: [1/8 inch (3.2 mm)][5/32 inch (4 mm)][3/16 inch (5 mm)][1/4 inch (6.4 mm)][5/16 inch (7.9 mm)][7/16 inch (11 mm)].
 8. Panel Size:
 - a. [48 by 96 inches (1219 by 2438 mm)][48 by 120 inches (1219 by 3048 mm)].
 - b. [1200 by 2400 mm][1200 by 3000 mm].
 9. Glue Bond: Type II (interior).
 10. Face Pattern: Manufacturer's standard [V][channel]-grooved pattern, with grooves at edges, center, and third points of panels, and at other locations to provide pattern resembling random-width boards.
 11. Finish: [Manufacturer's standard, transparent, UV-resistant, protective finish][As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range].
- B. Hardboard Paneling: Interior factory-finished hardboard paneling complying with ANSI A135.5.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Chesapeake Plywood LLC]
 - b. [Georgia-Pacific Gypsum LLC]
 - c. [Marlite, Inc.]
 - d. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Chesapeake Plywood LLC]



- b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Marlite, Inc.]**
 - d. **<Insert manufacturer's name>**
 - 3. Thickness: **[1/8 inch (3.2 mm)][5/32 inch (4 mm)][1/4 inch (6.4 mm)]**.
 - 4. Finish: **[Class I][Class II]**.
 - 5. Surface-Burning Characteristics: As follows, tested according to ASTM E84:
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 6. Colors, Textures, and Patterns: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]**.
- C. Board Paneling, MMPA: Interior wood-board paneling complying with MMPA WM 9.
- 1. Species: **[Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine][Southern pine][Western red cedar][Figured red gum]<Insert species>**.
 - 2. Grade: **[Clear No. 1][Clear No. 2][Knotty No. 1][Knotty No. 2][Finger jointed]**.
 - 3. Maximum Moisture Content: **[15 percent with at least 85 percent of shipment at 12 percent or less][9 percent]**.
 - 4. Pattern: **[V-joint, tongue and groove, PT 82][Beaded ceiling, PT 85][Beveled-edge channel, shiplapped, PT 82][As indicated]**.
 - 5. Net Coverage Width: Not less than **[5-1/16 inches (128 mm)][6-3/4 inches (171 mm)][8-3/4 inches (222 mm)]**.
- D. Board Paneling:
- 1. Species and Grade:
 - a. Eastern white pine; NeLMA or NLGA **[C Select][D Select][Finish or 1 Common][Premium or 2 Common]**.
 - b. Idaho white, lodgepole, ponderosa, radiata, or sugar pine; NLGA or WWPB **[C Select (Choice)][D Select (Quality)][1 Common (Colonial)][2 Common (Sterling)]**.
 - c. Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine; NeLMA, NLGA, or WWPB **[C Select (Choice)][D Select (Quality)][Finish or 1 Common (Colonial)][Premium or 2 Common (Sterling)]**.
 - d. Southern pine; SPIB **[B & B][C & Btr][No. 2]** Paneling.
 - e. Western red cedar; NLGA, WCLIB, or WWPB **[Clear Heart][Grade A][Grade B]**.
 - 2. Maximum Moisture Content: **[19][15] percent [with at least 85 percent of shipment at 12 percent or less]**.
 - 3. Pattern:
 - a. V-joint, tongue and groove, **[NeLMA EWP 4][SPIB SPP 54][or][WWPB WP 4]**.
 - b. Pickwick, tongue and groove, **[NeLMA EWP 2][SPIB SPP 52][or][WWPB WP 2]**.
 - c. Rounded-edge channel groove, tongue and groove, **[SPIB SPP 60][or][WWPB WP 6]**.
 - d. Edge and center bead, tongue and groove, **[NeLMA E & CB][or][WWPB E & CB Ceiling]**.
 - 4. Net Coverage Width: Not less than **[5-1/16 inches (128 mm)][6-3/4 inches (171 mm)][8-3/4 inches (222 mm)]**.

2.5 SHELVING AND CLOTHES RODS

- A. Shelving: **[Exposed][Closet][Utility]** shelving, made from **[the following material][one of the following materials]**, 3/4 inch (19 mm) thick:
1. Particleboard with **[radiused and filled][or][solid-wood]** front edge.
 2. MDF with **[radiused][or][solid-wood]** front edge.
 3. MDO softwood plywood with solid-wood edge.
 4. Melamine-faced particleboard with **[radiused and filled][applied-PVC]** front edge.
 5. Wood boards as specified above for **[lumber trim for opaque][softwood lumber trim for transparent][hardwood lumber trim for transparent]** finish.
 6. Softwood Boards:
 - a. Kiln-dried eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine; NeLMA, NLGA, or WWPB **[C Select (Choice)][D Select (Quality)][Finish or 1 Common (Colonial)][Premium or 2 Common (Sterling)]**.
 - b. Kiln-dried Douglas fir-larch, Douglas fir south, or hem-fir; SPIB **[Superior or C & Btr][Prime or D]** finish; NLGA, WCLIB, or WWPB; or southern pine; **[B & B][C]** finish.
- B. Shelf Cleats: **[3/4-by-3-1/2-inch (19-by-89-mm) boards][3/4-by-5-1/2-inch (19-by-140-mm) boards][3/4-by-5-1/2-inch (19-by-140-mm) boards with hole and notch to receive clothes rods]**, as specified above for **[shelving][lumber trim for opaque finish][softwood lumber trim for transparent finish][hardwood lumber trim for transparent finish]**.
- C. Shelf Brackets with Rod Support: BHMA A156.16, B04051; prime-painted formed steel.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[A&M Hardware, Inc.]**
 - b. **[EPCO, Engineered Products Co.]**
 - c. **[Knappe & Vogt Manufacturing Company]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[A&M Hardware, Inc.]**
 - b. **[EPCO, Engineered Products Co.]**
 - c. **[Knappe & Vogt Manufacturing Company]**
 - d. **<Insert manufacturer's name>**
- D. Shelf Brackets without Rod Support: BHMA A156.16, B04041; prime-painted formed steel.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[A&M Hardware, Inc.]**
 - b. **[Centerline Brackets; Centerline Steel, LLC]**
 - c. **[EPCO, Engineered Products Co.]**
 - d. **[Knappe & Vogt Manufacturing Company]**



e. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [A&M Hardware, Inc.]
- b. [Centerline Brackets; Centerline Steel, LLC]
- c. [EPCO, Engineered Products Co.]
- d. [Knape & Vogt Manufacturing Company]
- e. <Insert manufacturer's name>

- E. Standards for Adjustable Shelf Brackets: BHMA A156.9, B04102; [powder-coat-finished][brass-finished][zinc-plated] steel.
- F. Adjustable Shelf Brackets: BHMA A156.9, B04112; [powder-coat-finished steel][brass-finished steel][zinc-plated steel][bronze-anodized aluminum][black-anodized aluminum][natural aluminum].
- G. Standards for Adjustable Shelf Supports: BHMA A156.9, B04071; [powder-coat-finished][brass-finished][zinc-plated] steel.
- H. Adjustable Shelf Supports: BHMA A156.9, B04081 or B04091; [powder-coat-finished][brass-finished][zinc-plated] steel.
- I. Wood Clothes Rods: 1-1/2-inch- (38-mm-) diameter, clear, kiln-dried [hardwood][Douglas fir or southern pine].
- J. Metal Clothes Rods: 1-5/16-inch- (33-mm-) diameter, [aluminum tubes][chrome-plated-steel tubes][color-coated-steel tubes][stainless steel tubes][chrome-plated-steel telescoping tubes with end brackets for mounting on shelf cleats].
- K. Wood Rod Flanges: Clear, kiln-dried, [Douglas fir or southern pine][eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine][red oak][white maple][aspen, basswood, cottonwood, sap gum, white maple, or yellow poplar]<Insert species> turnings[with clear finish].
- L. Metal Rod Flanges: [Aluminum][Chrome-plated steel][Stainless steel].

2.6 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
- B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
 - 1. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of

- Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 4. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 5. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
 6. Adhesives shall have a VOC content of [30]<Insert value> g/L or less.
- C. Installation Adhesive for Foam-Plastic Moldings: Product recommended for indicated use by foam-plastic molding manufacturer.
1. Adhesives shall have a VOC content of [50]<Insert value> g/L or less.
 2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 5. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 6. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- D. Paneling Adhesive: Comply with paneling manufacturer's written instructions for adhesives.
1. Adhesives shall have a VOC content of [50]<Insert value> g/L or less.
 2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 5. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 6. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m,

and that of acetaldehyde shall not exceed 9 mcg/cu. m.

- E. Multipurpose Construction Adhesive: Formulation, complying with ASTM D3498, that is recommended for indicated use by adhesive manufacturer.
1. Adhesives shall have a VOC content of [70]<Insert value> g/L or less.
 2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 5. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 6. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

2.7 FABRICATION

- A. Back out or kerf backs of the following members, except those with ends exposed in finished work:
1. Interior standing and running trim, except shoe and crown molds.
 2. Wood-board paneling.
- B. Ease edges of lumber less than **1 inch (25 mm)** in nominal thickness to **1/16-inch (1.5-mm)** radius and edges of lumber **1 inch (25 mm)** or more in nominal thickness to **1/8-inch (3-mm)** radius.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours[**unless longer conditioning is recommended by manufacturer**].

3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.
 - 1. Use concealed shims where necessary for alignment.
 - 2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 - 3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
 - 4. Install to tolerance of **1/8 inch in 96 inches (3 mm in 2438 mm)** for level and plumb. Install adjoining interior finish carpentry with **1/32-inch (0.8-mm)** maximum offset for flush installation and **1/16-inch (1.5-mm)** maximum offset for reveal installation.
 - 5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 INSTALLATION OF INTERIOR TRIM

- A. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available.
 - 1. Do not use pieces less than **24 inches (610 mm)** long, except where necessary.
 - 2. Stagger joints in adjacent and related standing and running trim.
 - 3. **[Cope][Miter]** at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint.
 - 4. Use scarf joints for end-to-end joints.
 - 5. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
 - 6. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
 - 7. Install trim after gypsum-board joint finishing operations are completed.
 - 8. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting.
 - 9. Fasten to prevent movement or warping.
 - 10. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 INSTALLATION OF PANELING

- A. Plywood Paneling: Select and arrange panels on each wall to minimize noticeable variations in grain character and color between adjacent panels.
 - 1. Leave **1/4-inch (6-mm)** gap to be covered with trim at top, bottom, and openings.
 - 2. Install with uniform tight joints between panels.
 - 3. Attach panels to supports with manufacturer's recommended panel adhesive and fasteners.
 - 4. Space fasteners and adhesive as recommended by panel manufacturer.
 - 5. Conceal fasteners to greatest practical extent.
 - 6. Arrange panels with grooves and joints over supports.
 - a. Fasten to supports with nails of type and at spacing recommended by panel manufacturer.
 - b. Use fasteners with prefinished heads matching groove color.

- B. Hardboard Paneling: Install according to manufacturer's written instructions.
 - 1. Leave **1/4-inch (6-mm)** gap to be covered with trim at top, bottom, and openings.
 - 2. Butt adjacent panels with moderate contact.
 - 3. Use fasteners with prefinished heads matching paneling color.
 - 4. Wood Stud or Furring Substrate: Install with **1-inch (25-mm)** annular-ring shank hardboard nails.
 - 5. Plaster or Gypsum-Board Substrate: Install with **1-5/8-inch (41-mm)** annular-ring shank hardboard nails.
 - 6. Nailing: Space nails **4 inches (100 mm)** o.c. at panel perimeter and **8 inches (200 mm)** o.c. at intermediate supports unless otherwise required by manufacturer.
- C. Board Paneling: Install according to manufacturer's written instructions.
 - 1. Arrange in random-width pattern suggested by manufacturer unless boards or planks are of uniform width.
 - 2. Install in full lengths without end joints.
 - 3. Stagger end joints in random pattern to uniformly distribute joints on each wall.
 - 4. Install with uniform end joints with only end-matched (tongue-and-groove) joints within each field of paneling.
 - 5. Install with uniform end joints. Locate end joints only over furring or blocking.
 - 6. Select and arrange boards on each wall to minimize noticeable variations in grain character and color between adjacent boards.
 - 7. Install with uniform tight joints between boards.
 - 8. Fasten paneling by face nailing, setting nails, and filling over nail heads.
 - 9. Fasten paneling with trim screws, set below face and filled.
 - 10. Fasten paneling by blind nailing through tongues.
 - 11. Fasten paneling with paneling system manufacturer's concealed clips.
 - 12. Fasten paneling to gypsum wallboard with panel adhesive.

3.6 INSTALLATION OF SHELVING AND CLOTHES RODS

- A. Cut shelf cleats at ends of shelves about **1/2 inch (13 mm)** less than width of shelves and sand exposed ends smooth.
 - 1. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled.
 - 2. Space fasteners not more than **16 inches (400 mm)** o.c. [**Use two fasteners at each framing member or fastener location for cleats 4 inches nominal (89 mm actual) in width and wider.**]
 - 3. Apply a bead of multipurpose construction adhesive to back of shelf cleats before installing.
 - 4. Remove adhesive that is squeezed out after fastening shelf cleats in place.
- B. Install shelf brackets according to manufacturer's written instructions, spaced not more than **[32 inches (800 mm)][36 inches (900 mm)]** o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
- C. Install standards for adjustable shelf supports according to manufacturer's written instructions. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Space fasteners not more than **12 inches (300 mm)** o.c.
- D. Install standards for adjustable shelf brackets according to manufacturer's written instructions, spaced not more than **36 inches (900 mm)** o.c. and within **6 inches (150 mm)** of ends of shelves. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

- E. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled.
 - 1. Install shelves, fully seated on cleats, brackets, and supports.
 - 2. Fasten shelves to cleats with finish nails or trim screws, set flush.
 - 3. Fasten shelves to brackets to comply with bracket manufacturer's written instructions.
- F. Install rod flanges for rods as indicated.
 - 1. Fasten to shelf cleats, framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
 - 2. Install rods in rod flanges.

3.7 ADJUSTING

- A. Replace interior finish carpentry that is damaged or does not comply with requirements.
 - 1. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.
- B. Adjust joinery for uniform appearance.

3.8 CLEANING

- A. Clean interior finish carpentry on exposed and semiexposed surfaces.
- B. Restore damaged or soiled areas and touch up factory-applied finishes if any.

3.9 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 06 20 00 00A



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06 - Wood, Plastics, and Composites

Task	Specification	Specification Description
06 22 00 00	06 20 00 00	Exterior Finish Carpentry
06 22 00 00	06 20 00 00a	Interior Finish Carpentry
06 22 13 00	06 20 00 00	Exterior Finish Carpentry
06 22 13 00	06 20 00 00a	Interior Finish Carpentry
06 25 00 00	06 20 00 00	Exterior Finish Carpentry
06 25 00 00	06 20 00 00a	Interior Finish Carpentry
06 25 16 00	06 20 00 00	Exterior Finish Carpentry
06 25 16 00	06 20 00 00a	Interior Finish Carpentry



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SECTION 06 40 00 00 - EXTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior standing and running trim for transparent finish.
2. Exterior standing and running trim for opaque finish.
3. Exterior frames and jambs for transparent finish.
4. Exterior frames and jambs for opaque finish.
5. Exterior shutters for transparent finish.
6. Exterior shutters for opaque finish.
7. Exterior stairs and railings.
8. Preservative-treated-wood material.
9. Fire-retardant-treated wood material.
10. Shutter hardware.
11. Miscellaneous materials.
12. Shop priming.
13. Shop finishing.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing exterior architectural woodwork that are concealed within other construction before exterior architectural woodwork installation.
2. Section 062013 "Exterior Finish Carpentry" for exterior carpentry exposed to view that is not specified in this Section.

1.2 COORDINATION

- ##### A.
- Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that exterior architectural woodwork can be supported and installed as indicated.

1.3 PREINSTALLATION MEETINGS

- ##### A.
- Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.4 ACTION SUBMITTALS

- ##### A.
- Product Data: For each type of product.

B.

Wood-Preservative Treatment:

1. Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
2. Indicate type of preservative used and net amount of preservative retained.

3. Include chemical-treatment manufacturer's written instructions for finishing treated material and manufacturer's written warranty.
- C. Fire-Retardant Treatment: Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- D. Waterborne Treatments: For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
- E. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 3. Environmental Product Declaration (EPD): For each product.
 4. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
 5. Environmental Product Declaration: For each product.
 6. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
 7. Environmental Product Declaration: For each product.
 8. Environmental Product Declaration: For each product.
 9. Third-Party Certifications: For each product.
 10. Third-Party Certified Life Cycle Assessment: For each product.
 11. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
- F. Shop Drawings:
1. Include dimensioned plans, elevations, sections, and attachment details.
 2. Show **[large-scale][full-size]** details.
 3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.
 4. Apply **[AWI Quality Certification][WI Certified Compliance]** Program label to Shop Drawings.
- G. Samples: For each exposed product and for each color and finish specified.
1. Size:
 - a. Panel Products: **12 inches by 12 inches (300 mm by 300 mm)**.
 - b. Lumber Products: Not less than **[5 inches (125 mm) wide by 12 inches (300 mm) long][5 inches (125 mm) wide by 24 inches (600 mm) long]**, for each species and cut, finished on one side and one edge.
- H. Samples for Initial Selection: For each type of exposed finish.
1. Size:
 - a. Panel Products: **12 inches by 12 inches (300 mm by 300 mm)**.
 - b. Lumber Products: Not less than **[5 inches (125 mm) wide by 12 inches (300 mm) long][5 inches (125 mm) wide by 24 inches (600 mm) long]**, for each species and cut, finished on one side and one edge.

- I. Samples for Verification: For the following:
 1. Lumber for Exterior Wood-Stain Finish: Not less than **5 inches (125 mm)** wide by **12 inches (300 mm)** long, for each species, with one-half of exposed surface finished.
 2. Lumber for Transparent Finish: Not less than **[5 inches (125 mm) wide by 12 inches (300 mm) long][5 inches (125 mm) wide by 24 inches (600 mm) long]**, for each species and cut, finished on one side and one edge.
 3. Lumber and Panel Products with Shop-Applied Opaque Finish: **5 inches (125 mm)** wide by **12 inches (300 mm)** long for lumber and **[8 by 10 inches (200 by 250 mm)][12 by 12 inches (300 by 300 mm)]** for panels, for each finish system and color.
 - a. Finish **[entire][one-half of]** exposed surface.
 4. Shutter Hardware: Full-size samples for each type and size of hardware in each finish, and color required.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[architectural woodwork manufacturer][and][Installer]**.
- B. Evaluation Reports: For **[preservative-treated][and][fire-retardant-treated]** wood materials, from ICC-ES.
- C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Quality Standard Compliance Certificates: **[AWI Quality Certification Program][WI Certified Compliance Program]** certificates.

1.7 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
 1. Manufacturer's Certification: Licensed participant in **[AWI's Quality Certification Program][WI's Certified Compliance Program]**.
- B. Installer Qualifications: **[Fabricator of products][Licensed participant in AWI's Quality Certification Program][Licensed participant in WI's Certified Compliance Program]**.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 1. Build mockups of **[typical exterior architectural woodwork as shown on Drawings]<Insert description>**.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Architectural Woodwork Standards, Section 2.
- B. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
 - 1. Handle and store fire-retardant-treated wood to comply with chemical-treatment manufacturer's written instructions.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation of exterior architectural woodwork only when existing and forecasted weather conditions permit work to be performed and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.
- B. Field Measurements: Where exterior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where exterior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL WOODWORK MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **<Insert, in separate subparagraphs, names for preapproved architectural woodworking firms>.**

2.2 ARCHITECTURAL WOODWORK, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of exterior architectural woodwork indicated for construction, finishes, installation, and other requirements.
 - 1. Provide **[labels][and][certificates]** from **[AWI][WI]** certification program indicating that woodwork**[and installation]** complies with requirements of grades specified.
 - a. This project has been registered with AWI as AWI Quality Certification Program Number **<Insert number>.**

- b. Contractor is to register the Work under this Section with the AWI Quality Certification Program at www.awiqcp.org or by calling 800-345-0991.
- 2. The Contract Documents contain requirements that are more stringent than the Architectural Woodwork Standards. Comply with Contract Documents and the Architectural Woodwork Standards.
 - B. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
 - C. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site.
 - D. Regional Materials: Wood products shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
 - E. Indigenous Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 - F. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 - G. Certified Wood: Wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.
 - H. Certified Wood: Wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.
 - I. Certified Wood: Wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
 - J. Certified Wood: Wood products shall [**contain not less than 60 percent**][**be made from**] certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."
 - K. Certified Wood: Wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
- 2.3 EXTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH
 - A. Architectural Woodwork Standards Grade: [**Premium**][**Custom**][**Economy**].
 - B. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
 - C. Wood Species: [**All-heart redwood**][**Western red cedar**][**Ponderosa pine or sugar pine**][**Eastern**

white pine]<Insert species>.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than **3 inches (76 mm)** wide.
2. Wood Moisture Content: **[9 to 15][10 to 15][7 to 12]** percent.

2.4 EXTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

- A. Architectural Woodwork Standards Grade: **[Premium][Custom][Economy]**.
- B. Backout or groove backs of flat trim members, and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
- C. Wood Species: **[All-heart redwood][Western red cedar][Ponderosa pine or sugar pine][Eastern white pine, sugar pine, or western white pine][Any closed-grain hardwood]<Insert species>.**
 1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than **3 inches (76 mm)** wide.
 2. Wood Moisture Content: **[9 to 15][10 to 15][7 to 12]** percent.

2.5 EXTERIOR FRAMES AND JAMBS FOR TRANSPARENT FINISH

- A. Architectural Woodwork Standards Grade: **[Premium][Custom][Economy]**.
- B. Wood Species: **[Teak][All-heart redwood][Western red cedar][White oak][Ponderosa pine or sugar pine]<Insert species>.**
 1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than **3 inches (76 mm)** wide.
 2. Wood Moisture Content: **[9 to 15][10 to 15][7 to 12]** percent.

2.6 EXTERIOR FRAMES AND JAMBS FOR OPAQUE FINISH

- A. Architectural Woodwork Standards Grade: **[Premium][Custom][Economy]**.
- B. Wood Species: **[All-heart redwood][Western red cedar][Ponderosa pine][Ponderosa pine or sugar pine][Eastern white pine, sugar pine, or western white pine][Any closed-grain hardwood]<Insert species>.**
 1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than **3 inches (76 mm)** wide.
 2. Wood Moisture Content: **[9 to 15][10 to 15][7 to 12]** percent.

2.7 EXTERIOR SHUTTERS FOR TRANSPARENT FINISH

- A. Architectural Woodwork Standards Grade: **[Premium][Custom][Economy]**.
- B. Wood Species: **[Teak][African mahogany][All-heart redwood][Ponderosa pine or sugar pine]<Insert species>.**

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than **3 inches (76 mm)** wide.
2. Wood Moisture Content: **[9 to 15][10 to 15][7 to 12]** percent.

2.8 EXTERIOR SHUTTERS FOR OPAQUE FINISH

- A. Architectural Woodwork Standards Grade: **[Premium][Custom][Economy]**.
- B. Wood Species: **[All-heart redwood][Ponderosa pine][Ponderosa pine or sugar pine]<Insert species>**.
 1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than **3 inches (76 mm)** wide.
 2. Wood Moisture Content: **[9 to 15][10 to 15][7 to 12]** percent.

2.9 EXTERIOR STAIRS AND RAILINGS

- A. Architectural Woodwork Standards Grade: **[Premium][Custom][Economy]**.
- B. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane.
- C. Stair Treads:
 1. **[1-1/4-inch- (32-mm-)][1-inch- (25-mm-)]** thick, kiln-dried[, **pressure-preservative-treated**] stepping with half-round or rounded edge nosing, of any of the following:
 - a. Douglas fir, NLGA, WCLIB, or WWPA C & Btr VG (Vertical Grain) stepping.
 - b. Hem-fir, NLGA, WCLIB, or WWPA C & Btr VG (Vertical Grain) stepping.
 - c. Southern pine, SPIB B & B stepping.
 2. **[1-1/4-inch- (32-mm-)][1 inch- (25 mm-)]** actual thickness, kiln-dried with half-round or rounded edge nosing.
 - a. Redwood, RIS **[Deck Heart or Construction Heart][Deck Common or Construction Common]**.
 - b. Redwood, RIS **[Heart Clear][Heart B or Select Heart]**.
 - c. Western red cedar, WWPA **[Patio 1][Patio 2]**.
 - d. Western red cedar, WCLIB **[Select Dex][Commercial Dex]**.
 - e. Western red cedar (North), NLGAS **[Select Patio][Commercial Patio]**.
 3. **[1-1/4-inch- (32-mm-)][1-inch- (25-mm-)][3/4-inch- (19-mm-)]** actual thickness radius-edged S4S boards, with one face free of planer skip, machine burn, and torn or chipped grain.
 - a. Species: **[Ipe][Teak][Cumaru][Garapa][Goncalo alves]<Insert name>**.
 - b. Grade Characteristics:
 - 1) Clear[**one face; small pin knots and worm holes allowed on back face**].
 - 2) Sound; small pin knots, worm holes, and fixed knots allowed.
 - 3) All heart[**one face**].
 - 4) Straight grained and parallel cut.
 - 5) Free of heart centers.
 - 6) No decay, incipient decay, honeycomb, knot holes, shakes, splits, or wane.

- 7) No discoloration.

D. Stair Risers:

1. **3/4-inch- (19-mm-)** thick, kiln-dried[, **pressure-preservative-treated**] finish boards, of any of the following:
 - a. Douglas fir, NLGA, WCLIB, or WWPA C & Btr or Superior finish.
 - b. Hem-fir, NLGA, WCLIB, or WWPA C & Btr or Superior finish.
 - c. Southern pine, SPIB B & B.
2. **3/4-inch- (19-mm-)** actual thickness, kiln-dried with half-round or rounded edge nosing.
 - a. Redwood, RIS [**Deck Heart or Construction Heart**][**Deck Common or Construction Common**].
 - b. Redwood, RIS [**Heart Clear**][**Heart B or Select Heart**].
 - c. Western red cedar, WWPA [**Patio 1**][**Patio 2**].
 - d. Western red cedar, WCLIB [**Select Dex**][**Commercial Dex**].
 - e. Western red cedar (North), NLGAS [**Select Patio**][**Commercial Patio**].
3. **3/4-inch- (19-mm-)** actual thickness radius-edged S4S boards, with one face free of planer skip, machine burn, and torn or chipped grain.
 - a. Species: [**Ipe**][**Teak**][**Cumaru**][**Garapa**][**Goncalo alves**]<Insert name>.
 - b. Grade Characteristics:
 - 1) Clear[**one face; small pin knots and worm holes allowed on back face**].
 - 2) Sound; small pin knots, worm holes, and fixed knots allowed.
 - 3) All heart[**one face**].
 - 4) Straight grained and parallel cut.
 - 5) Free of heart centers.
 - 6) No decay, incipient decay, honeycomb, knot holes, shakes, splits, or wane.
 - 7) No discoloration.

E. Railing Members:

1. Clear, kiln-dried, solid, [**yellow poplar**][**pressure-preservative-treated Douglas fir**][**pressure-preservative-treated southern pine**]; railing stock of pattern indicated on Drawings.
2. [**Select Structural**][**No. 1**][**No. 2**][**Construction or No. 2**] grade and[**any of**] the following species:
 - a. Hem-fir or hem-fir (North); NLGA, WCLIB, or WWPA.
 - b. Douglas fir-larch, Douglas fir-larch (North), or Douglas fir-south; NLGA, WCLIB, or WWPA.
 - c. Mixed southern pine; SPIB.
 - d. Redwood; RIS.
 - e. Spruce-pine-fir or spruce-pine-fir (South); NeLMA, NLGA, WCLIB, or WWPA.
3. Redwood, RIS [**Heart Clear**][**Heart B or Select Heart**].
4. Any of the following species and grades:
 - a. Douglas fir, NLGA, WCLIB, or WWPA C & Btr finish or C Select.
 - b. Hem-fir, NLGA, WCLIB, or WWPA C & Btr finish or C Select.
 - c. Redwood, RIS [**Heart Clear**][**Heart B or Select Heart**].
 - d. Southern pine, SPIM B & B finish.

5. Radius-edged [Ipe][Teak] S4S boards, [same grade as stair treads][clear][clear all heart][, straight grained and parallel cut].

F. Balusters:

1. 1-1/16-inch- (27-mm-) square, clear, kiln-dried, solid, [yellow poplar][pressure-preservative-treated Douglas fir][pressure-preservative-treated southern pine].
2. 1-1/16-inch- (27-mm-) square, [Select Structural][No. 1][No. 2][Construction or No. 2] grade, and[any of] the following species:
 - a. Hem-fir or hem-fir (North); NLGA, WCLIB, or WWPA.
 - b. Douglas fir-larch, Douglas fir-larch (North), or Douglas fir-south; NLGA, WCLIB, or WWPA.
 - c. Mixed southern pine; SPIB.
 - d. Redwood; RIS.
 - e. Spruce-pine-fir or spruce-pine-fir (South); NeLMA, NLGA, WCLIB, or WWPA.
3. 1-1/16-inch- (27-mm-) square, redwood, RIS [Heart Clear][Heart B or Select Heart].
4. 1-1/16-inch- (27-mm-) square,[and any of the following species and grades:]
 - a. Douglas fir, NLGA, WCLIB, or WWPA C & Btr finish or C Select.
 - b. Hem-fir, NLGA, WCLIB, or WWPA C & Btr finish or C Select.
 - c. Redwood, RIS [Heart Clear][Heart B or Select Heart].
 - d. Southern pine, SPIM B & B finish.
5. 1-1/16-inch- (27-mm-) square, radius-edged [Ipe][Teak] S4S boards, [same grade as stair treads][clear][clear all heart][, straight grained and parallel cut].

G. Newel Posts:

1. 2-3/4-inch- (70-mm-) square, clear, kiln-dried, [yellow poplar][pressure-preservative-treated Douglas fir][pressure-preservative-treated southern pine], turned newel posts of pattern and size indicated on Drawings.
2. 2-3/4-inch- (70-mm-) square, [Select Structural][No. 1][No. 2][Construction or No. 2] grade, and[any of] the following species:
 - a. Hem-fir or hem-fir (North); NLGA, WCLIB, or WWPA.
 - b. Douglas fir-larch, Douglas fir-larch (North), or Douglas fir-south; NLGA, WCLIB, or WWPA.
 - c. Mixed southern pine; SPIB.
 - d. Redwood; RIS.
 - e. Spruce-pine-fir or spruce-pine-fir (South); NeLMA, NLGA, WCLIB, or WWPA.
3. 2-3/4-inch- (70-mm-) square, redwood, RIS [Heart Clear][Heart B or Select Heart].
4. 2-3/4-inch- (70-mm-) square,[and any of the following species and grades:]
 - a. Douglas fir, NLGA, WCLIB, or WWPA C & Btr finish or C Select.
 - b. Hem-fir, NLGA, WCLIB, or WWPA C & Btr finish or C Select.
 - c. Redwood, RIS [Heart Clear][Heart B or Select Heart].
 - d. Southern pine, SPIM B & B finish.
5. 2-3/4-inch- (70-mm-) square, radius-edged [Ipe][Teak] S4S boards, [same grade as stair treads][clear][clear all heart][, straight grained and parallel cut].

2.10 WOOD MATERIALS

- A. Hardboard: ANSI A135.4.

- B. Softwood Plywood: DOC PS 1, exterior[, **medium-density overlay**].

2.11 PRESERVATIVE-TREATED-WOOD MATERIAL

- A. Preservative-Treated-Wood Materials: Provide with water-repellent preservative treatment complying with AWWA N1 (dip, spray, flood, or vacuum-pressure treatment).
1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC)[, **combined with a compatible EPA-registered insecticide**].
 2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
- B. Extent of Preservative-Treated Wood Materials: Treat wood materials [**unless otherwise indicated on Drawings**][**except items indicated to be fire-retardant treated**][**Insert requirements**].
1. Items fabricated from the following wood species need not be treated:
 - a. **[Redwood]**[**All-heart redwood**].
 - b. **[Western red cedar]**[**All-heart western red cedar**].
 - c. White oak.
 - d. African mahogany.
 - e. Honduras mahogany.
 - f. Ipe.
 - g. Dark red meranti.
 - h. Teak.

2.12 FIRE-RETARDANT-TREATED WOOD MATERIAL

- A. Fire-Retardant-Treated Wood Materials, General: Where fire-retardant-treated materials are indicated, use materials complying with requirements that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products according to test method indicated by a qualified testing agency.
1. Use treated materials that comply with requirements of the Architectural Woodwork Standards for the grade specified. Do not use materials that are warped, discolored, or otherwise defective.
 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Exterior Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E84 after being subjected to accelerated weathering according to ASTM D2898, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than **10.5 feet (3.2 m)** beyond the centerline of the burners at any time during the test.
1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
 2. For items indicated to receive a stained, transparent, or natural finish, use organic resin chemical formulation.
 3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.

4. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

C. Extent of Fire-Retardant-Treated Wood Materials:

1. Exterior architectural woodwork located more than **40 feet (12.192 m)** above grade.
2. Exterior architectural woodwork in locations with a fire-separation distance of **5 feet (1.524 m)** or less.
3. **[Where indicated on Drawings]<Insert requirements>**.

2.13 SHUTTER HARDWARE

A. Offset Strap Hinges: For inset shutters and with tapered strap. Shutters can lift off pintles after installation. Provide top and bottom hinges for each shutter and matching wood screws for installation.

1. Offset: **[1/2 inch (13 mm)][1-1/2 inches (38 mm)][2-1/4 inches (57 mm)][3-1/4 inches (83 mm)]<Insert dimension>**.
2. Strap Length: **[10 inches (254 mm)][12 inches (300 mm)][14 inches (356 mm)][16 inches (406 mm)]<Insert dimension>**.
3. Strap Width: **[1-3/4 inches (45 mm)]<Insert dimension>** at widest point.
4. Pintle Plate: **[3-1/2 by 1-1/2 by 1/8 inches (89 by 38 by 3 mm)]<Insert dimensions>**.
5. Pintle Diameter: **[3/8 inch (10 mm)]<Insert dimension>**.
6. Material and Finish: **[Zinc-chromate-plated steel with black finish]<Insert requirements>**.

B. New York-Style Hinges: Offset type for full-inset shutters. Provide top and bottom hinges for each shutter and matching wood screws for installation.

1. Overall Hinge Dimensions: **[4-1/4 by 5 inches (108 by 127 mm)][6 by 6-3/4 inches (152 by 172 mm)]<Insert dimensions>**.
2. Offset: **[1-1/16 inches (27 mm)][1-1/4 inches (32 mm)][2-1/8 inches (54 mm)][2-1/4 inches (57 mm)]<Insert dimension>**.
3. Pintle Plate: **[2 by 1-1/8 inches (51 by 29 mm)][3-1/8 by 1-1/8 inches (79 by 29 mm)][3-5/8 by 1-3/16 inches (92 by 30 mm)]<Insert dimensions>**.
4. Material and Finish: **[Cast iron with rust-inhibiting primer and black matte powder-coated polyurethane finish][Galvanized steel][Solid bronze with wax finish]<Insert requirements>**.

C. L-Type Hinges: Offset type for inset shutters; with tapered long-leg of L-shape oriented horizontally. Shutters can lift off pintles after installation. Provide top and bottom hinges[**and matching middle, straight-plate hinge**] for each shutter and matching wood screws for installation.

1. L-Shape Plate: **[5-inch- (127-mm-) long vertical leg and 6-inch- (152-mm-) long horizontal leg]<Insert requirements>**.
2. Maximum Leg Width: **[1-3/8 inches (35 mm)]<Insert dimension>**.
3. Offset: **[1/2 inch (13 mm)][1-1/2 inches (38 mm)][2-1/4 inches (57 mm)]<Insert dimension>**.
4. Pintle Plate: **[3-1/2 by 1-1/2 by 1/8 inch (89 by 38 by 3 mm)]<Insert dimensions>**.
5. Pintle Diameter: **[3/8 inch (10 mm)]<Insert dimension>**.
6. Material and Finish: **[Zinc-chromate-plated steel with wrought-iron black finish]<Insert requirements>**.

D. Connecticut-Style Hinges: Strap-type, loose-joint hinges with threaded pintle. Provide top and bottom hinges[**and matching middle hinge**] for each shutter and matching wood screws for installation.

1. Type: **[No offset][1-1/4-inch (32-mm) offset][2-3/16-inch (56-mm) offset]<Insert description>**.
2. Strap Dimensions: **[1 by 4-1/4 inches (25 by 108 mm)][1 by 6-1/2 inches (25 by 165 mm)]<Insert dimensions>**.

- mm)]<Insert dimensions>.
3. Pintle: [2-3/8 inches (60 mm) long with 5/16-inch- (8-mm-) diameter thread][2-3/4 inches (70 mm) long with 1/4-inch- (6-mm-) diameter thread][4-1/2 inches (114 mm) long with 3/8-inch- (10-mm-) diameter thread][4-1/2 inches (114 mm) long with 7/16-inch- (11-mm-) diameter thread]<Insert requirements>.
4. Material and Finish: [Galvanized steel][Stainless steel with black finish]<Insert requirements>.

E. Bermuda-Style Hinges: For top-hung shutters. Provide [two]<Insert number> hinges and one matching, shutter stay per shutter. Provide matching wood screws for installation.

1. Overall Hinge Dimensions: [6-3/16 by 3-1/2 inches (157 by 89 mm)]<Insert dimensions>.
2. Hinge Leg Width: Approximately [1-1/16 inches (27 mm)]<Insert dimension>.
3. Hinge Material Thickness: Approximately [1/4 inch (6 mm)]<Insert dimension>.
4. Shutter Stay: [24-inch- (610-mm-)]<Insert dimension> long.
5. Material and Finish: [Cast iron and coated with a black textured powder coat]<Insert requirements>.

F. Shutter Dogs: For holding shutters in open position.

1. Type: [Traditional scroll design]<Insert requirements>.
2. Overall Dimensions: [6-3/4 by 2-3/8 inches (172 by 60 mm)][8-1/8 by 3-1/4 inches (206 by 83 mm)]<Insert dimensions>.
3. Material and Finish: [Steel with rough black, rust-inhibiting finish]<Insert requirements>.

2.14 FASTENERS

A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.

1. Use [stainless steel][fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329/F2329M] unless otherwise indicated.
2. For pressure-preservative-treated wood, use stainless steel fasteners.
3. For redwood, use [brass/bronze][stainless steel][hot-dip galvanized-steel] fasteners.

B. Nails: ASTM F1667.

C. Power-Driven Fasteners: ICC-ES AC70.

D. Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.

E. Carbon-Steel Bolts: **ASTM A307** with **ASTM A563 (ASTM A563M)** hex nuts and, where indicated, flat washers all hot-dip zinc coated.

F. Stainless Steel Bolts: **ASTM F593, Alloy Group 1 or 2**; with **ASTM F594, Alloy Group 1 or 2 (ASTM F836M, Grade A1 or Grade A4)** hex nuts and, where indicated, flat washers.

G. Postinstalled Anchors: Stainless steel, [chemical][or][torque-controlled expansion] anchors with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing according to ASTM E488/E488M conducted by a qualified independent testing and inspecting agency.

1. Stainless steel bolts and nuts complying with **ASTM F593 and ASTM F594, Alloy Group 1 or 2 (ASTM F836M, Grade A1 or Grade A4)**.

2.15 MISCELLANEOUS MATERIALS

- A. Blocking, Shims, and Nailers: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
 1. Wood-Preservative Treatment: By pressure process, AWP A U1; Use Category UC3b.
 - a. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
 - b. Preservative Chemicals: Acceptable to authorities having jurisdiction[**and containing no arsenic or chromium**].
 - c. Mark lumber with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee's (ALSC) Board of Review.
 2. Fire-Retardant Treatment: Complying with requirements; provide [where indicated on Drawings]<Insert requirements>.

2.16 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate exterior architectural woodwork to dimensions, profiles, and details indicated.
 1. Ease edges to radius indicated for the following:
 - a. Edges of Solid-Wood (Lumber) Members: **1/16 inch (1.5 mm)** unless otherwise indicated.
 - b. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: **1/8 inch (3 mm)**.
- C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.
 1. Disassemble components only as necessary for shipment and installation.
 2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
 3. Notify Architect seven days in advance of the dates and times exterior architectural woodwork fabrication will be complete.
 4. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.
 - a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
 - b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

2.17 SHOP PRIMING

- A. Preparations for Finishing: Comply with the Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing exterior architectural woodwork, as applicable to each unit of work.
- B. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork.[**Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.**]

- C. Exterior Architectural Woodwork for Opaque Finish: Shop prime all surfaces with one coat of wood primer as specified in Section 099113 "Exterior Painting."
- D. Exterior Architectural Woodwork for Transparent Finish:
 - 1. Shop seal surfaces to be concealed
 - 2. Shop seal exposed surfaces with stain (if specified), other required pretreatments, and first coat of finish as specified in Section 099300 "Staining and Transparent Finishing."

2.18 SHOP FINISHING

- A. Finish exterior architectural woodwork [**with transparent finish**][**indicated on Drawings**] at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with the Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing exterior architectural woodwork, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of exterior architectural woodwork. Apply two coats to end-grain surfaces.
- C. Transparent Finish: Comply with Section 099300 "Staining and Transparent Finishing."
- D. Opaque Finish: Comply with Section 099113 "Exterior Painting."

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition exterior architectural woodwork to average prevailing humidity conditions at Project site.
- B. Before installing exterior architectural woodwork, examine shop-fabricated work for completion, and complete work as required, including removing packing and backpriming concealed surfaces.

3.2 INSTALLATION

- A. Grade: Install exterior architectural woodwork to comply with same grade as item to be installed.
- B. Assemble exterior architectural woodwork, and complete fabrication at Project site to the extent that it was not completed during shop fabrication.
- C. Install exterior architectural woodwork level, plumb, true in line, and without distortion.
 - 1. Shim as required with concealed shims.
 - 2. Install level and plumb to a tolerance of **1/8 inch in 96 inches (3 mm in 2400 mm)**.
- D. Standing and Running Trim:
 - 1. Install with minimum number of joints possible, using full-length pieces (from maximum length of

- lumber available) to greatest extent possible.
- 2. Do not use pieces less than **[36 inches (900 mm)][60 inches (1500 mm)][96 inches (2400 mm)]** long, except where shorter single-length pieces are necessary.
- 3. Scarf running joints and stagger in adjacent and related members.
- E. Scribe and cut exterior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- F. Preservative-Treated Wood Materials: Where field cut or drilled, treat cut ends and drilled holes according to AWWPA M4.
- G. Fire-Retardant-Treated Wood Materials: Install fire-retardant-treated materials to comply with chemical treatment manufacturer's written instructions.
- H. Anchor exterior architectural woodwork to anchors or blocking built in or directly attached to substrates.
 - 1. Secure with countersunk, concealed fasteners and blind nailing.
 - 2. Use fine finishing nails **[or finishing screws]** for exposed fastening, countersunk and filled flush with exterior architectural woodwork.
 - 3. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced and with adjacent rows staggered.
 - 4. For shop-finished items, use filler matching finish of items being installed.
- I. Stair and Railing Installation:
 - 1. Treads and Risers:
 - a. Install stair tread with crown side up (bark side down).
 - b. Secure treads and risers by gluing and nailing to carriages.
 - 1) Extend treads over carriages **[and finish with bullnose edge]**.
 - c. Countersink nail heads, fill flush, and sand filler.
 - 2. Balusters:
 - a. Fit balusters to treads, glue, and nail in place.
 - b. Countersink nail heads, fill flush, and sand filler.
 - c. Let into railings and glue in place.
 - 3. Newel Posts: Secure newel posts to stringers and risers with **[through bolts][lag screws][countersunk-head wood screws and glue]**.
 - 4. Railings:
 - a. Secure wall rails with metal brackets.
 - b. Fasten freestanding railings to newel posts and to trim at walls with glue and countersunk-head wood screws or rail bolts.
 - 5. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced and with adjacent rows staggered.
 - 6. Install stairs with no more than **3/16-inch (4.7-mm)** variation between adjacent treads and risers and with no more than **3/8-inch (10-mm)** variation between largest and smallest treads and risers within each flight.
- J. Touch up finishing work specified in this Section after installation of exterior architectural woodwork.



1. Fill nail holes with matching filler where exposed.
2. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.

K. Field Finishing: See **[Section 099113 "Exterior Painting"]****[and]****[Section 099300 "Staining and Transparent Finishing"]** for final finishing of installed exterior architectural woodwork.

3.3 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through **[AWI's Quality Certification Program]****[WI's Certified Compliance Program]** certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.

1. Inspection entity is to prepare and submit report of inspection.

3.4 REPAIR

A. Repair damaged and defective exterior architectural woodwork, where possible, to eliminate functional and visual defects **[and to result in exterior architectural woodwork being in compliance with requirements of the Architectural Woodwork Standards for the specified grade]**.

B. Where not possible to repair, replace defective woodwork.

3.5 CLEANING

A. Clean exterior architectural woodwork on exposed and semiexposed surfaces.

END OF SECTION 06 40 00 00

SECTION 06 40 00 00A - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standing and running trim for transparent finish.
2. Interior standing and running trim for opaque finish.
3. Closet and utility shelving.
4. Interior frames and jambs for transparent finish.
5. Interior frames and jambs for opaque finish.
6. Interior wood stairs and railings.
7. Preservative-treated wood material.
8. Fire-retardant-treated wood material.
9. Miscellaneous materials.
10. Shop priming.
11. Shop finishing.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing interior architectural woodwork that are concealed within other construction before interior architectural woodwork installation.
2. Section 062023 "Interior Finish Carpentry" for interior carpentry exposed to view that is not specified in this Section.

1.2 COORDINATION

- A.** Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior architectural woodwork can be supported and installed as indicated.

1.3 PREINSTALLATION MEETINGS

- A.** Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Anchors.
2. Adhesives.
3. Shop finishing materials.

B. Wood-Preservative Treatment:

1. Include data and warranty information from chemical-treatment manufacturer and certification by

- treating plant that treated materials comply with requirements.
 2. Indicate type of preservative used and net amount of preservative retained.
 3. Include chemical-treatment manufacturer's written instructions for finishing treated material and manufacturer's written warranty.
- C. Fire-Retardant Treatment: Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- D. Waterborne Treatments: For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
- E. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 3. Environmental Product Declaration (EPD): For each product.
 4. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
 5. Environmental Product Declaration: For each product.
 6. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
 7. Environmental Product Declaration: For each product.
 8. Environmental Product Declaration: For each product.
 9. Third-Party Certifications: For each product.
 10. Third-Party Certified Life Cycle Assessment: For each product.
 11. Environmental Product Declaration (EPD): Provide one of the following EPDs: critically reviewed life-cycle assessment complying with ISO 14044; internally reviewed, product-specific Type III EPD; third-party-verified, industrywide Type III EPD.
 12. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
 13. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
 14. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
 15. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
 16. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
 17. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
 18. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
 19. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
 20. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
 21. Product Data: For composite wood products, indicating compliance with requirements for formaldehyde emissions.
 22. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
- F. Shop Drawings:
1. Include the following:

- a. Dimensioned plans, elevations, and sections.
 - b. Attachment details.
 2. Show **[large-scale][full-size]** details.
 3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.
 4. Apply **[AWI Quality Certification][WI Certified Compliance]** Program label to Shop Drawings.
 - G. Samples: For each exposed product and for each shop-applied color and finish specified.
 1. Size:
 - a. Panel Products: **12 inches by 12 inches (300 mm by 300 mm)**.
 - b. Lumber Products: Not less than **[5 inches (125 mm) wide by 12 inches (300 mm) long][5 inches (125 mm) wide by 24 inches (600 mm) long]**, for each species and cut, finished on one side and one edge.
 - H. Samples for Initial Selection: For each type of shop-applied exposed finish.
 1. Size:
 - a. Panel Products: **12 inches by 12 inches (300 mm by 300 mm)**.
 - b. Lumber Products: Not less than **[5 inches (125 mm) wide by 12 inches (300 mm) long][5 inches (125 mm) wide by 24 inches (600 mm) long]**, for each species and cut, finished on one side and one edge.
 - I. Samples for Verification: For the following:
 1. Lumber for Transparent Finish: Not less than **[5 inches (125 mm) wide by 12 inches (300 mm) long][5 inches (125 mm) wide by 24 inches (600 mm) long]**, for each species and cut, finished on one side and one edge.
 2. Veneer Leaves: Representative of and selected from flitches to be used for transparent-finished interior architectural woodwork.
 3. Lumber and Panel Products with Shop-Applied Opaque Finish: **5 inches (125 mm) wide by 12 inches (300 mm) long** for lumber and **[8 by 10 inches (200 by 250 mm)][12 by 12 inches (300 by 300 mm)]** for panels, for each finish system and color.
 - a. Finish **[entire][one-half of]** exposed surface.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For **[architectural woodwork manufacturer][and][Installer]**.
 - B. Product Certificates: For the following:
 1. Composite wood products.
 2. Adhesives.
 - C. Evaluation Reports: For **[preservative-treated][and][fire-retardant-treated]** wood materials, from ICC-ES.
 - D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Quality Standard Compliance Certificates: **[AWI Quality Certification Program][WI Certified Compliance Program]** certificates.

1.7 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
 - 1. Manufacturer's Certification: Licensed participant in **[AWI's Quality Certification Program][WI's Certified Compliance Program]**.
 - 2. Installer Qualifications: **[Manufacturer of products][and][Licensed participant in AWI's Quality Certification Program][Licensed participant in WI's Certified Compliance Program]**.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockups of **[typical interior architectural woodwork as shown on Drawings]<Insert description>**.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Architectural Woodwork Standards, Section 2.
- B. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.
- C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
 - 1. Handle and store fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions.

1.9 FIELD CONDITIONS

- A. Environmental Limitations without Humidity Control: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of the construction period.
- B. Environmental Limitations with Humidity Control: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between **60 and 90 deg F (16 and 32 deg C)** and relative humidity between **[25 and 55][43 and 70][20 and 50]<Insert number>** percent during the remainder of the construction period.
- C. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction,

verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.
- D. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Frames: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
1. Smoke- and Draft-Control Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.
- B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing in accordance with NFPA 257 or UL 9.

2.2 ARCHITECTURAL WOODWORK

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **<Insert, in separate subparagraphs, names of preapproved architectural woodworking firms>.**

2.3 WOODWORK, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
1. Provide **[labels][and][certificates]** from **[AWI][WI]** certification program indicating that woodwork**[and installation]** complies with requirements of grades specified.
 - a. This project has been registered with AWI as AWI Quality Certification Program Number **<Insert number>.**
 2. The Contract Documents contain requirements that are more stringent than the Architectural Woodwork Standards. Comply with Contract Documents and Architectural Woodwork Standards.



- B. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- C. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site.
- D. Regional Materials: Wood products shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- E. Indigenous Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- F. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- G. Certified Wood: Wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.
- H. Certified Wood: Wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.
- I. Certified Wood: Wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
- J. Certified Wood: Wood products shall [**contain not less than 60 percent**][**be made from**] certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."
- K. Certified Wood: Wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.

2.4 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

- A. Architectural Woodwork Standards Grade: [**Premium**][**Custom**][**Economy**].
- B. Hardwood Lumber:
 - 1. Wood Species and Cut: [**Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.**]
 - 2. Species: [**Red oak**][**White oak**][**White ash**][**Hickory**]<Insert species>.
 - 3. Cut: [**Plain sliced/plain sawn**][**Rift cut/rift sawn**][**Quarter cut/quarter sawn**].
 - 4. Wood Moisture Content: [**5 to 10**][**8 to 13**][**4 to 9**] percent.
 - 5. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.

6. For trim items[**other than base**] wider than available lumber, use veneered construction. Do not glue for width.
 - a. For veneered base, use hardwood lumber core, glued for width.
7. For base wider than available lumber, glue for width. Do not use veneered construction.
8. For rails thicker than available lumber, use veneered construction. Do not glue for thickness.

C. Softwood Lumber:

1. Wood Species and Cut:[**Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.**]
2. Species: [Eastern white pine][Sugar pine][Western white pine][Douglas fir]<Insert species>.
3. Cut: [Plain sawn]<Insert cut>.
4. Wood Moisture Content: [5 to 10][8 to 13][4 to 9] percent.
5. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.
6. For trim items[**other than base**] wider than available lumber, use veneered construction. Do not glue for width.
 - a. For veneered base, use softwood lumber core, glued for width.
7. For base wider than available lumber, glue for width. Do not use veneered construction.
8. For rails thicker than available lumber, use veneered construction. Do not glue for thickness.
9. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than **3 inches (76 mm)** wide.

2.5 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

- A. Architectural Woodwork Standards Grade: [Premium][Custom][Economy].
 1. Wood Species: [Any closed-grain hardwood][Eastern white pine, sugar pine, or western white pine]<Insert species>.
 2. Wood Moisture Content: [5 to 10][8 to 13][4 to 9] percent.

2.6 CLOSET AND UTILITY SHELVING

- A. Architectural Woodwork Standards Grade: [Premium][Custom][Economy].
- B. Shelf Material: **3/4-inch (19-mm) [solid lumber][veneer-faced panel product with solid-lumber edge][veneer-faced panel product with veneer edge banding][thermally fused laminate panel with solid-lumber edge][thermally fused laminate panel with PVC T-mold edge][MDF with solid-lumber edge][particleboard with solid-lumber edge][MDF with radiused edge][particleboard with radiused and filled edge].**
- C. Cleats: **3/4-inch (19-mm) [solid lumber][thermally fused laminate panel][panel product].**
- D. Wood Species: [Red oak][Match species indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated][Match species indicated for door to closet where shelving is located][Any closed-grain hardwood][Eastern white pine, sugar pine, or western white pine]<Insert species>.

- E. Wood Closet Rods: **1-1/2-inch- (38-mm-)** diameter, [**red oak**][**hardwood**][**Douglas fir or southern pine**]**<Insert species>**.
- F. Metal Closet Rods: **1-5/16-inch- (33-mm-)** diameter, [**aluminum**][**chrome-plated-steel**][**color-coated-steel**][**stainless steel**] tubes complying with BHMA A156.16, L03131.
- G. Wood Rod Flanges: Clear, kiln-dried, [**red oak**][**hardwood**][**Douglas fir or southern pine**][**eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine**]**<Insert species>** turnings.
- H. Metal Rod Flanges: [**Aluminum**][**Chrome-plated steel**][**Stainless steel**].
- I. Wood Finish: [**Transparent**][**Opaque**][**As indicated on Drawings or in schedules**]**<Insert requirements>**.

2.7 INTERIOR FRAMES AND JAMBS FOR TRANSPARENT FINISH

- A. Architectural Woodwork Standards Grade: [**Premium**][**Custom**][**Economy**].
- B. Wood Species and Cut: [**Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.**]
 - 1. Species: [**Red oak**][**White oak**][**White ash**][**Hickory**]**<Insert species>**.
 - 2. Cut: [**Plain sliced/plain sawn**][**Rift cut/rift sawn**][**Quarter cut/quarter sawn**].
 - 3. Wood Moisture Content: [**5 to 10**][**8 to 13**][**4 to 9**] percent.
 - 4. Provide split species on frames and jambs that face areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.
- C. For frames or jambs wider than available lumber, use veneered construction. Do not glue for width.
 - 1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than **3 inches (76 mm)** wide.
- D. Fire-Rated Interior Frames and Jambs: Products fabricated from fire-retardant particleboard or fire-retardant MDF with veneered exposed surfaces and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing in accordance with NFPA 252.
 - 1. Fire Rating: 20 minutes.

2.8 INTERIOR FRAMES AND JAMBS FOR OPAQUE FINISH

- A. Architectural Woodwork Standards Grade: [**Premium**][**Custom**][**Economy**].
- B. Wood Species: [**Any closed-grain hardwood**][**Eastern white pine, sugar pine, or western white pine**]**<Insert species>**.
 - 1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than **3 inches (76 mm)** wide.
 - 2. Wood Moisture Content: [**5 to 10**][**8 to 13**][**4 to 9**] percent.
- C. Fire-Rated Interior Frames and Jambs: Products fabricated from fire-retardant particleboard with veneered exposed surfaces or fire-retardant MDF and listed and labeled by a testing and inspecting

agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing in accordance with NFPA 252.

1. Fire Rating: 20 minutes.

2.9 INTERIOR WOOD STAIRS AND RAILINGS

- A. Architectural Woodwork Standards Grade: **[Premium][Custom][Economy]**.

- B. Wood for Transparent Finish:

1. Species and Cut:

- a. Stringers: **[Red oak, plain sawn][Red oak, quarter sawn][Hard maple, plain sawn]<Insert species and cut>**.
- b. Risers: **[Red oak, plain sawn][Red oak, quarter sawn][Hard maple, plain sawn]<Insert species and cut>**.
- c. Treads: **[Red oak, plain sawn][Red oak, quarter sawn][Hard maple, plain sawn]<Insert species and cut>**.
- d. Railings: **[Red oak, plain sawn][Red oak, quarter sawn][Hard maple, plain sawn]<Insert species and cut>**.
- e. Balusters: **[Red oak, plain sawn][Red oak, quarter sawn][Hard maple, plain sawn]<Insert species and cut>**.
- f. Newels: **[Red oak, plain sawn][Red oak, quarter sawn][Hard maple, plain sawn]<Insert species and cut>**.
- g. Moldings: **[Red oak, plain sawn][Red oak, quarter sawn][Hard maple, plain sawn]<Insert species and cut>**.

2. Wood Moisture Content: **[5 to 10][8 to 13][4 to 9]** percent.

- C. Wood for Opaque Finish:

1. Species: **[Any closed-grain hardwood][Eastern white pine, sugar pine, or western white pine][Any closed-grain hardwood, except that eastern white pine, sugar pine, or western white pine may be used for risers, stringers, and moldings]<Insert species>**.
2. Wood Moisture Content: **[5 to 10][8 to 13][4 to 9]** percent.

- D. Rough Carriage Stairs:

1. Laminated veneer lumber, made with an exterior-type adhesive complying with ASTM D2559, and with the following allowable design values as determined in accordance with ASTM D5456:
 - a. Extreme Fiber Stress in Bending, Edgewise: **[3100 psi (21.3 MPa)][2900 psi (20.0 MPa)][2600 psi (17.9 MPa)][2250 psi (15.5 MPa)]<Insert value>** for 12-inch nominal- (286-mm actual-) depth members.
 - b. Modulus of Elasticity, Edgewise: **[2,000,000 psi (13 800 MPa)][1,800,000 psi (12 400 MPa)][1,500,000 psi (10 300 MPa)]<Insert value>**.
2. Wood Grade: **[Select Structural][No. 1][No. 2]**, kiln-dried to 15 percent maximum moisture content.
 - a. Acceptable Species:
 - 1) Hem-fir (north).
 - 2) Southern pine.

- 3) Douglas fir-larch.
- 4) Douglas fir-larch (north).
- 5) Spruce-pine-fir.
- 6) Hem-fir.
- 7) Douglas fir-south.
- 8) Spruce-pine-fir (south).

E. Finishes for Stair Parts:

1. Treads: **[Transparent][Opaque]**.
2. Risers: **[Transparent][Opaque]**.
3. Stringers: **[Transparent][Opaque]**.
4. Balusters: **[Transparent][Opaque]**.
5. Handrails: **[Transparent][Opaque]**.
6. Scotia, Cove, and Other Moldings: **[Transparent][Opaque]**.

F. Handrail Brackets: **[Cast nickel-silver][Cast aluminum][Cast bronze][Cast stainless steel]** with wall flange drilled **[for exposed anchor][and tapped for concealed hanger bolt]** and with support arm for screwing to underside of rail. Size to provide **1-1/2-inch (38-mm)** clearance between handrail and face of wall.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Julius Blum & Co., Inc.]**
 - b. **[The Wagner Companies]**
 - c. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Julius Blum & Co., Inc.]**
 - b. **[The Wagner Companies]**
 - c. **<Insert manufacturer's name>**

G. Handrail/Bumper Rail Brackets: Pairs of extruded-aluminum channels: one for fastening to back of rail and one for fastening to face of wall, assembled in overlapping fashion and fastened together at top and bottom with self-tapping screws. Size to provide **1-1/2-inch (38-mm)** clearance between handrail and wall.

2.10 HARDWOOD SHEET MATERIALS

A. Composite Wood Products: Provide materials that comply with requirements of the Architectural Woodwork Standards for each type of interior architectural woodwork and quality grade specified unless otherwise indicated.

1. Recycled Content of MDF and Particleboard: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
2. Composite Wood Products: Products shall be made without urea formaldehyde.
3. Composite Wood Products: Products shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of

4. Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
5. Composite Wood Products: Formaldehyde emission rates shall not be greater than the following when tested according to ASTM D6007 or ASTM E1333:
 - a. Hardwood Plywood: 0.05 ppm.
 - b. Particleboard: 0.09 ppm.
 - c. MDF More Than **5/16 Inch (8 mm)** Thick: 0.11 ppm.
 - d. MDF **5/16 Inch (8 mm)** or Less in Thickness: 0.13 ppm.
6. Composite Wood Products: Products shall be made without urea formaldehyde.
7. Medium-Density Fiberboard (MDF): ANSI A208.2, **[Grade 130]<Insert grade>**.
8. Particleboard: ANSI A208.1, **[Grade M-2][Grade M-2-Exterior Glue]**.
9. Softwood Plywood: DOC PS 1[, **medium-density overlay**].
10. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

2.11 PRESERVATIVE-TREATED-WOOD MATERIAL

- A. Preservative-Treated-Wood Materials: Provide with water-repellent preservative treatment complying with AWWA N1 (dip, spray, flood, or vacuum-pressure treatment).
 1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC)[, **combined with a compatible EPA-registered insecticide**].
 2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
- B. Extent of Preservative-Treated Wood Materials: Treat **[interior architectural woodwork in contact with concrete or masonry]<Insert requirements>**.
 1. Items fabricated from the following wood species need not be treated:
 - a. **[Redwood][All-heart redwood]**.
 - b. **[Western red cedar][All-heart western red cedar]**.
 - c. White oak.
 - d. African mahogany.
 - e. Honduras mahogany.
 - f. Ipe.
 - g. Dark red meranti.
 - h. Teak.

2.12 FIRE-RETARDANT-TREATED WOOD MATERIAL

- A. Fire-Retardant-Treated Wood Materials: Where fire-retardant-treated materials are indicated, use materials complying with requirements that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products in accordance with test method indicated by a qualified testing agency.
 1. Use treated materials that comply with requirements of the Architectural Woodwork Standards. Do not use materials that are warped, discolored, or otherwise defective.
 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.

3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than **10.5 feet (3.2 m)** beyond the centerline of the burners at any time during the test.
1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
 2. For items indicated to receive a stained, transparent, or natural finish, use organic resin chemical formulation.
 3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
 4. Mill lumber before treatment, and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
- C. Fire-Retardant Particleboard: Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture, to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less in accordance with ASTM E84.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Arauco North America]**
 - b. **[Timber Products, Inc.]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Arauco North America]**
 - b. **[Timber Products, Inc.]**
 - c. **<Insert manufacturer's name>**
 3. For panels **3/4 inch (19 mm)** thick and less, comply with ANSI A208.1 for Grade M-2, except for the following minimum properties: modulus of rupture, **1600 psi (11 MPa)**; modulus of elasticity, **300,000 psi (2070 MPa)**; internal bond, **80 psi (550 kPa)**; and screw-holding capacity on face and edge, **250 and 225 lbf (1100 and 1000 N)**, respectively.
 4. For panels **13/16 to 1-1/4 inches (20 to 32 mm)** thick, comply with ANSI A208.1 for Grade M-1, except for the following minimum properties: modulus of rupture, **1300 psi (9 MPa)**; modulus of elasticity, **250,000 psi (1720 MPa)**; linear expansion, 0.50 percent; and screw-holding capacity on face and edge, **250 and 175 lbf (1100 and 780 N)**, respectively.
- D. Fire-Retardant Fiberboard: Medium-density fiberboard (MDF) panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture, to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less in accordance with ASTM E84.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the**

following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Roseburg]
 - b. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Roseburg]
 - b. <Insert manufacturer's name>

2.13 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Nailers: **[Softwood or hardwood lumber][Fire-retardant-treated softwood lumber]**, kiln-dried to less than 15 percent moisture content.
 - 1. Preservative Treatment: Provide softwood lumber treated by pressure process, AWPA U1; Use Category UC3b.
 - a. Provide **[where indicated][where in contact with concrete or masonry]<Insert requirements>**.
 - b. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
 - c. Preservative Chemicals: Acceptable to authorities having jurisdiction **[and containing no arsenic or chromium]**.
 - d. Mark lumber with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee's (ALSC) Board of Review.
 - 2. Fire-Retardant Treatment: Complying with requirements; provide **[where indicated]<Insert requirements>**.
- B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.
- C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.
 - 1. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
 - 2. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- D. Adhesives: Do not use adhesives that contain urea formaldehyde.
- E. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- F. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- G. Adhesives: Do not use adhesives that contain urea formaldehyde.

- H. Adhesives: Do not use adhesives that contain urea formaldehyde.
- I. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.
 - 1. Adhesives shall have a VOC content of [70]<Insert value> g/L or less.
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 4. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 - 5. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 6. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit or 33 mcg/cu. m and that of acetaldehyde shall not exceed 9 mcg/cu. m.

2.14 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.
 - 1. Ease edges to radius indicated for the following:
 - a. Edges of Solid-Wood (Lumber) Members: **1/16 inch (1.5 mm)** unless otherwise indicated.
 - b. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: **1/8 inch (3 mm)**.
- C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.
 - 1. Disassemble components only as necessary for shipment and installation.
 - 2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
 - 3. Notify Architect seven days in advance of the dates and times interior architectural woodwork fabrication will be complete.
 - 4. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.
 - a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
 - b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.
- D. Stairs: Cut rough carriages to accurately fit treads and risers.
 - 1. Glue treads to risers, and glue and nail treads and risers to carriages.
 - 2. House [wall][and][face] stringers, and glue and wedge treads and risers.
 - 3. Fabricate stairs with treads and risers no more than **1/8 inch (3 mm)** from indicated position and no more than **1/16 inch (1.5 mm)** out of relative position for adjacent treads and risers.

2.15 SHOP PRIMING

- A. Preparations for Finishing: Comply with the Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.
- B. Interior Architectural Woodwork for Opaque Finish: Shop prime with one coat of wood primer as specified in Section 099123 "Interior Painting."
 - 1. Backpriming: Apply one coat of primer, compatible with finish coats, to concealed surfaces of woodwork. **[Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.]**
- C. Interior Architectural Woodwork for Transparent Finish: Shop-seal concealed surfaces with required pretreatments and first coat of finish as specified in Section 099300 "Staining and Transparent Finishing."
 - 1. Backpriming: Apply one coat of sealer, compatible with finish coats, to concealed surfaces of woodwork. **[Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.]**

2.16 SHOP FINISHING

- A. Finish interior architectural woodwork **[with transparent finish][indicated on Drawings]** at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with Architectural Woodwork Standards, Section 5 for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of interior architectural woodwork. Apply two coats to end-grain surfaces.
- C. Transparent Finish:
 - 1. Architectural Woodwork Standards Grade: **[Premium][Custom][Economy][Same as item to be finished]**.
 - 2. Finish System:
 - a. 1: Lacquer, Nitrocellulose.
 - b. 2: Lacquer, Pre Catalyzed.
 - c. 3: Lacquer, Post Catalyzed.
 - d. 4: Latex Acrylic, Water Based.
 - e. 5: Varnish, Conversion.
 - f. 6: Oil, Synthetic Penetrating.
 - g. 7: Vinyl, Catalyzed.
 - h. 8: Acrylic Cross Linking, Water Based.
 - i. 9: UV Curable, Acrylated Epoxy, Polyester, or Urethane.
 - j. 10: UV Curable, Water Based.
 - k. 11: Polyurethane, Catalyzed.
 - l. 12: Polyurethane, Water Based.
 - m. 13: Polyester, Catalyzed.
 - 3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.

4. Staining: **[None required][Match approved sample for color][Match Architect's sample]**.
5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
6. Filled Finish for Open-Grain Woods: **[After staining, apply wash-coat sealer and allow to dry.]** Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
7. Sheen: **[Flat, 15-30][Satin, 31-45][Semigloss, 46-60][Gloss, 61-100]** gloss units measured on 60-degree gloss meter in accordance with ASTM D523.

D. Opaque Finish:

1. Architectural Woodworking Standards Grade: **[Premium][Custom][Economy][Same as item to be finished]**.
2. Finish System:
 - a. 1: Lacquer, Nitrocellulose.
 - b. 2: Lacquer, Pre Catalyzed.
 - c. 3: Lacquer, Post Catalyzed.
 - d. 4: Latex Acrylic, Water Based.
 - e. 5: Varnish, Conversion.
 - f. 7: Vinyl, Catalyzed.
 - g. 8: Acrylic Cross Linking, Water Based.
 - h. 9: UV Curable, Acrylated Epoxy, Polyester, or Urethane.
 - i. 10: UV Curable, Water Based.
 - j. 11: Polyurethane, Catalyzed.
 - k. 12: Polyurethane, Water Based.
 - l. 13: Polyester, Catalyzed.
3. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]**.
4. Sheen: **[Flat, 15-30][Satin, 31-45][Semigloss, 46-60][Gloss, 61-100]** gloss units measured on 60-degree gloss meter in accordance with ASTM D523.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.
- B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming of concealed surfaces.

3.2 INSTALLATION

- A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.
- B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.
- C. Install interior architectural woodwork level, plumb, true in line, and without distortion.
 1. Shim as required with concealed shims.

2. Install level and plumb to a tolerance of **1/8 inch in 96 inches (3 mm in 2400 mm)**.
- D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Preservative-Treated Wood: Where cut or drilled in field, treat cut ends and drilled holes in accordance with AWP A M4.
- F. Fire-Retardant-Treated Wood: Install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- G. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.
 1. Secure with countersunk, concealed fasteners and blind nailing.
 2. Use fine finishing nails[**or finishing screws**] for exposed fastening, countersunk and filled flush with interior architectural woodwork.
 3. For shop-finished items, use filler matching finish of items being installed.
- H. Standing and Running Trim:
 1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
 2. Do not use pieces less than **[36 inches (900 mm)][60 inches (1500 mm)][96 inches (2400 mm)]** long, except where shorter single-length pieces are necessary.
 3. Scarf running joints and stagger in adjacent and related members.
 4. Fill gaps, if any, between top of base and wall with **[plastic wood filler; sand smooth; and finish same as wood base if finished][latex sealant, painted to match wall]**.
 5. Install standing and running trim with no more variation from a straight line than **1/8 inch in 96 inches (3 mm in 2400 mm)**.
- I. Stairs: Securely anchor carriages to supporting substrates.
 1. Install stairs with treads and risers no more than **1/8 inch (3 mm)** from indicated position.
 2. Secure with countersunk, concealed fasteners and blind nailing.
 3. Use fine finishing nails[**or finishing screws**] for exposed fastening, countersunk and filled flush with wood surface.
- J. Railings:
 1. Install rails with no more than **1/8 inch in 96-inch (3 mm in 2400-mm)** variation from a straight line.
 2. Stair Rails: Glue and dowel or pin balusters to treads and railings, and railings to newel posts.
 - a. Secure with countersunk, concealed fasteners and blind nailing.
 - b. Use fine finishing nails[**or finishing screws**] for exposed fastening, countersunk and filled flush with wood surface.
 3. Wall Rails: Support rails on wall brackets securely fastened to wall framing.
 - a. Space rail brackets not more than **<Insert dimension>** o.c.

3.3 FIELD QUALITY CONTROL

- A. Inspections: Provide inspection of installed Work through **[AWI's Quality Certification Program][WI's**



Certified Compliance Program] certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.

1. Inspection entity is to prepare and submit report of inspection.

3.4 REPAIR

- A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects[**and to result in interior architectural woodwork being in compliance with requirements of Architectural Woodwork Standards for the specified grade**].
- B. Where not possible to repair, replace defective woodwork.
- C. Shop Finish: Touch up finishing work specified in this Section after installation of interior architectural woodwork.
 1. Fill nail holes with matching filler where exposed.
 2. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.
- D. Field Finish: See [**Section 099123 "Interior Painting"**][and][**Section 099300 "Staining and Transparent Finishing"**] for final finishing of installed interior architectural woodwork not indicated to be shop finished.

3.5 CLEANING

- A. Clean interior architectural woodwork on exposed and semiexposed surfaces.

END OF SECTION 06 40 00 00A

SECTION 06 41 00 00 - ARCHITECTURAL WOOD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood-veneer-faced casework for transparent finish.
2. Wood-veneer-faced casework for opaque finish.
3. Plastic-laminate-clad casework.
4. Wood materials.
5. Glass.
6. Casework hardware.
7. Accessories.
8. Shop finishing.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.
2. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud-framing required for anchoring cabinets.
3. [Section 123616 "Metal Countertops."][Section 123619 "Wood Countertops."][Section 123623.13 "Plastic-Laminate-Clad Countertops."][Section 123640 "Stone Countertops."][Section 123661 "Simulated Stone Countertops."]

1.2 ALLOWANCES

- A. See Section 012100 "Allowances" for description of allowances affecting items specified in this Section.
- B. Wood Veneer Allowance: Wood veneer for architectural cabinets is part of [Wood Veneer Allowance]<Insert name of allowance>. Allowance includes the cost of veneer that is wasted due to selection, cutting, and trimming.

1.3 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.
- B. Coordinate wood species, veneer, cut, grade, matching, finishing, and other requirements with [wood doors][wood paneling]<Insert item> as specified in [Section 064216 "Flush Wood Paneling."][Section 081416 "Flush Wood Doors."][Section 123553.19 "Wood Laboratory Casework."><Insert Section number and title.>
- C. Hardware Coordination: Distribute copies of approved hardware schedule specified in [Section 087100 "Door Hardware"][Section 087111 "Door Hardware (Descriptive Specification)"] to manufacturer of architectural cabinets; coordinate Shop Drawings and fabrication with hardware requirements.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference [at Project site][by web conference]<Insert location>.
 - 1. Review locations and method of attachment of backing required for casework installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include panel material description and finish.
 - 2. Include glazing.
 - 3. Include accessories.
 - 4. Include hardware.
 - 5. Include shop finishing.
- B. Shop Drawings:
 - 1. Plans, elevations, sections, and attachment details.
 - a. Show large-scale details.
 - b. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - c. Show locations and sizes of cutouts and holes for items installed in architectural cabinets.
 - d. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
 - 2. Apply AWI's Quality Certification Program (hereafter AWI QCP) label to Shop Drawings.
- C. Samples for Initial Selection: For each exposed product and for each color and finish specified, in manufacturer's standard size.
- D. Samples for Verification: Provide a minimum of three samples showing the full range of color and/or grain to be expected in the finished work, for the following.
 - 1. Lumber for Transparent Finish: Not less than **8 inches (200 mm)** long by **3/4 inch (19 mm)** thick, and as wide as practical, for each species and cut, finished on one side and one edge.
 - 2. Veneer Leaves: Representative of and selected from flitches to be used for transparent-finished cabinets. Samples to show the full range of color and grain to be expected.
 - 3. Veneer Panel for Transparent Finish: **8 by 8 inches (200 mm by 200 mm)** by **1/4 inch (6.4 mm)**, representative of and selected from flitches to be used for transparent-finished casework.
 - 4. Lumber and Panel Products with Shop-Applied Opaque Finish: Not less than **8 inches (200 mm)** long by **3/4 inches (19 mm)** thick, and as wide as practical, for each species and cut for lumber and **8 by 10 inches (200 by 250 mm)** for panels, for each finish system and color.
 - a. Finish [entire][one-half of] exposed surface.
 - 5. Plastic Laminates: **8 by 8 inches (200 by 200 mm)**, for each type, color, pattern, and surface finish required.
 - a. Provide one Sample applied to core material with specified edge material applied to one edge.

6. Thermally Fused Laminate (TFL) Panels: **8 by 10 inches (200 by 250 mm)**, for each color, pattern, and surface finish.
 - a. Provide edgebanding on one edge.
7. Corner Pieces:
 - a. Cabinet-front frame joints between stiles and rails and at exposed end pieces, **18 inches (450 mm)** high by **18 inches (450 mm)** wide by **6 inches (150 mm)** deep.
 - b. Miter joints for standing trim.
8. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

E. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
3. Product Data: Verify compliance with requirements for Forest Stewardship Council U.S. (FSC).
4. Laboratory Test Reports: For composite wood products, indicating compliance with the formaldehyde emissions evaluation.
5. Product Data: For installation adhesives, indicating VOC content.
6. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low-emitting materials.
7. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
8. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

1.6 INFORMATIONAL SUBMITTALS

- A. Test Reports: Valid AWI "Performance Quality Test Report" indicating compliance with specified ANSI/AWI 0641 Structural Performance Duty Level.
- B. Certification Reports:
 1. Provide **[labels][and][certificates]** from AWI QCP indicating woodwork **[complies][and installation comply]** with requirements of aesthetic grade and duty level specified.
 - a. Project has been registered with AWI as AWI QCP Number **<Insert number>**.
 - b. Register the Work of this Section with AWI's Quality Certification Program.
 2. The Contract Documents contain requirements that are more stringent than the referenced woodwork quality standard. Comply with requirements of the Contract Documents in addition to those of the referenced quality standard.
- C. Product Certificates: For **[each type of product.][the following:]**
 1. Composite wood products.
 2. Thermally fused laminate (TFL) panels.
 3. Glass.
 4. Adhesives.
- D. Field quality control reports.

- E. Qualification Statements: For **[manufacturer][and][Installer]**.

1.7 CLOSEOUT SUBMITTALS

- A. Quality Standard Compliance Certificates: AWI QCP Certificate.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

- 1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

- B. Installer Qualifications: **[Manufacturer of products][Licensed participant in AWI QCP]**.

1.9 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

- 1. Build mockups of **[typical architectural cabinets as indicated on Drawings]<Insert description>**.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.11 FIELD CONDITIONS

- A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Environmental Limitations with Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between **60 and 90 deg F (16 and 32 deg C)** and relative humidity between **[25 and 45][30 and 55][43 and 65]<Insert numbers>** percent during the remainder of the construction period.
- C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.
- D. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 1. **<Insert, in separate subparagraphs, names of preapproved woodworking firms>.**

2.2 PERFORMANCE REQUIREMENTS

- A. Unless otherwise indicated, comply with ANSI/AWI 0641 for duty level and grade of architectural cabinets indicated for construction, finishes, installation, and other requirements.
 1. Provide **[labels][and][certificates]** from AWI QCP indicating that **woodwork [complies][and installation comply]** with requirements of aesthetic grade and duty level specified.

2.3 WOOD-VENEER-FACED CASEWORK FOR TRANSPARENT FINISH

- A. Architectural Woodwork Institute (AWI) Standard:
 1. Structural Performance Duty Level: **[1][2][3][4][As indicated on Drawings]**.
 2. Aesthetic Performance Grade: **[Premium][Custom][Economy][As indicated on Drawings]**.
 3. Product Data: Verify materials were fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
 4. Product Data: Verify materials were fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, multiply the distance by 0.25 to determine the distance to Project site.
 5. Certified Wood: Verify wood products are certified as "FSC Pure"[**or "FSC Mixed Credit"**] in accordance with FSC STD-01-001 and FSC STD-40-004.
 6. Certified Wood: Verify wood products are labeled in accordance with the AF&PA's Sustainable Forestry Initiative, certified as "FSC Pure" in accordance with FSC STD-01-001 and FSC STD-40-004, or certified and labeled in accordance with the standards of the Programme for Endorsement of Forest Certification.
 7. Certified Wood: Verify wood products are certified in accordance with the American Tree Farm System's "ATFS 2021 Standards of Sustainability," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
 8. Verify adhesives have a VOC content of **[30]<Insert number> g/L** or less.
- B. Casework Construction Type: **[Frameless][Face frame]**.

C. Door and Drawer-Front:

1. Design: **[Flush panel][Stile and rail]**.
2. Style: **[Flush overlay][Reveal overlay][Flush inset]**.
 - a. Reveal Dimension: **[1/2 inch (13 mm)][As determined by hinge type and clearance][As indicated on Drawings]<Insert dimension>**.

D. Exposed Exterior Surfaces:**[As indicated on Drawings.]**

1. Species: **[Red oak][White oak][White ash][White birch][Select white maple][As indicated on Drawings]<Insert species>**.
2. Cut: **[Plain sliced/plain sawn][Rift cut/rift sawn][Quarter cut/quarter sawn]**.
3. Grain Direction: **[Vertically for drawer fronts, doors, and fixed panels][Horizontally for drawer fronts, doors, and fixed panels][Vertically for doors and fixed panels, horizontally for drawer fronts][As indicated on Drawings]**.
4. Veneer Matching:
 - a. Matching of Veneer Leaves: **[Book][Slip][Random]** match.
 - b. Veneer Matching within Panel Face: **[Running][Balance][Center-balance]** match.
 - c. Veneer Matching within Room: Provide cabinet veneers in each room or other space from a single flitch with doors, drawer fronts, and other surfaces matched in a sequenced set with continuous match where veneers are interrupted perpendicular to the grain.
 - d. Blueprint Matching: Match veneers on casework[, **wall paneling,**][and][doors] in room indicated on Drawings.
5. Edgeband: **[Solid wood][Veneer]** matching exposed surfaces.

E. Exposed Interior Surfaces:**[As indicated on Drawings.]**

1. Species: **[Match exposed exterior surfaces][Red oak][White oak][White ash][White birch][Select white maple][As indicated on Drawings]<Insert species>**.
2. Cut: **[Match exposed exterior surfaces][Plain sliced/plain sawn][Rift cut/rift sawn][Quarter cut/quarter sawn]**.
3. Veneer Matching: Match exposed exterior surfaces.
4. Edgeband: **[Solid wood][Veneer][Match exposed exterior surfaces]**.

F. Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: **[Same species wood veneer panel indicated for exposed surfaces][Thermally fused laminate (TFL) panels][High-pressure decorative laminate (HDPL)][Compatible species to that indicated for exposed surfaces, stained to match]<Insert requirements>**.
2. Drawer Subfronts, Backs, and Sides: **[Solid-hardwood lumber, same species indicated for exposed surfaces][Solid-hardwood lumber, stained to match species indicated for exposed surfaces][Solid birch or maple hardwood lumber][Seven- or nine-ply hardwood plywood with no internal voids][Thermally fused laminate (TFL) panels]<Insert requirements>**.
3. Drawer Bottoms: **[Hardwood plywood][Thermally fused laminate (TFL) panels]<Insert requirements>**.
4. Shelves: **[Adjustable][Fixed]**.
 - a. Loading Capacity: **[40 lb/sq. ft][50 lb/sq. ft]**.
5. Edgeband: **[Wood veneer compatible for color and grain of exposed surfaces][PVC or**

polyester][Match exposed surfaces]<Insert requirements>.

2.4 WOOD-VENEER-FACED CASEWORK FOR OPAQUE FINISH

A. Architectural Woodwork Institute (AWI) Standard:

1. Structural Performance Duty Level: [1][2][3][4][As indicated on Drawings].
2. Aesthetic Performance Grade: [Premium][Custom][Economy][As indicated on Drawings].
3. Product Data: Verify materials were fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
4. Product Data: Verify materials were fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, multiply the distance by 0.25 to determine the distance to Project site.
5. Certified Wood: Verify wood products are certified as "FSC Pure"[or "FSC Mixed Credit"] in accordance with FSC STD-01-001 and FSC STD-40-004.
6. Certified Wood: Verify wood products are labeled in accordance with the AF&PA's Sustainable Forestry Initiative, certified as "FSC Pure" in accordance with FSC STD-01-001 and FSC STD-40-004, or certified and labeled in accordance with the standards of the Programme for Endorsement of Forest Certification.
7. Certified Wood: Verify wood products are certified in accordance with the American Tree Farm System's "ATFS 2021 Standards of Sustainability," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
8. Composite Wood Products: Verify products are made using ultra-low-emitting formaldehyde resins, as defined in CARB 93120, "Airborne Toxic Control Measure (ATCM) for Formaldehyde Emissions from Composite Wood Products," or are made with no added formaldehyde.
9. Composite Wood Products: Verify formaldehyde emission rates are not greater than the following when tested in accordance with ASTM D6007 or ASTM E1333:
 - a. Hardwood Plywood: 0.05 ppm.
 - b. Particleboard: 0.09 ppm.
 - c. MDF More Than 5/16 Inch (8 mm) Thick: 0.11 ppm.
 - d. MDF 5/16 Inch (8 mm) or Less in Thickness: 0.13 ppm.
10. Verify adhesives have a VOC content of [30]<Insert number> g/L or less.

B. Casework Construction Type: [Frameless][Face frame].

C. Door and Drawer-Front:

1. Design: [Flush panel][Stile and rail].
2. Style: [Flush overlay][Reveal overlay][Flush inset].
 - a. Reveal Dimension: [1/2 inch (13 mm)][As determined by hinge type and clearance][As indicated on Drawings]<Insert dimension>.

D. Exposed Exterior Surfaces: [Any closed-grain hardwood suitable for opaque finish][Medium-density fiberboards (MDF)][Medium-density overlay (MDO)].

1. Edgeband: [Solid wood][Veneer] matching exposed surfaces.

E. Exposed Interior Surfaces: [Any closed-grain hardwood suitable for opaque finish][Medium-density fiberboards (MDF)][Medium-density overlay (MDO)].

1. Edgeband: **[Solid wood][Veneer][Match exposed exterior surfaces]**.

F. Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: **[Match materials indicated for exposed surfaces][Thermally fused laminate (TFL) panels]<Insert requirements>**.
2. Drawer Sides and Backs: **[Solid birch or maple hardwood lumber][Seven- or nine-ply hardwood plywood with no interior voids][Thermally fused laminate (TFL) panels]<Insert requirements>**.
3. Drawer Bottoms: **[Hardwood plywood][Thermally fused laminate (TFL) panels]<Insert requirements>**.
4. Shelves: **[Fixed][Adjustable]**.
 - a. Loading Capacity: **[40 lb/sq. ft][50 lb/sq. ft]**.
5. Edgeband:
 - a. Edges of Veneer Panels: **[Solid wood][Veneer][Veneer tape]** compatible for color and grain of exposed surfaces.
 - b. Edges of Thermally Fused Laminate (TFL) Panels: **[PVC or ABS, 0.018-inch (0.460-mm) minimum thickness][PVC, 3.0 mm thick]**.

2.5 PLASTIC-LAMINATE-CLAD CASEWORK

A. Architectural Woodwork Institute (AWI) Standard:

1. Structural Performance Duty Level: **[1][2][3][4][As indicated on Drawings]**.
2. Aesthetic Performance Grade: **[Premium][Custom][Economy][As indicated on Drawings]**.
3. Product Data: Verify materials were fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
4. Product Data: Verify materials were fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, multiply the distance by 0.25 to determine the distance to Project site.
5. Certified Wood: Verify wood products are certified as "FSC Pure"[or "FSC Mixed Credit"] in accordance with FSC STD-01-001 and FSC STD-40-004.
6. Certified Wood: Verify wood products are labeled in accordance with the AF&PA's Sustainable Forestry Initiative, certified as "FSC Pure" in accordance with FSC STD-01-001 and FSC STD-40-004, or certified and labeled in accordance with the standards of the Programme for Endorsement of Forest Certification.
7. Certified Wood: Verify wood products are certified in accordance with the American Tree Farm System's "ATFS 2021 Standards of Sustainability," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
8. Composite Wood Products: Verify products are made using ultra-low-emitting formaldehyde resins, as defined in CARB 93120, "Airborne Toxic Control Measure (ATCM) for Formaldehyde Emissions from Composite Wood Products," or are made with no added formaldehyde.
9. Composite Wood Products: Verify formaldehyde emission rates are not greater than the following when tested in accordance with ASTM D6007 or ASTM E1333:
 - a. Hardwood Plywood: 0.05 ppm.
 - b. Particleboard: 0.09 ppm.
 - c. MDF More Than 5/16 Inch (8 mm) Thick: 0.11 ppm.

- d. MDF 5/16 Inch (8 mm) or Less in Thickness: 0.13 ppm.
- 10. Verify adhesives have a VOC content of [30]<Insert number> g/L or less.
- B. Casework Construction Type: [Frameless][Face frame].
- C. Door and Drawer-Front:
 - 1. Design: [Flush panel][Stile and rail].
 - 2. Style: [Flush][Reveal] overlay.
 - a. Reveal Dimension: [1/2 inch (13 mm)][As determined by hinge type and clearance][As indicated on Drawings]<Insert dimension>.
- D. High-Pressure Decorative Laminate (HDPL): ISO 4586-3, grades as indicated or, if not indicated, as required by quality standard.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [ABET Inc.]
 - b. [Formica Corporation]
 - c. [Laminart LLC]
 - d. [Pionite; a Panolam Industries International, Inc. brand]
 - e. [Wilsonart LLC]
 - f. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [ABET Inc.]
 - b. [Formica Corporation]
 - c. [Laminart LLC]
 - d. [Pionite; a Panolam Industries International, Inc. brand]
 - e. [Wilsonart LLC]
 - f. <Insert manufacturer's name>
- E. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As indicated by laminate manufacturer's designations.
 - 2. Match Architect's sample.
 - 3. As selected by Architect from laminate manufacturer's full range in the following categories:
 - a. Solid colors, [gloss][matte] finish.
 - b. Solid colors with core same color as surface, [gloss][matte] finish.
 - c. Wood grains, [gloss][matte] finish.
 - d. Patterns, [gloss][matte] finish.
- F. Exposed Exterior Surfaces:
 - 1. Plastic-Laminate Grade: [HGP][HGS][VGS].
 - 2. Pattern Direction: [Vertically for drawer fronts, doors, and fixed panels][Horizontally for

- drawer fronts, doors, and fixed panels**][As indicated on Drawings].
3. Edgebanding: **[High-pressure decorative laminate (HDPL)]****[PVC or ABS, 0.018-inch (0.460-mm) minimum thickness]****[PVC, 3.0 mm thick]**.

G. Exposed Interior Surfaces: **[High-pressure decorative laminate (HDPL) the same color and pattern as exposed exterior surfaces]****[Thermally fused laminate (TFL) the same color and pattern as exterior surfaces]**.

1. Edgebanding: **[High-pressure decorative laminate (HDPL)]****[PVC or ABS, 0.018-inch (0.460-mm) minimum thickness]****[PVC, 3.0 mm thick]**.

H. Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: **[High-pressure decorative laminate (HDPL) cabinet liner Grade CLS, ISO 4586-3]****[Thermally fused laminate (TFL) panels]**.
2. Drawer Sides and Backs: **[Solid-hardwood lumber]****[Seven- or nine-ply plywood with no internal voids]****[Thermally fused laminate (TFL) panels with PVC or polyester edgebanding]**.
3. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate (HDPL), ISO 4583-3, grade to match exposed surface.
4. Drawer Bottoms: **[Hardwood plywood]****[Thermally fused laminate (TFL) panels]**.
5. Shelves: **[Fixed]****[Adjustable]**.

a. Loading Capacity: **[40 lb/sq. ft]****[50 lb/sq. ft]**.

6. Edgebanding: **[High-pressure decorative laminate (HDPL)]****[PVC or ABS, 0.018-inch (0.460-mm) minimum thickness]****[PVC, 3.0 mm thick]**.

2.6 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than **3 inches (75 mm)** wide.
2. Wood Moisture Content:
 - a. Non-Climate-Controlled Environments: **[7 to 12]****[9 to 15]****[10 to 15]** percent.
 - b. Climate-Controlled Environments: **[4 to 9]****[6 to 10]****[8 to 13]** percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
2. Recycled Content: Provide manufacturer documentation for recycled content, indicating postconsumer and preconsumer recycled content.
3. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.
4. Composite Wood Products: Verify products are made using ultra-low-emitting formaldehyde resins, as defined in CARB 93120, "Airborne Toxic Control Measure (ATCM) for Formaldehyde Emissions from Composite Wood Products," or are made with no added formaldehyde.
5. Composite Wood Products: Verify formaldehyde emission rates are not greater than the following when tested in accordance with ASTM D6007 or ASTM E1333:

- a. Hardwood Plywood: 0.05 ppm.
 - b. Particleboard: 0.09 ppm.
 - c. MDF More Than 5/16 Inch (8 mm) Thick: 0.11 ppm.
 - d. MDF 5/16 Inch (8 mm) or Less in Thickness: 0.13 ppm.
6. Medium-Density Fiberboard (MDF): ANSI A208.2, [**Grade 130**]**<Insert grade>**.
 7. Particleboard (Medium Density): ANSI A208.1, [**Grade M-2**]**[Grade M-2-Exterior Glue]**.
 8. Softwood Plywood: DOC PS 1, [**medium-density overlay**].
 9. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
 10. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper [**and complying with requirements of AWI 300**].

2.7 GLASS

- A. Float Glass for Cabinet Doors: ASTM C1036, Type I, [**Class 1 (clear)**]**[Class 2 or 3 (tinted)]**, Quality-Q3.
 1. Thickness: [**3.0 mm**]**[4.0 mm]****[5.0 mm]****[6.0 mm]**.
 2. Tint Color: [**Blue-green**]**[Bronze]****[Green]****[Gray]****<Insert color>**.
- B. Tempered Float Glass for Cabinet Doors: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), complying with ANSI Z97.1.
 1. Door Inserts: Type I, [**Class 1 (clear)**]**[Class 2 or 3 (tinted)]**, Quality-Q3.
 - a. Thickness: [**6.0 mm**]**<Insert thickness>**.
 - b. Tint Color: [**Blue-green**]**[Bronze]****[Green]****[Gray]****<Insert color>**.
 2. Frameless Sliding Doors: Type I, [**Class 1 (clear)**]**[Class 2 or 3 (tinted)]**, Quality-Q3.
 - a. Thickness: [**6.0 mm**]**<Insert thickness>**.
 - b. Tint Color: [**Blue-green**]**[Bronze]****[Green]****[Gray]****<Insert color>**.
 - c. Unframed Glass Doors: Grind smooth and polish exposed edges and corners.
- C. Laminated Glass for Cabinet Doors: ASTM C1172, Type II, complying with ANSI Z97.1.
 1. Thickness: [**6.0 mm**]**<Insert thickness>**.
 2. Tint Color: [**Blue-green**]**[Bronze]****[Green]****[Gray]****<Insert color>**.
- D. Mirror Glass for Cabinet Doors: ASTM C1503, Mirror [**Select**]**[Glazing]**, Quality-Q3.
 1. Thickness: [**3.0 mm**]**[4.0 mm]****[5.0 mm]****[6.0 mm]**.
- E. Decorative Glass for Cabinet Doors: Provide decorative glass complying with Section 088113 "Decorative Glass Glazing."
- F. Tempered Float Glass for Cabinet Shelves: ASTM C1048, Kind FT, Condition A, Type I, [**Class 1 (clear)**]**[Class 2 or 3 (tinted)]**, Quality-Q3; with exposed edges seamed before tempering, 6 mm thick.
 1. Thickness: [**3.0 mm**]**[4.0 mm]****[5.0 mm]****[6.0 mm]**.
 2. Tint Color: [**Blue-green**]**[Bronze]****[Green]****[Gray]****<Insert color>**.

2.8 CASEWORK HARDWARE

- A. Cabinet Hardware: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in **[Section 087100 "Door Hardware."][Section 087111 "Door Hardware (Descriptive Specification)."]**
- B. Hinges:
 - 1. Butt Hinges: **2-3/4-inch (70-mm)**, Grade 1 five-knuckle steel hinges made from **0.095-inch- (2.4-mm-)** thick metal, and as follows:
 - a. Semi-Concealed Hinges, Back Mounted, for Flush Doors: ANSI/BHMA A156.9, B01361.
 - b. Semi-Concealed Hinges, Back Mounted, for Overlay Doors: ANSI/BHMA A156.9, B01511.
 - 2. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, **[95-110][115-140][160-180]** degrees of opening[, **self-closing**][, **with integral soft-close damper**].
- C. Pulls and Knobs:
 - 1. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011, **3-inch (75-mm)** centers.
 - 2. Wire Pulls: Back mounted, **[solid metal][plastic]**, **4 inches (100 mm) long, 5/16 inch (8 mm) in diameter****[5 inches (127 mm) long, 5/16 inch (8 mm) in diameter]**.
 - 3. Back-Mounted Knobs: ANSI/BHMA A156.9, B02041.
- D. Catches and Latches:
 - 1. Magnetic Catches: ANSI/BHMA A156.9, B03141.
 - 2. Push-in Magnetic Catches: ANSI/BHMA A156.9, B03132.
 - 3. Roller Catches, Double Rollers: ANSI/BHMA A156.9, B03072.
 - 4. Ball Friction Catches: ANSI/BHMA A156.9, B03013.
- E. Shelf Rests and Standards:
 - 1. Adjustable Shelf Standards and Supports: **[ANSI/BHMA A156.9, B04071; with shelf rests, B04081][ANSI/BHMA A156.9, B04102; with shelf brackets, B04112]**.
 - 2. Shelf Rests: ANSI/BHMA A156.9, B04013; **[metal][plastic][two-pin plastic with shelf hold-down clip]**.
- F. Drawer Slides: ANSI/BHMA A156.9.
 - 1. Standard Duty (Grade 1 and Grade 2): **[Side mount][Undermount][and extending under bottom edge of drawer]**.
 - 2. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200): **[Side mount][Undermount]**.
 - a. Type: **[Full][Full overtravel][Partial]** extension.
 - b. Material: **[Aluminum][Epoxy-coated polymer][Galvanized-steel ball-bearing][Stainless steel][Zinc-plated ball-bearing]** slides.
 - c. Motion Feature: **[Push to open][and][soft close dampener][self-closing mechanism]**.
 - 3. Drawer Types:
 - a. Pencil drawers not more than **3 inches (75 mm)** high and not more than **24 inches (600 mm)** wide provide **[50 lb (22.7 kg)]<Insert weight>** load capacity.
 - b. General-purpose drawers more than **3 inches (75 mm)** high, but not more than **6 inches**

- (150 mm) high and not more than 24 inches (600 mm) wide, provide [75 lb (34 kg)]<Insert weight> load capacity.
 - c. File drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide provide [100 lb (45 kg)]<Insert weight> load capacity.
 - d. Lateral file drawers more than 6 inches (150 mm) high and more than 24 inches (600 mm), but not more than 30 inches (762 mm) wide, provide [150 lb (68 kg)]<Insert weight> load capacity.
 - e. Lateral file drawers more than 6 inches (150 mm) high and more than 30 inches (762 mm) wide provide [200 lb (90.7 kg)]<Insert weight> load capacity.
 - f. Computer keyboard tray provides [75 lb (34 kg)]<Insert weight> load capacity.
- G. Tracks for Sliding Glass Doors: [Surface][Recessed] mounting, ANSI/BHMA A156.9, B07063; [plastic][aluminum].
- H. Locks for Drawer and Hinged-Doors: [Cylindrical (cam)][Mortise] type, five-pin tumbler, brass with chrome-plated finish, and complying with ANSI/BHMA A156.11, Grade 1.
- 1. Provide a minimum of two keys per lock and six master keys.
 - 2. Provide locks [where indicated][on every door and drawer].
- I. Door Bumpers: Manufacturer's standard self-adhering clear silicone pads.
- J. Hardware Finish:
- 1. Exposed Hardware: Provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
 - a. Dark, Oxidized, Satin Bronze, Oil Rubbed: ANSI/BHMA 613 for bronze base; ANSI/BHMA 640 for steel base.
 - b. Bright Brass, Clear Coated: ANSI/BHMA 605 for brass base; ANSI/BHMA 632 for steel base.
 - c. Bright Brass, Vacuum Coated: ANSI/BHMA 723 for brass base; ANSI/BHMA 729 for zinc-coated-steel base.
 - d. Satin Brass, Blackened, Bright Relieved, Clear Coated: ANSI/BHMA 610 for brass base; ANSI/BHMA 636 for steel base.
 - e. Satin Chromium Plated: ANSI/BHMA 626 for brass or bronze base; ANSI/BHMA 652 for steel base.
 - f. Bright Chromium Plated: ANSI/BHMA 625 for brass or bronze base; ANSI/BHMA 651 for steel base.
 - g. Satin Stainless Steel: ANSI/BHMA 630.
 - 2. Concealed Hardware: Manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.9 ACCESSORIES

- A. Grommets:
- 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Doug Mockett & Company, Inc.]
 - b. [Hafele America Co.]

- c. **[W.W. Grainger, Inc.]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[Doug Mockett & Company, Inc.]**
 - b. **[Hafele America Co.]**
 - c. **[W.W. Grainger, Inc.]**
 - d. **<Insert manufacturer's name>**
3. Wire-Management Grommets: Circular, grommets and matching caps with slot for wire passage.
- a. Finish: **[Metal][Molded plastic]**.
 - b. Outside Diameter: **[1-1/4 inches (32 mm)][2 inches (51 mm)]<Insert dimension>**.
 - c. Color: **[Brushed, nickel plated][Polished, chrome plated][Black, epoxy coated][Brown][Black]<Insert finish>**.
4. Power/Data Grommets: UL-listed **[recessed][pop-up]** grommet.
- a. Power Outlets: **[Two][Three][Five]**.
 - b. USB Charger: **[Type A][Type B][1 Dual]<Insert type>**.
5. Paper Slot Grommet: **[12 inches (305 mm)][17 inches (432 mm)]** long by **1-3/4 inches (45 mm)** wide by **1 inch (25 mm)** deep; molded-plastic, paper-slot liner with **1/4 inch (6.4 mm)** lip.
- a. Color: **[Brown][Black]<Insert color>**.

2.10 FABRICATION

- A. Fabricate architectural cabinets to dimensions, profiles, and details indicated. Ease sharp edges and corners.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of dates and times architectural cabinet fabrication will be complete.
 - 2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
- D. Install glass to comply with applicable requirements in Section 088000 "Glazing" and in NGA's "GANA Glazing Manual."
 - 1. For glass in wood frames, secure glass with removable stops.

2. For exposed glass edges, polish and grind smooth.

2.11 SHOP FINISHING

- A. Finish architectural cabinets at manufacturer's shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- B. Shop-finish transparent-finished architectural cabinets at manufacturer's shop as specified in this Section. See Section 099123 "Interior Painting" for field finishing of opaque-finished architectural cabinets.
- C. Drawings indicate items that are required to be shop finished. Finish these items at manufacturer's shop as specified in this Section. See **[Section 099123 "Interior Painting"]** and **[Section 099300 "Staining and Transparent Finishing"]** for field finishing of architectural cabinets.
- D. Shop Priming: Shop apply the prime coat including backpriming, if any, for **[transparent-finished]** items specified to be field finished. See **[Section 099123 "Interior Painting"]** and **[Section 099300 "Staining and Transparent Finishing"]** for material and application requirements.
- E. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural cabinets, as applicable to each unit of work.
 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of cabinets.
- F. Transparent Finish:
 1. Aesthetic Performance Grade: **[Premium][Custom][Economy][Same as item to be finished]**.
 2. Finish System: **[TR-1, lacquer, nitrocellulose][TR-2A, lacquer, post-catalyzed][TR-2B, lacquer, pre-catalyzed][TR-3, latex acrylic, water-based][TR-4, varnish, conversion][TR-5, oil, synthetic penetrating][TR-6, polyurethane, catalyzed][TR-7, acrylic crosslinking, water-based][TR-8, acrylated epoxy, polyester, or urethane, UV-cure][TR-9, UV curable, water-based][TR-10, vinyl, catalyzed][TR-11, polyurethane, water-based][TR-12, polyester, catalyzed]**.
 3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to cabinets made from closed-grain wood before staining and finishing.
 4. Staining: **[None required][Match approved sample for color][Match Architect's sample]**.
 5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
 6. Filled Finish for Open-Grain Woods: **[After staining, apply wash-coat sealer and allow to dry.]** Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
 7. Sheen: **[Flat, 15-30][Satin, 31-45][Semigloss, 46-60][Gloss, 61-100]** gloss units measured on 60-degree gloss meter per ASTM D523.
- G. Opaque Finish:
 1. Aesthetic Performance Grade: **[Premium][Custom][Economy][Same as item to be finished]**.
 2. Finish System: **[OP-1, lacquer, nitrocellulose][OP-2A, lacquer, post-catalyzed][OP-2B, lacquer, pre-catalyzed][OP-3, latex acrylic, water-based][OP-4, varnish, conversion][OP-5, oil, synthetic penetrating][OP-6, polyurethane, catalyzed][OP-7, acrylic crosslinking, water-based][OP-8, acrylated epoxy, polyester, or urethane, UV-cure][OP-9, UV curable, water-based][OP-10, vinyl, catalyzed][OP-11, polyurethane, water-based][OP-12, polyester, catalyzed]**.
 3. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]**.

4. Sheen: **[Flat, 15-30][Satin, 31-45][Semigloss, 46-60][Gloss, 61-100]** gloss units measured on 60-degree gloss meter per ASTM D523.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of the Work.
 1. Confirm location and adequacy of blocking and supports required for installation.
 2. Verify size and locations of cutouts for appliances, special equipment, sinks, plumbing, and other items to be mounted in or adjacent to casework.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.3 INSTALLATION OF CASEWORK

- A. Install casework to comply with requirements of the structural and aesthetic performance specified.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- C. Install cabinets level, plumb, and true in line to a tolerance of **1/8 inch in 96 inches (3 mm in 2400 mm)** using concealed shims.
 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 3. Maintain veneer sequence matching of cabinets with transparent finish.
- D. Anchor cabinets in accordance with AWI requirements or tested method to anchors or blocking built in or directly attached to framing or substrates.
 1. Install cabinets to comply with seismic requirements as indicated on Drawings.
- E. Shop Finishes: Touch up finishing after installation of architectural cabinets. Fill nail holes with matching filler.
 1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.
 - a. Use filler matching finish of items being installed.

- F. Field Finishing: See [Section 099123 "Interior Painting"] [and] [Section 099300 "Staining and Transparent Finishing"] for finishing of installed architectural cabinets.

3.4 FIELD QUALITY CONTROL

- A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that casework, including installation, complies with requirements of ANSI/AWI 0620 for the specified grade.
1. AWI QCP Inspector to prepare and submit inspection report.

3.5 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where impossible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware and other moving parts to function smoothly.
- C. Clean cabinets on exposed and semiexposed surfaces. Touch up finishes to restore damaged or soiled areas.

END OF SECTION 06 41 00 00



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06 - Wood, Plastics, and Composites

Task	Specification	Specification Description
06 41 00 00	06 40 00 00	Exterior Architectural Woodwork
06 41 00 00	06 40 00 00a	Interior Architectural Woodwork



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SECTION 06 41 13 00 - RESIDENTIAL CABINETS

DESCRIPTION OF WORK

This specification covers the furnishing and installation of materials for residential cabinets. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

GENERAL

Definitions

1. Supply and Delivery Only: Include supply and delivery to site(s) FOB destination freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by Owner.

System Description

2. Performance Requirements:
 - a. Comply with test procedures and required performances of ANSI/KCMA A161.1.
 - 1) Tests: Performed on standard 760 mm (30 inch) wall and base cabinets.
 - b. Drawers and Drawer Hardware for HUD Severe Use: Apply 330 N (75 pound) point load to exterior edge of drawer extended 150 mm (6 inches) from its closed position for period of 15 minutes.
 - 1) Successful Test: No failure in any part of drawer assembly or operating system and drawer remain operable with no mechanical interference with any part of cabinet assembly.

Submittals

3. Product Data: Submit product data for cabinets and countertops.
4. Shop Drawings: Submit Shop Drawings for cabinets and countertops for each type of kitchen.
5. Samples: Submit samples of following for selection:
 - a. Wood veneers with stain finishes.
 - b. Plastic laminate patterns and colors.
6. Quality Assurance/Control Submittals:
 - a. Certificates: Manufacturer's written certification that cabinets and countertops meet or exceed specified requirements.

Quality Assurance

7. Certifications:
 - a. Cabinets: Continuously tested, certified and display label or seal of Kitchen Cabinet Manufacturer's Association (KCMA) or Southern California Association of Cabinet Manufacturers Association in accordance with ANSI Z34.1.
 - 1) HUD Severe Use Cabinets: Bear KCMA Certification Seal and additional label indicating conformance to HUD Severe Use specifications.
 - 2) Normal/Elderly Use: Bear KCMA Certification Seal.
8. Regulatory Requirements: Comply with following:
 - a. Accessibility:
 - 1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing - regulations (24 CFR Part 40).
 - a) Uniform Federal Accessibility Standards (UFAS).
 - 2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
 - 3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).

- 4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).
9. Mock-ups:
 - a. Install mock-up of cabinets and countertops in kitchen as part of kitchen renovation mock-up.
 - b. Install mock-up of cabinets and countertops in bathroom as part of bathroom renovation mock-up.
 - c. Locations: As directed.
 - d. Approved Mock-up: Standard for rest of work.
 - e. Approved Mock-up: May remain part of completed project.

Delivery, Storage, And Handling

10. Packing, Shipping, Handling, and Unloading:
 - a. Do not deliver cabinets until building or storage area is enclosed and sufficiently dry to prevent damage from excessive changes in moisture content.
 - b. Protect casework and equipment from damage during delivery, storage, installation and subsequent building operations.

Scheduling

11. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

Project Conditions

12. Field Measurements: Field measure spaces to receive cabinets before beginning fabrication.
 - a. Cabinets: Conform to building lines and neatly fitted around openings, pipes, and other obstructions.

PRODUCTS**Normal/Elderly Use Cabinets**

13. Cabinets: Standard size factory manufactured, assembled and finished for normal/elderly and severe use as scheduled. Comply with:
 - a. HUD Minimum Property Standards for Housing, Paragraph 611-1.
 - b. ANSI/KCMA A161.1.
14. Cabinet Construction: Hardwood face frames and reveal overlay construction.
 - a. Base and Wall Cabinets: Same construction and same appearance.
15. Cabinet Materials:
 - a. Plywood: ANSI/HPMA HP and PS 1.
 - b. Particleboard, ANSI A208.1, medium density.
 - c. Pressure Treated Lumber: AWWA C2.
 - d. Cabinet Hardware: ANSI/BHMA A156.9.
 - 1) Cabinet Hardware: Finishing requirements of ANSI/BHMA A156, corrosion resisting.
16. Vanity Cabinets: Sizes as indicated.
 - a. Size if Not Indicated: 460 mm (18 inches) to 610 mm (24 inches) wide and 410 mm (16 inches) to 530 mm (21 inches) deep.
17. Cabinet Finish: Comply with ANSI/KCMA A161.1 finish test and performance requirements.
 - a. Exposed Surfaces and Interior of Cabinet: Factory finished consisting of stain, sealer and top coat, lightly sanded between application.
 - 1) Sealer and Top Coats: Oven dried.
 - 2) Stain Color: Selected from manufacturer's standard colors.
 - b. Toe Kick: Painted as directed.
 - c. Alternate Finish: High-pressure Decorative Laminates (HPDL) may be supplied in lieu of finish described above.
 - 1) HPDL: Comply with NEMA LD 3, Type GP 28, 0.7 mm (0.028 inch) thickness.
18. Fillers and Molding: Use scribe mould and fillers to assure accurate job fit.
 - a. Molding and Fillers: Outside corners, scribes, cove molding, and trim molding.

- b. Fillers: Include comer base fillers, base fillers, and wall fillers.
- c. Cove Molding: Hardwood.
- d. Finish: Match cabinet finish.
- 19. Joint Sealant: Mildew resistant one-component silicone; FS TT-S-001543A, Class A; ASTM C 920, Type S, Grade NS. Class 25, Uses NT, G, and A.
 - a. Color: As selected from manufacturer's standard line.

HUD Severe Use Cabinets

- 20. Wall and Base Cabinets: Comply with requirements under Cabinets - General above.
 - a. Construct to produce sturdy and rigid construction.
 - b. Wall and Base Cabinets and Countertops: Constructed of solid lumber and/or exterior grade plywood with wood veneer core.
 - 1) Particleboard, flakeboard, fiberboard, or hardboard not allowed.
 - c. Base Cabinets:
 - 1) Parts Touching Floor: Pressure treated solid lumber.
 - 2) Provide integral toe space of minimum 75 mm (3 inches) by 75 mm (3 inches).
 - 3) Toe Kicks: 19.1 mm (3/4 inch) net thickness, pressure treated solid lumber.
- 21. Face Frames: 19.1 mm (3/4 inches) net thick kiln dried solid hardwood, free of knots and selected for light uniform color suitable for stain finish.
 - a. Frames: Mortised and tenoned, dovetailed or doweled. glued and stapled under pressure and filled and sanded.
 - b. Vertical End Members (Stiles): Minimum 38 mm (1-1/2 inch) net width.
 - c. Vertical Center Members between Doors and Drawers (Mulls): Minimum 50 mm (2 inches) net width.
 - d. Horizontal Members (Rails): 44 mm (1-3/4 inches) net width.
 - e. Stiles and Top and Bottom Rails: Dadoed to receive ends, bottoms and tops.
- 22. Doors and Door Hardware:
 - a. Doors: 19.1 mm (3/4 inch) thick 7-ply A-D grade exterior hardwood plywood with no more than one veneer joint on face.
 - b. Edges: Reversed shaped to form continuous finger grip around sides.
 - c. Edges: Filled and sanded smooth prior to finish.
 - d. Edges: May be treated with hot foil transfer.
 - e. Edges: May be covered with 9.5 mm (3/8 inch) by 19.1 mm (3/4 inch) reverse shaped hardwood bands.
 - f. Acceptable Hardwoods: Beech, birch, maple or oak suitable for stain finish.
 - g. Hinges: Manufacturer's standard heavy duty with self closing feature, face mount or semi concealed type.
- 23. Drawers and Drawer Hardware:
 - a. Fronts Construction and Finish: Same as doors.
 - b. Sides and Backs: Minimum 17.4 mm (11/16 inch) net thickness Grade C solid lumber with sides dovetailed or mortised and tenoned into fronts.
 - c. Backs: Dadoed into sides.
 - d. Bottoms: Minimum 6.4 mm (1/4 inch) softwood or hardwood exterior plywood let into front, sides and back.
 - e. Drawer Parts: Glued and nailed or stapled together.
 - f. Mount drawers on metal side rails with 34 kg (75 pound) loading capacity.
 - g. Cabinet Members or Guides: Attached at rear to 19.1 mm (3/4 inch) solid lumber hanging rail or 12.7 mm (1/2 inch) solid lumber or plywood block which is attached to 19.1 mm (3/4 inch) solid lumber hanging rail by use of metal rear mount brackets or by continuous wraparound method.
- 24. Installation Cleats: Minimum 19.1 mm (3/4 inch) by 89 mm (3-1/2 inches) net thickness S4S, Grade C, kiln dried solid lumber, dadoed to receive bottoms and tops.
 - a. Provide two horizontal members running full length of cabinet at top and bottom.
 - b. Base Cabinets with Drawers: Side mount drawer slide bracket(s) rigidly attached to 12.7 mm (1/2 inch) thick plywood or wood block which is rigidly attached to top cleat. See "Drawers" paragraph above for alternate mounting.

25. End Panels:
 - a. Exposed End Panels: Minimum 2-2 Grade, 12.7 mm (1/2 inch) thick 5-ply exterior hardwood plywood, selected for light uniform color.
 - b. Ends Not Exposed : May be 12.7 mm (1/2 inch) exterior softwood plywood, Grade A-D, with Grade A side to inside of cabinet.
 - c. Ends: Dadoed minimum of 6 mm (1/4 inch) deep to receive shelves, bottoms and tops.
 - d. Ends: Let into dado in face frame.
 - e. Base Cabinet End Panels: Stop 89 mm (3-1/2 inches) above floor and supported by 19.1 mm (3/4 inch) by 89 mm (3-1/2 inch) pressure treated solid lumber member.
26. Shelves and Wall Cabinet Bottoms: 12.7 mm (1/2 inch) thick Grade 2-2 exterior hardwood plywood or Grade A-D exterior softwood plywood with wood banded front edge or 19.1 mm (3/4 inch) net thickness solid lumber.
 - a. Shelves: Let into dadoes of end panels and braced behind mulls.
 - b. Bottoms: Let into (rabbet or dado, manufacturer's choice) ends, cleats and front frames.
 - c. Shelves and Bottoms: Glued and stapled.
 - d. Optional Adjustable Shelves: 19.1 mm (3/4 inch) thick Grade 2-2 exterior hardwood plywood of Grade A-D exterior softwood plywood with wood banded front edge or 19.1 mm (3/4 inch) net thickness solid lumber.
 - 1) Shelves: Support as necessary to comply with shelf deflection provisions of ANSI/KCMA A161.1.
 - 2) Shelves: When loaded at 73.3 kg/sq. m (15 PSF) for seven days shall not deflect more than 1.6 mm (1/16 inch) per 305 mm (linear foot) between supports.
 - 3) Maximum Deflection: 6.4 mm (1/4 inch) between supports.
27. Backs: Provide on cabinets (optional on sink bases depending on job conditions).
 - a. Backs: Minimum 6.4 mm (1/4 inch) thick Grade 2-2 exterior hardwood plywood or A-D grade exterior softwood plywood.
 - b. Backs: Securely glued and stapled to ends, 89 mm (3-1/2 inch) cleats and shelves of cabinet.
 - c. Backs: May be let into dado of ends and cleats or may be applied flush with ends and cleats.
28. Base Bottoms: 12.7 mm (1/2 inch) thick Grade 2-2 exterior hardwood plywood or A-C Grade exterior softwood plywood.
 - a. Bottoms: Let into (rabbet or dado, manufacturer's choice) end panels, front rails and installation cleats.
 - b. Bottom: Supported by 19.1 mm (3/4 inch) net thickness pressure treated solid lumber braces 610 mm (24 inches) OC running front to rear of cabinet and resting on finished floor.

Countertops

29. Plastic Laminate Countertops: ANSI A161.2.
 - a. Type: Post-formed with integral backsplashes.
 - 1) Front Edges: No-drip.
 - 2) Backsplashes: Minimum 100 mm (4 inches) high with cove beveled molding with Type A curved top and scribe edge.
 - 3) Provide backsplashes at juncture of countertop with back and side walls.
 - b. Materials: High pressure plastic laminated to 19.1 mm (3/4 inch) thick exterior plywood.
 - 1) Particleboard, flakeboard, fiberboard, or hardboard not allowed.
 - c. Plastic Laminate: NEMA LD 3, Type PF42, 1.1 mm. (0.042 inch) thickness.
 - 1) Colors, patterns, finishes as selected from manufacturer's standard offering.
 - d. Perimeter of Bottom of Countertops and Sink Cut-outs: Sealed with varnish.
30. Cultured Marble Countertops: ANSI Z124.3 and HUD UM 73a.
 - a. Cast in molds with integral lavatory bowls to achieve required shape and configuration in coordination with vanity cabinets and plumbing trim.
 - b. Integral Lavatory Bowls: Recessed oval shape.
 - c. Holes for Plumbing Trim: Coordinate with Division 15 Section "Plumbing."

- d. Provide radius corners and edges.
- e. Backsplashes: Provide where counters meet walls including at back and at sides.
- f. Finish: Polished.

Metal Grease Splash Material

- 31. Stainless Steel: AISI Type 304, nonmagnetic sheets, free of buckles, waves, and surface imperfections, No. 4 polished finish on exposed surfaces, 24 gage, sanded edges.

Wall Cabinet Soffit Material

- 32. Gypsum Board or Plaster.
- 33. Wood:
 - a. Exposed Wood Soffit Face: 6.4 mm (1/4 inch) 3-ply birch-faced cabinet grade plywood.
 - b. Blocking: Hemlock-Fir No. 2.

Source Quality Control

- 34. Testing: Performed under Third Party Administrator who is in compliance with ANSI Z34.1.

EXECUTION

Examination

- 35. Site Verification of Conditions:
 - a. Existing Conditions: Examine spaces to verify that they are ready to receive cabinets and countertops.
 - b. Verify grounds, blocking and supports for proper location and support of cabinets before beginning installation. Verify location of mechanical and electrical rough-ins to assure proper match with installed equipment.
 - c. Survey each kitchen and bath to verify dimensions for cabinets and countertops.

Preparation

- 36. Protection: Protect adjacent elements from damage and disfiguration.
 - a. Repair or replace damaged elements.
- 37. Remove and dispose of existing cabinets and countertops.

Installation

- 38. General: Deliver, uncrate, place in proper location and assemble cabinets and countertops in accordance with manufacturer's recommendations and approved Shop Drawings.
- 39. Cabinets: Set cabinets accurately in place, level, and plumb.
 - a. Maintain distance between bottom of wall cabinets and top of countertop between 380 and 455 mm (15 and 18 inches).
 - b. Scribe and secure to floor and walls.
 - c. Provide connecting and attaching devices, closures, and trim members as required for complete installation.
 - d. Install items complete and adjust moving parts to operate smoothly.
 - e. Wall Cabinets: Hang from masonry walls or secure directly to wall studs.
 - f. Scribe and closely fit casework to adjacent work.
 - g. Vanity Cabinet: Seal joint between cabinets and walls with joint sealant.
- 40. Countertops: Secure to casework and walls with concealed fasteners.
 - a. Plastic Laminate Post-Formed Countertops: Miter inside corner joints. a. Seal cut edge of plywood at sink opening with spar varnish.
 - b. Seal joints between countertops and walls with joint sealant.
- 41. Sinks, Lavatories, and Trim: Provided and installed under Division 15 Section "Plumbing."
- 42. Metal Grease Splash: Install on wall full width of range from top of range to bottom of range hood. Secure to wall with appropriate rounded head fasteners at perimeter.
- 43. Wall Cabinet Soffits:
 - a. Gypsum Board or Plaster.

- b. Wood: Provide plywood soffit with backup blocking above cabinets where existing drywall drop soffit does not exist.
 - 1) Blocking: Provide blocking required to secure drop soffit plywood material in its intended location above new wall cabinets.
 - 2) Plywood Facing: Trim butt edge conditions with solid wood strip pieces to match. Trim corner conditions with solid wood premilled corner to match. Secure facing materials with fine finish nails and fill nail holes.
 - 3) Finish to match cabinet finish.

Adjusting And Cleaning

- 44. Adjusting: Adjust and lubricate moving parts to operate smoothly.
- 45. Cleaning: Comply with requirements of Detailed Scope of Work.

END OF SECTION 06 41 13 00



Task	Specification	Specification Description
06 41 13 00	06 40 00 00	Exterior Architectural Woodwork
06 41 13 00	06 40 00 00a	Interior Architectural Woodwork
06 41 13 00	06 41 00 00	Architectural Wood Casework
06 41 93 00	06 40 00 00	Exterior Architectural Woodwork
06 41 93 00	06 40 00 00a	Interior Architectural Woodwork
06 41 93 00	06 41 00 00	Architectural Wood Casework
06 41 93 00	08 71 00 00	Door Hardware
06 42 00 00	06 40 00 00	Exterior Architectural Woodwork
06 42 00 00	06 40 00 00a	Interior Architectural Woodwork
06 42 13 00	06 40 00 00	Exterior Architectural Woodwork
06 42 13 00	06 40 00 00a	Interior Architectural Woodwork



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SECTION 06 42 16 00 - FLUSH WOOD PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flush wood paneling (wood-veneer wall surfacing).
2. Fire-retardant-treated materials.
3. Installation materials.

B. Related Requirements:

1. Section 057000 "Decorative Metal" for metal reveals at wood paneling.
2. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing paneling that is concealed within other construction before paneling installation.

1.2 ALLOWANCES

- ##### A. Wood Veneer Allowance:
- Wood veneer for paneling is part of **[Wood Veneer Allowance]<Insert name of allowance>**. Allowance includes the cost of veneer that is wasted due to selection, cutting, and trimming.

1.3 COORDINATION

- ##### A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that paneling can be installed as indicated.

1.4 PREINSTALLATION MEETINGS

- ##### A. Preinstallation Conference:
- Conduct conference at **[Project site]<Insert location>**.

1.5 ACTION SUBMITTALS

- ##### A. Product Data:
- For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

- ##### B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Environmental Product Declaration (EPD): For each product.

4. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
5. Environmental Product Declaration: For each product.
6. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
7. Environmental Product Declaration: For each product.
8. Environmental Product Declaration: For each product.
9. Third-Party Certifications: For each product.
10. Third-Party Certified Life Cycle Assessment: For each product.
11. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
12. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
13. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
14. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
15. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
16. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
17. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
18. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
19. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
20. Product Data: For composite wood products, indicating compliance with requirements for formaldehyde emissions.
21. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
22. Product Data: For installation adhesives, indicating VOC content.
23. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For flush wood paneling.

1. Include plans, elevations, sections, and attachment details.
2. Show details full size.
3. Show locations and sizes of furring and blocking, including concealed blocking specified in other Sections.
4. For paneling produced from premanufactured sets, show finished panel sizes, set numbers, sequence numbers within sets, and method of cutting panels to produce indicated sizes.
5. For paneling veneered in fabrication shop, show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
6. Apply **[AWI Quality Certification][WI Certified Compliance]** Program label to Shop Drawings.

D. Samples: For each exposed product and for each color and finish specified, in manufacturer's or fabricator's standard size.

E. Samples for Initial Selection: For each type of exposed finish.

F. Samples for Verification: For the following:

1. Lumber for Transparent Finish: Not less than **[5 inches (125 mm) wide by 12 inches (300 mm) long][5 inches (125 mm) wide by 24 inches (600 mm) long]**, for each species and cut, finished

- on one side and one edge.
- 2. Veneer Leaves: Representative of and selected from flitches to be used for transparent-finished paneling.
- 3. Veneer-Faced Panel Products for Transparent Finish: **[8 by 10 inches (200 by 250 mm)][12 by 12 inches (300 by 300 mm)][12 by 24 inches (300 by 600 mm)]**, for each species and cut. Include at least one face-veneer seam and finish as specified.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[Installer][fabricator]**.
- B. Product Certificates: For each type of product.
- C. Quality Standard Compliance Certificates: **[AWI Quality Certification Program][WI Certified Compliance Program]**.
- D. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Shop Certification: **[AWI's Quality Certification Program accredited participant][WI's Certified Compliance Program licensee]**.
- C. Installer Qualifications: **[Fabricator of products][AWI's Quality Certification Program accredited participant][WI's Certified Compliance Program licensee]**.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockups of **[typical paneling as shown on Drawings]<Insert description>**.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver paneling until painting and similar operations that might damage paneling have been completed in installation areas. Store paneling in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.10 FIELD CONDITIONS

- A. Environmental Limitations without Humidity Control: Do not deliver or install paneling until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.



- B. Environmental Limitations with Humidity Control: Do not deliver or install paneling until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature between **60 and 90 deg F (16 and 32 deg C)** and relative humidity between **[25 and 55][43 and 70][17 and 50]<Insert numbers>** percent during the remainder of the construction period.
- C. Field Measurements: Where paneling is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support paneling by field measurements before being enclosed/concealed by construction and indicate measurements on Shop Drawings.
- D. Established Dimensions: Where paneling is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of paneling **[and][wood-veneer-faced architectural cabinets][ornamental woodwork][wood trim][wood frames][and][wood doors faced with veneers from same flitches as paneling]**.

2.2 PANELING FABRICATORS

- A. Fabricators: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available fabricators offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **<Insert, in separate subparagraphs, names and contact information for preapproved woodworking firms>**.

2.3 PANELING, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of flush wood paneling (wood-veneer wall surfacing) indicated for construction, finishes, installation, and other requirements.
 - 1. Provide inspections of fabrication and installation together with labels and certificates from **[AWI][WI]** certification program indicating that woodwork complies with requirements of grades specified.
 - 2. The Contract Documents contain requirements that are more stringent than the referenced woodwork quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.
- B. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500**

miles (800 km) of Project site.

- C. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site.
- D. Regional Materials: Wood products shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- E. Indigenous Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- F. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.

2.4 FLUSH WOOD PANELING (WOOD-VENEER WALL SURFACING)

- A. Grade: **[Premium][Custom][Economy]**.
- B. Certified Wood: Wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.
- C. Certified Wood: Wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.
- D. Certified Wood: Wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
- E. Certified Wood: Wood products shall **[contain not less than 60 percent][be made from]** certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."
- F. Certified Wood: Wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
- G. Wood Species and Cut: **[White oak, rift sliced][Select white ash, plain sliced][Sycamore, plain sliced][Cherry, plain sliced][Butternut, plain sliced][Avodire, quarter sliced]<Insert species and cut>**.
- H. Veneer Matching Method:
 - 1. Adjacent Veneer Leaves: **[Book][Slip][Pleasant (Random)]** match.
 - 2. Within Panel Face: **[Running][Balance][Center-balance]** match.
 - 3. Adjacent Veneer Leaves and within Panel Face: Slip, center-balance, or book match.
- I. Panel-Matching Method:

1. No matching is required between adjacent panels. Select and arrange panels for similarity of grain pattern and color between adjacent panels.
 2. **[Premanufactured panel sets used full width][Premanufactured panel sets selectively reduced in width][Made-to-order, sequence-matched panels][Made-to-order, blueprint-matched panels and components]** within each separate area.
 - a. See Section 011000 "Summary" for requirements concerning flitches reserved by Architect.
- J. Vertical Panel-Matching Method: **[Continuous end match; veneer leaves of upper panels are continuations of veneer leaves of lower panels][Architectural end book match; veneer leaves are individually book matched from lower panels to upper panels][Architectural end slip match; veneer leaves are individually slip matched from lower panels to upper panels][Panel end book match; panels are book matched from lower panels to upper panels][Panel end slip match; panels are slip matched from lower panels to upper panels].**
- K. Panel Core Construction: **[Hardwood veneer-core plywood][Particleboard or MDF][Fire-retardant particleboard or fire-retardant MDF].**
1. Thickness: **[3/4 inch (19 mm)][As indicated on Drawings].**
- L. Exposed Panel Edges: **[Inset solid-wood or wood-veneer matching faces][Legs of metal channels forming reveals][Applied solid-wood banding 11/16 inch (18 mm) thick by depth of panels][Applied bronze flat bars 1/16 inch (1.6 mm) thick by depth of panels]<Insert description>.**
- M. Panel Reveals: **[Matte black plastic laminate][Bronze sheet][Stainless steel sheet][Bronze channels, 1 by 1 by 1/8 inch (25.4 by 25.4 by 3.2 mm) thick][Stainless steel channels, 1 by 1 by 1/16 inch (25.4 by 25.4 by 1.6 mm) thick]<Insert description>.**
- N. Fire-Retardant-Treated Paneling: Panels are to consist of wood-veneer and fire-retardant particleboard or fire-retardant, medium-density fiberboard (MDF). Panels are to have a flame-spread index of **[25][75]** or less and a smoke-developed index of 450 or less per ASTM E84, and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
- O. Assemble panels by gluing and concealed fastening.
- 2.5 MATERIALS
- A. Materials, General: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.
- B. Wood Moisture Content: **[5 to 10][8 to 13][4 to 9]** percent.
- C. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.
1. Recycled Content of MDF and Particleboard: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
 2. Composite Wood Products: Products shall be made without urea formaldehyde.
 3. Composite Wood Products: Products shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce

- Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
5. Composite Wood Products: Formaldehyde emission rates shall not be greater than the following when tested according to ASTM D 6007 or ASTM E 1333:
 - a. Hardwood Plywood: 0.05 ppm.
 - b. Particleboard: 0.09 ppm.
 - c. MDF More Than **5/16 Inch (8 mm)** Thick: 0.11 ppm.
 - d. MDF **5/16 Inch (8 mm)** or Less in Thickness: 0.13 ppm.
 6. Composite Wood Products: Products shall be made without urea formaldehyde.
 7. MDF: ANSI A208.2, [**Grade 130**]**<Insert grade>**.
 8. Particleboard (Medium Density): ANSI A208.1, [**Grade M-2**]**[Grade M-2-Exterior Glue]**.
 9. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
- D. Adhesives: Do not use adhesives that contain urea formaldehyde.
- E. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- F. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- G. Adhesives: Do not use adhesives that contain urea formaldehyde.
- H. Adhesives: Do not use adhesives that contain urea formaldehyde.

2.6 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than **10.5 feet (3.2 m)** beyond the centerline of the burners at any time during the test.
1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
 2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
 3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
 4. Mill lumber before treatment and implement procedures during treatment and drying processes

that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of paneling.

- C. Fire-Retardant Particleboard: Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E84.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Arauco North America]**
 - b. **[Timber Products, Inc.]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Arauco North America]**
 - b. **[Timber Products, Inc.]**
 - c. **<Insert manufacturer's name>**
 3. For panels **3/4 inch (19 mm)** thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, **1600 psi (11 MPa)**; modulus of elasticity, **300,000 psi (2070 MPa)**; internal bond, **80 psi (550 kPa)**; and screw-holding capacity on face and edge, **250 and 225 lbf (1100 and 1000 N)**, respectively.
 4. For panels **13/16 to 1-1/4 inches (20 to 32 mm)** thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: modulus of rupture, **1300 psi (9 MPa)**; modulus of elasticity, **250,000 psi (1720 MPa)**; linear expansion, 0.50 percent; and screw-holding capacity on face and edge, **250 and 175 lbf (1100 and 780 N)**, respectively.
- D. Fire-Retardant Fiberboard: MDF panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E84.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Roseburg]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Roseburg]**
 - b. **<Insert manufacturer's name>**

2.7 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: **[Softwood or hardwood lumber][Fire-retardant-treated softwood lumber]**, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls.
- C. Installation Adhesive: Product recommended by panel fabricator for each substrate for secure anchorage.
 - 1. Adhesives shall have a VOC content of **[70]<Insert value>** g/L or less.
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 4. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 - 5. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 6. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit or 33 mcg/cu. m and that of acetaldehyde shall not exceed 9 mcg/cu. m.

2.8 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Arrange paneling in shop or other suitable space in proposed sequence for examination by Architect. Mark units with temporary sequence numbers to indicate position in proposed layout.
 - 1. Lay out one elevation at a time if approved by Architect.
 - 2. Notify Architect seven days in advance of the date and time when layout will be available for viewing.
 - 3. Provide lighting of similar type and level as that of final installation for viewing layout unless otherwise approved by Architect.
 - 4. Rearrange paneling as directed by Architect until layout is approved.
 - 5. Do not trim end units and other nonmodular-size units to less than modular size until after Architect's approval of layout. **[Indicate trimming by masking edges of units with nonmarking material.]**
 - 6. Obtain Architect's approval of layout before start of assembly. Mark units and Shop Drawings with assembly sequence numbers based on approved layout.
- C. Complete fabrication, including assembly, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times paneling fabrication will be complete.

- D. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.9 SHOP FINISHING

- A. General: Finish paneling at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- B. Shop Priming: Shop apply the prime coat including backpriming, if any, for **[transparent-finished]** paneling specified to be field finished. See Section 099300 "Staining and Transparent Finishing" for material and application requirements.
- C. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing paneling, as applicable to each unit of work.

1. Backpriming: Apply two coats of sealer or primer, compatible with finish coats, to concealed surfaces of paneling.

- D. Transparent Finish:

1. Grade: **[Premium][Custom][Economy][Same as item to be finished]**.
2. Finish: System - **[1, nitrocellulose lacquer][2, precatalyzed lacquer][3, postcatalyzed lacquer][4, water-based latex acrylic][5, conversion varnish][6, synthetic penetrating oil][7, catalyzed vinyl][8, water-based crosslinking acrylic][9, UV curable acrylated epoxy, polyester, or urethane][10, water-based UV curable][11, catalyzed polyurethane][12, water-based polyurethane][13, catalyzed polyester]**.
3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
4. Staining: **[None required][Match approved sample for color][Match Architect's sample]**.
5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
6. Filled Finish for Open-Grain Woods: **[After staining, apply wash-coat sealer and allow to dry.]** Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
7. Sheen: **[Flat, 15-30][Satin, 31-45][Semigloss, 46-60][Gloss, 61-100]** gloss units measured on 60-degree gloss meter per ASTM D523.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition paneling to humidity conditions in installation areas.
- B. Before installing paneling, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install paneling to comply with quality standard grade of paneling to be installed.
- B. Install paneling level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of **1/8 inch in 96 inches (3 mm in 2400 mm)**. Install with no more than **1/16 inch in 96-inch (1.6 mm in 2400-mm)** vertical cup or bow and **1/8 inch in 96-inch (3 mm in 2400-mm)** horizontal variation from a true plane.
 - 1. For flush paneling with revealed joints, install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding **[1/32 inch (0.8 mm)][1/16 inch (1.5 mm)]**.
- C. Anchor paneling to supporting substrate with **[concealed panel-hanger clips][splined connection strips][blind nailing]**.
 - 1. Do not use face fastening unless **[covered by trim][otherwise indicated]**.
- D. Complete finishing work specified in this Section to extent not completed at shop or before installation of paneling. Fill nail holes with matching filler where exposed.
 - 1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.
- E. See Section 099300 "Staining and Transparent Finishing" for final finishing of installed paneling.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective paneling, where possible, to eliminate defects. Where not possible to repair, replace paneling. Adjust for uniform appearance.
- B. Clean paneling on exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 42 16 00

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06 - Wood, Plastics, and Composites

Task	Specification	Specification Description
06 42 16 00	06 40 00 00	Exterior Architectural Woodwork
06 42 16 00	06 40 00 00a	Interior Architectural Woodwork



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SECTION 06 42 19 00 - PLASTIC-LAMINATE-FACED WOOD PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-faced wood paneling.

B. Related Requirements:

1. Section 057000 "Decorative Metal" for metal reveals at plastic-laminate-faced wood paneling.
2. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing paneling that is concealed within other construction before paneling installation.

1.2 COORDINATION

- A.** Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that paneling can be installed as indicated.

1.3 PREINSTALLATION MEETINGS

- A.** Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Plastic-laminate-faced wood paneling.

B. Product Data Submittals: For each product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

C. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Environmental Product Declaration (EPD): For each product.
4. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
5. Environmental Product Declaration: For each product.
6. Product Certificates: For regional materials, indicating location of material manufacturer and point

of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.

7. Environmental Product Declaration: For each product.
8. Environmental Product Declaration: For each product.
9. Third-Party Certifications: For each product.
10. Third-Party Certified Life Cycle Assessment: For each product.
11. Environmental Product Declaration (EPD): Provide one of the following EPDs: critically reviewed life-cycle assessment complying with ISO 14044; internally reviewed, product-specific Type III EPD; third-party-verified, industrywide Type III EPD.
12. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
13. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
14. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
15. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
16. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
17. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
18. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
19. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
20. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
21. Product Data: For composite wood products, indicating compliance with requirements for formaldehyde emissions.
22. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
23. Product Data: For installation adhesives, indicating VOC content.
24. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low-emitting materials.

D. Shop Drawings: For plastic-laminate-faced wood paneling.

1. Include plans, elevations, sections, and attachment details.
2. Show details full size.
3. Show locations and sizes of furring and blocking, including concealed blocking specified in other Sections.
4. Apply **[AWI Quality Certification][WI Certified Compliance]** Program label to Shop Drawings.

E. Samples: For each exposed product and for each color and texture specified, in manufacturer's or fabricator's standard size.

F. Samples for Initial Selection: For each type of plastic laminate.

G. Samples for Verification: For each type of exposed laminate, **[8 by 10 inches (200 by 250 mm)][12 by 12 inches (300 by 300 mm)]**.

1. Provide one Sample applied to core material **[and with specified edge material applied to one edge]**.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For **[Installer][fabricator]**.

- B. Product Certificates: For each type of product.
- C. Quality Standard Compliance Certificates: **[AWI Quality Certification Program][WI Certified Compliance Program]**.
- D. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
 - 1. Shop Certification: **[AWI's Quality Certification Program accredited participant][WI's Certified Compliance Program licensee]**.
- B. Installer Qualifications: **[Fabricator of products][AWI's Quality Certification Program accredited participant][WI's Certified Compliance Program licensee]**.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockups of **[typical paneling as indicated on Drawings]<Insert description>**.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver paneling until painting and similar operations that might damage paneling have been completed in installation areas. Store paneling in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

- A. Environmental Limitations without Humidity Control: Do not deliver or install paneling until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Environmental Limitations with Humidity Control: Do not deliver or install paneling until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature between **60 and 90 deg F (16 and 32 deg C)** and relative humidity between **[25 and 55][43 and 70][17 and 50]<Insert numbers>** percent during the remainder of the construction period.
- C. Field Measurements: Where paneling is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support paneling by field measurements before being enclosed/concealed by construction and indicate measurements on Shop Drawings.
- D. Established Dimensions: Where paneling is indicated to fit to other construction, establish dimensions

for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS**2.1 PANELING FABRICATORS**

- A. Fabricators: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available fabricators offering products that may be incorporated into the Work include, but are not limited to, the following]**:

1. **<Insert, in separate subparagraphs, names and contact information for preapproved woodworking firms>.**

2.2 PANELING, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-faced wood paneling (decorative laminate surfacing) indicated for construction, finishes, installation, and other requirements.
1. Provide inspections including installation together with labels and certificates from **[AWI][WI]** certification program indicating that woodwork complies with requirements of grades specified.
 2. The Contract Documents contain requirements that are more stringent than the referenced woodwork quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.
- B. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- C. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site.
- D. Regional Materials: Wood products shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- E. Indigenous Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- F. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.

2.3 PLASTIC-LAMINATE-FACED WOOD PANELING

- A. Grade: **[Premium][Custom][Economy]**.

- B. Certified Wood: Wood products shall be certified as "FSC Pure"[or **"FSC Mixed Credit"**] according to FSC STD-01-001 and FSC STD-40-004.
- C. Certified Wood: Wood products shall be certified as "FSC Pure"[or **"FSC Mixed Credit"**] according to FSC STD-01-001 and FSC STD-40-004.
- D. Certified Wood: Wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
- E. Certified Wood: Wood products shall **[contain not less than 60 percent][be made from]** certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."
- F. Certified Wood: Wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
- G. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed surfaces complying with the following requirements:
 - 1. As indicated by manufacturer's designations.
 - 2. Match Architect's samples.
 - 3. As selected by Architect from laminate manufacturer's full range in the following categories:
 - a. Solid colors, **[gloss][matte]** finish.
 - b. Solid colors with core same color as surface, **[gloss][matte]** finish.
 - c. Wood grains, **[gloss][matte]** finish.
 - d. Patterns, **[gloss][matte]** finish.
 - 4. Grain Direction: **[Vertical][Horizontal]**.
- H. Panel Core: **[Particleboard or MDF][Fire-retardant particleboard or fire-retardant MDF]**.
 - 1. Thickness: **[3/4 inch (19 mm)][As indicated on Drawings]**.
- I. Exposed Panel Edges: **[Plastic-laminate matching faces][Legs of metal channels forming reveals][Applied solid-wood banding 11/16 inch (18 mm) thick by depth of panels][Applied bronze flat bars 1/16 inch (1.6 mm) thick by depth of panels]<Insert description>**.
- J. Panel Reveals: **[Matte black plastic laminate][Bronze sheet][Stainless steel sheet][Bronze channels, 1 by 1 by 1/8 inch (25.4 by 25.4 by 3.2 mm) thick][Stainless steel channels, 1 by 1 by 1/16 inch (25.4 by 25.4 by 1.6 mm) thick]<Insert description>**.
- K. Adhesives for Bonding Plastic Laminate: **[Type I, waterproof type][Type II water-resistant type]** as selected by fabricator to comply with requirements .
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive[or **adhesive specified above for faces**].
- L. Fire-Retardant-Treated Paneling: Panels are to consist of fire-retardant plastic laminate and fire-retardant particleboard or fire-retardant, medium-density fiberboard (MDF). Panels are to have a flame-spread index of **[25][75]** or less and a smoke-developed index of 450 or less per ASTM E84, and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

- M. Assemble panels by gluing and concealed fastening.

2.4 MATERIALS

- A. Materials, General: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.
- B. Wood Moisture Content: **[5 to 10][8 to 13][4 to 9]** percent.
- C. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.
 - 1. Recycled Content of MDF and Particleboard: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
 - 2. Composite Wood Products: Products shall be made without urea formaldehyde.
 - 3. Composite Wood Products: Products shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 4. Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
 - 5. Composite Wood Products: Formaldehyde emission rates shall not be greater than the following when tested according to ASTM D6007 or ASTM E1333:
 - a. Hardwood Plywood: 0.05 ppm.
 - b. Particleboard: 0.09 ppm.
 - c. MDF More Than **5/16 Inch (8 mm)** Thick: 0.11 ppm.
 - d. MDF **5/16 Inch (8 mm)** or Less in Thickness: 0.13 ppm.
 - 6. Composite Wood Products: Products shall be made without urea formaldehyde.
 - 7. MDF: ANSI A208.2, **[Grade 130]<Insert grade>**.
 - 8. Particleboard (Medium Density): ANSI A208.1, **[Grade M-2][Grade M-2-Exterior Glue]**.

2.5 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
 - 1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
 - 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 - 3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than **10.5 feet (3.2 m)** beyond the centerline of the burners at any time during the test.

1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
 2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
 3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
 4. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of paneling.
- C. Fire-Retardant Particleboard: Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E84.
1. For panels **3/4 inch (19 mm)** thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, **1600 psi (11 MPa)**; modulus of elasticity, **300,000 psi (2070 MPa)**; internal bond, **80 psi (550 kPa)**; and screw-holding capacity on face and edge, **250 and 225 lbf (1100 and 1000 N)**, respectively.
 2. For panels **13/16 to 1-1/4 inches (20 to 32 mm)** thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: modulus of rupture, **1300 psi (9 MPa)**; modulus of elasticity, **250,000 psi (1720 MPa)**; linear expansion, 0.50 percent; and screw-holding capacity on face and edge, **250 and 175 lbf (1100 and 780 N)**, respectively.
 3. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Arauco North America]**
 - b. **[Timber Products, Inc.]**
 - c. **<Insert manufacturer's name>**
 4. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Arauco North America]**
 - b. **[Timber Products, Inc.]**
 - c. **<Insert manufacturer's name>**
- D. Fire-Retardant Fiberboard: MDF panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E84.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Roseburg]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Roseburg]**
 - b. **<Insert manufacturer's name>**

2.6 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: **[Softwood or hardwood lumber][Fire-retardant-treated softwood lumber]**, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls.
- C. Installation Adhesive: Product recommended by panel fabricator for each substrate for secure anchorage.
 - 1. Adhesives shall have a VOC content of **[70]<Insert value>** g/L or less.
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 4. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 - 5. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 6. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit or 33 mcg/cu. m and that of acetaldehyde shall not exceed 9 mcg/cu. m.

2.7 FABRICATION

- A. Complete fabrication, including assembly, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times paneling fabrication will be complete.
- B. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition paneling to humidity conditions in installation areas.

- B. Before installing paneling, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install paneling to comply with quality standard grade of paneling to be installed.
- B. Install paneling level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of **1/8 inch in 96 inches (3 mm in 2400 mm)**. Install with no more than **1/16 inch in 96-inch (1.6 mm in 2400-mm)** vertical cup or bow and **1/8 inch in 96-inch (3 mm in 2400-mm)** horizontal variation from a true plane.
 - 1. For flush paneling with revealed joints, install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding **1/32 inch (0.8 mm)** **1/16 inch (1.5 mm)**.
- C. Anchor paneling to supporting substrate with **[concealed panel-hanger clips][splined connection strips][blind nailing]**. Do not use face fastening unless **[covered by trim][otherwise indicated]**.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective paneling, where possible, to eliminate defects. Where not possible to repair, replace paneling. Adjust for uniform appearance.
- B. Clean paneling on exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 42 19 00

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SECTION 06 42 19 00A - PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic sheet paneling.
2. Factory-laminated plastic sheet paneling.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring for installing plastic paneling.
2. Section 064219 "Plastic-Laminate-Faced Wood Paneling."
3. Section 102600 "Wall and Door Protection" for corner guards installed over plastic paneling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Data: For adhesives, indicating VOC content.
3. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
4. Product Data: For sealants, indicating VOC content.
5. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
6. Laboratory Test Reports: For wall materials, indicating compliance with requirements for low-emitting materials.
7. Laboratory Test Reports: For wall materials, indicating compliance with requirements for low-emitting materials.
8. Laboratory Test Reports: For wall materials, indicating compliance with requirements for low-emitting materials.
9. Laboratory Test Reports: For wall materials, indicating compliance with requirements for low-emitting materials.

C. Samples: For plastic paneling[**and trim accessories**], in manufacturer's standard sizes.

1.3 QUALITY ASSURANCE

A. Testing Agency: [**Acceptable to authorities having jurisdiction**][**FM Approvals**].

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and

weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING

- A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319. **[Panels are to be USDA accepted for incidental food contact.]**
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Crane Composites, Inc.]**
 - b. **[Glasteel]**
 - c. **[Marlite, Inc.]**
 - d. **[Newcourt, Inc.]**
 - e. **[Nudo]**
 - f. **[Parkland Plastics]**
 - g. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Crane Composites, Inc.]**
 - b. **[Glasteel]**
 - c. **[Marlite, Inc.]**
 - d. **[Newcourt, Inc.]**
 - e. **[Nudo]**
 - f. **[Parkland Plastics]**
 - g. **<Insert manufacturer's name>**
 3. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 5. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less.
 6. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

7. Surface-Burning Characteristics: As follows when tested by a qualified testing agency in accordance with ASTM E84. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: **[25][200]<Insert value>** or less.
 - b. Smoke-Developed Index: 450 or less.
 8. Nominal Thickness: Not less than **[0.075 inch (1.9 mm)][0.09 inch (2.3 mm)][0.12 inch (3.0 mm)]**.
 9. Surface Finish: **[Smooth][Molded pebble texture][Smooth surface with filled grooves at 4 inches (102 mm) o.c. to resemble tile][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]**.
 10. Color: **[White][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]**.
- B. Unreinforced Polypropylene Paneling:** Solid polypropylene panels made from no less than 80 percent recycled material. **[Panels are to be USDA accepted for incidental food contact.]**
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Parkland Plastics]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Parkland Plastics]**
 - b. **<Insert manufacturer's name>**
 3. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 5. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less.
 6. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 7. Surface-Burning Characteristics: As follows when tested by a qualified testing agency in accordance with ASTM E84. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 200 or less.
 - b. Smoke-Developed Index: 450 or less.
 8. Nominal Thickness: Not less than **[0.06 inch (1.5 mm)][0.09 inch (2.3 mm)]**.
 9. Surface Finish: **[Smooth][Molded pebble texture][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full**

range].

10. Color: **[White][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range].**

C. Unreinforced PVC Paneling: Solid polyvinyl chloride panels. **[Panels are to be USDA accepted for incidental food contact.]**

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Acoustic Ceiling Products, LLC]**
 - b. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Acoustic Ceiling Products, LLC]**
 - b. **<Insert manufacturer's name>**
3. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
4. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
5. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less.
6. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
7. Surface-Burning Characteristics: As follows when tested by a qualified testing agency in accordance with ASTM E84. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
8. Nominal Thickness: Not less than **0.03 inch (0.75 mm)**.
9. Surface Finish: **[Smooth][Molded pebble texture][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range].**
10. Color: **[White][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range].**

D. Biobased Plastic Paneling: Solid paneling made from biobased modified polyactide resin with flame retardant and integral color.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the**

following]:

- a. **[Alpar Architectural Products, LLC]**
 - b. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[Alpar Architectural Products, LLC]**
 - b. **<Insert manufacturer's name>**
3. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
4. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
5. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less.
6. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
7. Surface-Burning Characteristics: As follows when tested by a qualified testing agency in accordance with ASTM E84. Identify products with appropriate markings of applicable testing agency.
- a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
8. Nominal Thickness: Not less than **0.04 inch (1.0 mm)**.
9. Surface Finish: Suede texture.
10. Color: **[White][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]**.

2.3 FACTORY-LAMINATED PLASTIC SHEET PANELING

- A. Factory-Laminated Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319, laminated to **[plywood][oriented strand board][fire-retardant particleboard][gypsum board][high-impact gypsum board][water-resistant gypsum board]**. **[Panels are to be USDA accepted for incidental food contact.]**
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
- a. **[Arcoplast]**
 - b. **[Citadel Architectural Products, Inc.]**
 - c. **[Crane Composites, Inc.]**
 - d. **[Glasteel]**
 - e. **[Newcourt, Inc.]**
 - f. **[Nudo]**

- g. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Arcoplast]
 - b. [Citadel Architectural Products, Inc.]
 - c. [Crane Composites, Inc.]
 - d. [Glasteel]
 - e. [Newcourt, Inc.]
 - f. [Nudo]
 - g. <Insert manufacturer's name>
3. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
4. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
5. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less.
6. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
7. Surface-Burning Characteristics: As follows when tested by a qualified testing agency in accordance with ASTM E84. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: [25][200]<Insert value> or less.
 - b. Smoke-Developed Index: 450 or less.
8. Glass-Fiber-Reinforced Plastic Panel Nominal Thickness: Not less than [0.03 inch (0.76 mm)][0.05 inch (1.3 mm)][0.075 inch (1.9 mm)][0.09 inch (2.3 mm)].
9. Surface Finish: [Smooth][Molded pebble texture][Smooth surface with filled grooves at 4 inches (102 mm) o.c. to resemble tile][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range].
10. Color: [White][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range].
11. Plywood: DOC PS 1, Exterior B-C, [1/4 inch (6.4 mm)][3/8 inch (9.5 mm)][1/2 inch (12.7 mm)][5/8 inch (15.9 mm)][3/4 inch (19.1 mm)] thick.
12. Oriented Strand Board: DOC PS 2, Exposure 1, [1/4 inch (6.4 mm)][3/8 inch (9.5 mm)][1/2 inch (12.7 mm)][3/4 inch (19.1 mm)] thick.
13. Fire-Retardant Particleboard: Product complying with ANSI A208.1, Grade M-S, except for modulus of rupture; with flame-spread index of 25 or less in accordance with ASTM E84; and [3/8 inch (9.5 mm)][1/2 inch (12.7 mm)] thick.
14. Gypsum Board: ASTM C1396/C1396M, [Regular, 1/2 inch (12.7 mm)][Type X, 5/8 inch (15.9 mm)].
15. High-Impact Gypsum Board: ASTM C1396/C1396M, 5/8 inch (15.9 mm), with Type X core, and [0.010-inch (0.254-mm)][0.020-inch (0.508-mm)][0.030-inch (0.762-mm)][0.081-inch (2.057-mm)] plastic film laminated to back side for greater resistance to penetration (impact resistance).
16. Water-Resistant Gypsum Board: ASTM C1396/C1396M or ASTM C1178/C1178M, 5/8 inch (15.9 mm), Type X, with water-resistant core and surfaces.

- B. Factory-Laminated PVC Paneling: Solid polyvinyl chloride sheet, laminated to [plywood][oriented strand board][fire-retardant particleboard][gypsum board][high-impact gypsum board][water-resistant gypsum board]. [Panels are USDA accepted for incidental food contact.]
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Newcourt, Inc.]
 - b. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Newcourt, Inc.]
 - b. <Insert manufacturer's name>
 3. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 5. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less.
 6. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 7. Surface-Burning Characteristics: As follows when tested by a qualified testing agency in accordance with ASTM E84. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 8. Nominal Thickness: Not less than **0.015 inch (0.38 mm)**.
 9. Surface Finish: [Smooth][Molded pebble texture][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range].
 10. Color: [White][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range].
 11. Plywood: DOC PS 1, Exterior B-C, [1/4 inch (6.4 mm)][3/8 inch (9.5 mm)][1/2 inch (12.7 mm)][5/8 inch (15.9 mm)][3/4 inch (19.1 mm)] thick.
 12. Oriented Strand Board: DOC PS 2, Exposure 1, [1/4 inch (6.4 mm)][3/8 inch (9.5 mm)][1/2 inch (12.7 mm)][3/4 inch (19.1 mm)] thick.
 13. Fire-Retardant Particleboard: Product complying with ANSI A208.1, Grade M-S, except for modulus of rupture; with flame-spread index of 25 or less in accordance with ASTM E84; and [3/8 inch (9.5 mm)][1/2 inch (12.7 mm)] thick.
 14. Gypsum Board: ASTM C1396/C1396M, [Regular, 1/2 inch (12.7 mm)][Type X, 5/8 inch (15.9 mm)].
 15. High-Impact Gypsum Board: ASTM C1396/C1396M, 5/8 inch (15.9 mm), with Type X core, and [0.010-inch (0.254-mm)][0.020-inch (0.508-mm)][0.030-inch (0.762-mm)][0.081-inch (2.057-



- mm)] plastic film laminated to back side for greater resistance to penetration (impact resistance).
16. Water-Resistant Gypsum Board: ASTM C1396/C1396M or ASTM C1178/C1178M, 5/8 inch (15.9 mm), Type X, with water-resistant core and surfaces.

2.4 ACCESSORIES

- A. Trim Accessories: Manufacturer's standard **[one-piece][two-piece, snap-on]** vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, **[outside corners,]** and caps as needed to conceal edges.
1. Color: **[White][Match panels][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]**.
- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.
- D. Adhesive: As recommended by plastic paneling manufacturer.
1. Adhesives shall have a VOC content of **[50]<Insert value>** g/L or less.
 2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 5. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 6. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit or 33 mcg/cu. m and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- E. Sealant: **[Mildew-resistant, single-component, neutral-curing silicone][Mildew-resistant, single-component, neutral-curing or acid-curing silicone][Latex]** sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."
1. Sealant shall have a VOC content of 250 g/L or less.
 2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 3. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall

- not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
5. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 6. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.
- B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- E. Lay out paneling before installing. Locate panel joints **[where indicated][to provide equal panels at ends of walls not less than half the width of full panels][so that trimmed panels at corners are not less than 12 inches (300 mm) wide]**.
 1. Mark plumb lines on substrate at **[trim accessory][panel joint]** locations for accurate installation.
 2. Locate **[trim accessories][panel joints]** to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
 1. Drill oversized fastener holes in panels and center fasteners in holes.
 2. Apply sealant to fastener holes before installing fasteners.



- D. Install factory-laminated panels using concealed mounting splines in panel joints.
- E. Install trim accessories with [adhesive][and][nails][or][staples]. [**Do not fasten through panels.**]
- F. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- G. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- H. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
- I. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 42 19 00A



06 - Wood, Plastics, and Composites

Task	Specification	Specification Description
06 42 19 00	06 40 00 00	Exterior Architectural Woodwork
06 42 19 00	06 40 00 00a	Interior Architectural Woodwork
06 43 00 00	06 40 00 00	Exterior Architectural Woodwork
06 43 00 00	06 40 00 00a	Interior Architectural Woodwork
06 43 13 00	06 40 00 00	Exterior Architectural Woodwork
06 43 13 00	06 40 00 00a	Interior Architectural Woodwork
06 43 16 00	06 40 00 00	Exterior Architectural Woodwork
06 43 16 00	06 40 00 00a	Interior Architectural Woodwork



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SECTION 06 44 00 00 - ORNAMENTAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior ornamental woodwork for transparent finish.
2. Exterior ornamental woodwork for opaque finish.
3. Interior ornamental woodwork for transparent finish.
4. Interior ornamental woodwork for opaque finish.
5. Wood furring, blocking, shims, and hanging strips for installing ornamental woodwork items that are not concealed within other construction.
6. Shop priming of exterior ornamental woodwork.
7. Shop priming of interior ornamental woodwork.
8. Shop finishing of exterior ornamental woodwork.
9. Shop finishing of interior ornamental woodwork.

B. Related Requirements:

1. **[Section 061000 "Rough Carpentry"]**[Section 061052 "Miscellaneous Rough Carpentry"] for wood furring, blocking, shims, and hanging strips required for installing ornamental woodwork that are concealed within other construction before ornamental woodwork installation.
2. Section 062013 "Exterior Finish Carpentry" for exterior carpentry exposed to view that is not specified in this Section.
3. Section 062023 "Interior Finish Carpentry" for interior carpentry exposed to view that is not specified in this Section.

1.2 COORDINATION

- ##### A.
- Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior ornamental woodwork can be supported and installed as indicated.

1.3 PREINSTALLATION MEETINGS

- ##### A.
- Preinstallation Conference: Conduct conference at **[Project site]**<Insert location>.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Composite wood products.
2. Fire-retardant-treated materials.
3. Finishing materials and processes.
4. Wood-Preservative Treatment:

- a. Include data and warranty from chemical-treatment manufacturer and certification by

- treating plant that treated materials to comply with requirements.
- b. Indicate type of preservative used and net amount of preservative retained.
- c. Include chemical-treatment manufacturer's written instructions for finishing treated material and manufacturer's written warranty.

- 5. Fire-Retardant Treatment: Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials to comply with requirements.
- 6. Waterborne Treatments: For products receiving a waterborne treatment, Include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Sustainable Design Submittals:

- 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
- 3. Environmental Product Declaration (EPD): For each product.
- 4. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
- 5. Environmental Product Declaration: For each product.
- 6. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
- 7. Environmental Product Declaration: For each product.
- 8. Environmental Product Declaration: For each product.
- 9. Third-Party Certifications: For each product.
- 10. Third-Party Certified Life Cycle Assessment: For each product.
- 11. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
- 12. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
- 13. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
- 14. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
- 15. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
- 16. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
- 17. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
- 18. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
- 19. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
- 20. Product Data: For composite wood products, indicating compliance with requirements for formaldehyde emissions.
- 21. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

C. Shop Drawings: Show location of each item, including the following:

- 1. Dimensioned plans, elevations, and sections.
- 2. Attachment devices, and other components.
- 3. Show **[large-scale][full-size]** details.

4. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.
 5. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
 6. Apply **[AWI Quality Certification][WI Certified Compliance]** Program label to Shop Drawings.
- D. Samples: For each exposed product and for each shop-applied color and finish specified.
1. Size:
 - a. Panel Products: **12 inches by 12 inches (300 mm by 300 mm)**.
 - b. Lumber Products: Not less than **[5 inches (125 mm) wide by 12 inches (300 mm) long][5 inches (125 mm) wide by 24 inches (600 mm) long]**, for each species and cut, finished on one side and one edge.
- E. Samples for Initial Selection: For each type of shop-applied exposed finish.
1. Size:
 - a. Panel Products: **12 inches by 12 inches (300 mm by 300 mm)**.
 - b. Lumber Products: Not less than **[5 inches (125 mm) wide by 12 inches (300 mm) long][5 inches (125 mm) wide by 24 inches (600 mm) long]**, for each species and cut, finished on one side and one edge.
- F. Samples for Verification:
1. Lumber for Exterior Wood-Stain Finish: Not less than **5 inches (125 mm)** wide by **12 inches (300 mm)** long, for each species, with one-half of exposed surface finished.
 2. Lumber for Transparent Finish: Not less than **[5 inches (125 mm) wide by 12 inches (300 mm) long][5 inches (125 mm) wide by 24 inches (600 mm) long]**, for each species and cut, finished on one side and one edge.
 3. Veneer Leaves: Representative of and selected from flitches to be used for transparent-finished ornamental woodwork.
 4. Lumber and Panel Products with Shop-Applied Opaque Finish: **5 inches (125 mm)** wide by **12 inches (300 mm)** long for lumber and **[8 by 10 inches (200 by 250 mm)][12 by 12 inches (300 by 300 mm)]** for panels, for each finish system and color, with **[one-half of]** exposed surface finished.
 - a. Finish **[entire][one-half of]** exposed surface.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For **[ornamental woodwork manufacturer][and][Installer]**.
 - B. Product Certificates: For **[each type of product.][the following:]**
 1. Composite wood products.
 2. Adhesives.
 - C. Evaluation Reports: For **[wood-preserved-treated][and][fire-retardant-treated]** wood materials, from ICC-ES.
 - D. Field quality-control reports.



1.6 CLOSEOUT SUBMITTALS

- A. Quality Standard Compliance Certificates: **[AWI Quality Certification Program][WI Certified Compliance Program]** certificates.

1.7 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
 - 1. Manufacturer's Certification: Licensed participant in **[AWI's Quality Certification Program][WI's Certified Compliance Program]**.
- B. Installer Qualifications: **[Manufacturer of products][and][Licensed participant in AWI's Quality Certification Program][Licensed participant in WI's Certified Compliance Program]**.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockups of **<Insert description>**.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Architectural Woodwork Standards, Section 2.
- B. Do not deliver interior ornamental woodwork until painting and similar operations that could damage woodwork have been completed in installation areas.
- C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
 - 1. Handle and store fire-retardant-treated wood to comply with chemical-treatment manufacturer's written instructions.

1.9 FIELD CONDITIONS

- A. Weather Limitations for Exterior Work: Proceed with installation of exterior ornamental woodwork only when existing and forecasted weather conditions permit work to be performed and at least one coat of specified finish is to be applied without exposure to rain, snow, or dampness.
- B. Environmental Limitations for Interior Work without Humidity Control: Do not deliver or install interior ornamental woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupancy for the remainder of the construction period.
- C. Environmental Limitations for Interior Work with Humidity Control: Do not deliver or install interior ornamental woodwork until building is enclosed, wet-work is complete, and HVAC system is operating

and maintaining temperature between **60 and 90 deg F (16 and 32 deg C)** and relative humidity between **[25 and 55][43 and 70][20 and 50]<Insert humidity range>** percent during the remainder of the construction period.

- D. Field Measurements: Where ornamental woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.
- E. Established Dimensions: Where ornamental woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 ORNAMENTAL WOODWORK MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **<Insert in separate subparagraphs, names of preapproved ornamental woodworking firms>**.

2.2 ORNAMENTAL WOODWORK, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of ornamental woodwork indicated for construction, finishes, installation, and other requirements.
 - 1. Provide **[labels][and][certificates]** from **[AWI][WI]** certification program indicating that woodwork, **including installation,** complies with requirements of grades specified.
 - a. This project has been registered with AWI as AWI Quality Certification Program Number **<Insert number>**.
 - b. Contractor is to register the Work under this Section with the AWI Quality Certification Program at www.awiqcp.org or by calling 800-345-0991.
 - 2. The Contract Documents contain requirements that are more stringent than the Architectural Woodwork Standards. Comply with Contract Documents and Architectural Woodwork Standards.
- B. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- C. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site.
- D. Regional Materials: Wood products shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.

- E. Indigenous Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- F. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- G. Certified Wood: Wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.
- H. Certified Wood: Wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.
- I. Certified Wood: Wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
- J. Certified Wood: Wood products shall [**contain not less than 60 percent**][**be made from**] certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."
- K. Certified Wood: Wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.

2.3 EXTERIOR ORNAMENTAL WORK FOR TRANSPARENT FINISH

- A. Exterior ornamental work for transparent finish includes the following:
 - 1. Balustrades.
 - 2. Columns.
 - 3. Cupolas.
 - 4. Pediment heads.
 - 5. Pilasters.
 - 6. <Insert description>.
- B. Architectural Woodwork Standards Grade: [**Premium**][**Custom**][**Economy**].
- C. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- D. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site.
- E. Regional Materials: Wood products shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- F. Indigenous Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site

from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.

- G. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- H. Certified Wood: Wood products shall be certified as "FSC Pure"[**or "FSC Mixed Credit"**] according to FSC STD-01-001 and FSC STD-40-004.
- I. Certified Wood: Wood products shall be certified as "FSC Pure"[**or "FSC Mixed Credit"**] according to FSC STD-01-001 and FSC STD-40-004.
- J. Certified Wood: Wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
- K. Certified Wood: Wood products shall **[contain not less than 60 percent][be made from]** certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."
- L. Certified Wood: Wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
- M. Wood Species: **[Teak][African mahogany][All-heart redwood][Western red cedar][Ponderosa pine or sugar pine]<Insert species>**.
 - 1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than **3 inches (76 mm)** wide.
- N. Wood Moisture Content: **[9 to 15][10 to 15][7 to 12]** percent.

2.4 EXTERIOR ORNAMENTAL WORK FOR OPAQUE FINISH

- A. Exterior ornamental work for opaque finish includes the following:
 - 1. Balustrades.
 - 2. Columns.
 - 3. Cupolas.
 - 4. Pediment heads.
 - 5. Pilasters.
 - 6. **<Insert description>**.
- B. Architectural Woodwork Standards Grade: **[Premium][Custom][Economy]**.
- C. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- D. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site.

- E. Regional Materials: Wood products shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- F. Indigenous Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- G. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- H. Certified Wood: Wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.
- I. Certified Wood: Wood products shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.
- J. Certified Wood: Wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
- K. Certified Wood: Wood products shall **[contain not less than 60 percent][be made from]** certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."
- L. Certified Wood: Wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
- M. Wood Species: **[All-heart redwood][Western red cedar][Ponderosa pine][Ponderosa pine or sugar pine][Eastern white pine, sugar pine, or western white pine][Any closed-grain hardwood][Softwood plywood]<Insert species>**.
 - 1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than **3 inches (76 mm)** wide.
- N. Wood Moisture Content: **[9 to 15][10 to 15][7 to 12]** percent.

2.5 INTERIOR ORNAMENTAL WORK FOR TRANSPARENT FINISH

- A. Interior ornamental work for transparent finish includes the following:
 - 1. Altar.
 - 2. Balustrades.
 - 3. Columns.
 - 4. Grilles.
 - 5. Judge's bench.
 - 6. Lectern.
 - 7. Mantels.

8. Pediment heads.
 9. Pilasters.
 10. Pulpit.
 11. Witness stand.
 12. <Insert description>.
- B. Architectural Woodwork Standards Grade: **[Premium][Custom][Economy]**.
- C. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- D. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site.
- E. Regional Materials: Wood products shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- F. Indigenous Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- G. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- H. Certified Wood: Wood products shall be certified as "FSC Pure"[**or "FSC Mixed Credit"**] according to FSC STD-01-001 and FSC STD-40-004.
- I. Certified Wood: Wood products shall be certified as "FSC Pure"[**or "FSC Mixed Credit"**] according to FSC STD-01-001 and FSC STD-40-004.
- J. Certified Wood: Wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
- K. Certified Wood: Wood products shall **[contain not less than 60 percent][be made from]** certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."
- L. Certified Wood: Wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
- M. Wood Species and Cut: **[Match species and cut indicated for other types of transparent-finished ornamental woodwork located in same area of building unless otherwise indicated.]**
1. Species: **[Red oak][White oak][White ash][Hickory]<Insert species>**.
 2. Cut: **[Plain sliced/plain sawn][Rift cut/rift sawn][Quarter cut/quarter sawn][Any cut]**.
- N. Wood Moisture Content: **[5 to 10][8 to 13][4 to 9]** percent.

2.6 INTERIOR ORNAMENTAL WORK FOR OPAQUE FINISH

- A. Interior ornamental work for opaque finish includes the following:
1. Altar.
 2. Balustrades.
 3. Columns.
 4. Grilles.
 5. Lectern.
 6. Mantels.
 7. Pediment heads.
 8. Pilasters.
 9. Pulpit.
 10. **<Insert description>**.
- B. Architectural Woodwork Standards Grade: **[Premium][Custom][Economy]**.
- C. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- D. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site.
- E. Regional Materials: Wood products shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- F. Indigenous Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- G. Regional Materials: Wood products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- H. Certified Wood: Wood products shall be certified as "FSC Pure"[**or "FSC Mixed Credit"**] according to FSC STD-01-001 and FSC STD-40-004.
- I. Certified Wood: Wood products shall be certified as "FSC Pure"[**or "FSC Mixed Credit"**] according to FSC STD-01-001 and FSC STD-40-004.
- J. Certified Wood: Wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
- K. Certified Wood: Wood products shall **[contain not less than 60 percent][be made from]** certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."
- L. Certified Wood: Wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the

standards of the Programme for Endorsement of Forest Certification.

- M. Wood Species: **[Any closed-grain hardwood][Eastern white pine, sugar pine, or western white pine]<Insert species>**.
- N. Wood Moisture Content: **[5 to 10][8 to 13][4 to 9]** percent.

2.7 WOOD MATERIALS

- A. Composite Wood Products: Provide materials that comply with requirements of the Architectural Woodwork Standards for each type of ornamental woodwork and quality grade specified unless otherwise indicated.
 - 1. Recycled Content of MDF and Particleboard: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- B. Composite Wood Products: Products shall be made without urea formaldehyde.
- C. Composite Wood Products: Products shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
- E. Composite Wood Products: Formaldehyde emission rates shall not be greater than the following when tested according to ASTM D 6007 or ASTM E 1333:
 - 1. Hardwood Plywood: 0.05 ppm.
 - 2. Particleboard: 0.09 ppm.
 - 3. MDF More Than **5/16 Inch (8 mm)** Thick: 0.11 ppm.
 - 4. MDF **5/16 Inch (8 mm)** or Less in Thickness: 0.13 ppm.
- F. Composite Wood Products: Products shall be made without urea formaldehyde.
 - 1. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

2.8 PRESERVATIVE-TREATED WOOD MATERIALS

- A. Preservative-Treated Wood Materials: Provide with water-repellent preservative treatment complying with AWWA N1 (dip, spray, flood, or vacuum-pressure treatment).
 - 1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC)[, **combined with a compatible EPA registered insecticide**].
 - 2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
- B. Extent of Preservative Treated Wood Materials: Treat **[exterior ornamental woodwork indicated on Drawings][exterior ornamental woodwork unless otherwise indicated on Drawings][interior ornamental woodwork in contact with concrete or masonry]<Insert requirements>**.

1. Items fabricated from the following wood species need not be treated:

- a. **[Redwood][All-heart redwood].**
- b. **[Western red cedar][All-heart western red cedar].**
- c. White oak.
- d. African mahogany.
- e. Honduras mahogany.
- f. Ipe.
- g. Dark red meranti.
- h. Teak.

2.9 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Materials: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products in accordance with test method indicated by a qualified testing agency.
 1. Use treated materials that comply with requirements of Architectural Woodwork Standards for the grade specified. Do not use materials that are warped, discolored, or otherwise defective.
 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than **10.5 feet (3.2 m)** beyond the centerline of the burners at any time during the test.
 1. For exterior applications, use materials that comply with testing requirements after being subjected to accelerated weathering in accordance with ASTM D2898.
 2. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
 3. For items indicated to receive a stained, transparent or natural finish, use organic resin chemical formulation.
 4. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
 5. Mill lumber before treatment, and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
- C. Fire-Retardant Particleboard: Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture, to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less in accordance with ASTM E84.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Arauco North America]**
 - b. **[Timber Products, Inc.]**

- c. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Arauco North America]**
 - b. **[Timber Products, Inc.]**
 - c. **<Insert manufacturer's name>**
3. For panels **3/4 inch (19 mm)** thick and less, comply with ANSI A208.1 for Grade M-2, except for the following minimum properties: modulus of rupture, **1600 psi (11 MPa)**; modulus of elasticity, **300,000 psi (2070 MPa)**; internal bond, **80 psi (550 kPa)**; and screw-holding capacity on face and edge, **250 and 225 lbf (1100 and 1000 N)**, respectively.
4. For panels **13/16 to 1-1/4 inches (20 to 32 mm)** thick, comply with ANSI A208.1 for Grade M-1, except for the following minimum properties: modulus of rupture, **1300 psi (9 MPa)**; modulus of elasticity, **250,000 psi (1720 MPa)**; linear expansion, 0.50 percent; and screw-holding capacity on face and edge, **250 and 175 lbf (1100 and 780 N)**, respectively.
- D. Fire-Retardant Fiberboard: Medium-density fiberboard (MDF) panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less in accordance with ASTM E84.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Roseburg]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Roseburg]**
 - b. **<Insert manufacturer's name>**

2.10 FASTENERS

- A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than **1-1/2 inches (38 mm)** into wood substrate.
 1. Use **[stainless steel][fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329/F2329M]** unless otherwise indicated.
 2. For pressure-preservative-treated wood, use stainless steel fasteners.
 3. For redwood, use **[brass/bronze][stainless steel][hot-dip galvanized-steel]** fasteners.
- B. Nails: ASTM F1667.
- C. Power-Driven Fasteners: ICC-ES AC70.
- D. Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.

- E. Carbon-Steel Bolts: ASTM A307 with **ASTM A563 (ASTM A563M)** hex nuts and, where indicated, flat washers all hot-dip zinc coated.
- F. Stainless Steel Bolts: ASTM F593, Alloy Group 1 or 2; with **ASTM F594, Alloy Group 1 or 2 (ASTM F836M, Grade A1 or Grade A4)** hex nuts and, where indicated, flat washers.
- G. Postinstalled Anchors: Stainless steel, **[chemical][or][torque-controlled expansion]** anchors with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing in accordance with ASTM E488/E488M conducted by a qualified independent testing and inspecting agency.
 - 1. Stainless steel bolts and nuts complying with **ASTM F593 and ASTM F594, Alloy Group 1 or 2 (ASTM F738M and ASTM F836M, Grade A1 or Grade A4)**.

2.11 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, Hanging Strips, and Nailers: Softwood or hardwood lumber[, **pressure-preservative treated**][, **fire-retardant treated**], kiln dried to less than 15 percent moisture content.
 - 1. Wood-Preservative Treatment: By pressure process, AWP A U1; Use Category UC3b.
 - a. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
 - b. Preservative Chemicals: Acceptable to authorities having jurisdiction[**and containing no arsenic or chromium**].
 - c. Mark lumber with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee's (ALSC) Board of Review.
 - 2. Fire-Retardant Treatment: Complying with requirements; provide **[where indicated on Drawings]<Insert requirements>**.
- B. Adhesives: Do not use adhesives that contain urea formaldehyde.
- C. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. Adhesives: Do not use adhesives that contain urea formaldehyde.
- F. Adhesives: Do not use adhesives that contain urea formaldehyde.
- G. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.
 - 1. Adhesives shall have a VOC content of **[70]<Insert value>** g/L or less.
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical

- Emissions from Indoor Sources Using Environmental Chambers."
4. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 5. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 6. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit or 33 mcg/cu. m and that of acetaldehyde shall not exceed 9 mcg/cu. m.

2.12 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate ornamental woodwork to dimensions, profiles, and details indicated.
 1. Ease edges to radius indicated for the following:
 - a. Edges of Solid-Wood (Lumber) Members: **1/16 inch (1.5 mm)** unless otherwise indicated.
 - b. Edges of Rails and Similar Members More Than **3/4 inch (19 mm)** Thick: **1/8 inch (3 mm)**.
- C. Complete fabrication, including assembly[**and finishing**], to maximum extent possible before shipment to Project site.
 1. Disassemble components only as necessary for shipment and installation.
 2. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 3. Notify Architect seven days in advance of the dates and times ornamental woodwork fabrication will be complete.
 4. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.
 - a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
 - b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

2.13 SHOP PRIMING

- A. Preparations for Finishing: Comply with the Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing ornamental woodwork, as applicable to each unit of work.
- B. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of ornamental woodwork.[**Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.**]
- C. Exterior Ornamental Woodwork for Opaque Finish: Shop prime all surfaces with one coat of wood primer specified in Section 099113 "Exterior Painting."
- D. Exterior Ornamental Woodwork for Transparent Finish:

1. Shop seal surfaces to be concealed.
2. Shop seal exposed surfaces with stain (if specified), other required pretreatments, and first coat of finish as specified in Section 099300 "Staining and Transparent Finishing."

E. Interior Ornamental Woodwork for Opaque Finish: Shop prime with one coat of wood primer specified in Section 099123 "Interior Painting."

1. Backpriming: Apply one coat of primer, compatible with finish coats, to concealed surfaces of woodwork. **[Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.]**

F. Interior Ornamental Woodwork for Transparent Finish: Shop seal with stain (if required), other required pretreatments, and first coat of finish as specified in Section 099300 "Staining and Transparent Finishing."

1. Backpriming: Apply one coat of sealer, compatible with finish coats, to concealed surfaces of woodwork. **[Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.]**

2.14 SHOP FINISHING

A. Finish ornamental woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. Shop finish transparent-finished ornamental woodwork at fabrication shop as specified in this Section. Refer to **[Section 099113 "Exterior Painting"]** and **[Section 099123 "Interior Painting"]** for field finishing opaque-finished ornamental woodwork.

C. Drawings indicate items that are required to be shop finished. Finish such items at fabrication shop as specified in this Section. Refer to **[Section 099113 "Exterior Painting"]** **[Section 099123 "Interior Painting"]** and **[Section 099300 "Staining and Transparent Finishing"]** for field finishing ornamental woodwork not indicated to be shop finished.

D. Transparent Finish for Exterior Items: Comply with Section 099300 "Staining and Transparent Finishing."

E. Opaque Finish for Exterior Items: Comply with Section 099113 "Exterior Painting."

F. Transparent Finish for Interior Items:

1. Architectural Woodwork Standards Grade: **[Premium][Custom][Economy][Same as item to be finished]**.
2. Finish System - 1: Lacquer, Nitrocellulose.
3. Finish System - 2: Lacquer, Pre Catalyzed.
4. Finish System - 3: Lacquer, Post Catalyzed.
5. Finish System - 4: Latex Acrylic, Water-Based.
6. Finish System - 5: Varnish, Conversion.
7. Finish System - 6: Oil, Synthetic Penetrating.
8. Finish System - 7: Vinyl, Catalyzed.
9. Finish System - 8: Acrylic Cross Linking, Water-Based.
10. Finish System - 9: UV Curable, Acrylated Epoxy, Polyester, or Urethane.
11. Finish System - 10: UV curable, Water-Based.
12. Finish System - 11: Polyurethane, Catalyzed.
13. Finish System - 12: Polyurethane, Water-Based.

14. Finish System - 13: Polyester, Catalyzed.
15. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
16. Staining: **[None required][Match approved sample for color][Match Architect's sample]**.
17. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
18. Filled Finish for Open-Grain Woods: **[After staining, apply wash-coat sealer and allow to dry.]** Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
19. Sheen: **[Flat, 8-14][Satin, 15-25][Satin Gloss, 26-49][Semigloss, 50-70][Gloss, 71-90]** gloss units measured on 60-degree gloss meter in accordance with ASTM D523.

G. Opaque Finish for Interior Items:

1. Architectural Woodwork Standards Grade: **[Premium][Custom][Economy][Same as item to be finished]**.
2. Finish System - 1: Lacquer, Nitrocellulose.
3. Finish System - 2: Lacquer, Pre Catalyzed.
4. Finish System - 3: Lacquer, Post Catalyzed Lacquer.
5. Finish System - 4: Latex Acrylic, Water-Based.
6. Finish System - 5: Varnish, Conversion.
7. Finish System - 7: Vinyl, Catalyzed.
8. Finish System - 8: Acrylic Cross Linking, Water-Based.
9. Finish System - 9: UV Curable, Acrylated Epoxy, Polyester, or Urethane.
10. Finish System - 10: UV Curable, Water-Based.
11. Finish System - 11: Polyurethane, Catalyzed.
12. Finish System - 12: Polyurethane, Water-Based.
13. Finish System - 13: Polyester, Catalyzed.
14. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]**.
15. Sheen: **[Flat, 8-14][Satin, 15-25][Satin Gloss, 26-49][Semigloss, 50-70][Gloss, 71-90]** gloss units measured on 60-degree gloss meter in accordance with ASTM D523.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition ornamental woodwork to average prevailing humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.
- B. Before installing ornamental woodwork, examine shop-fabricated work for completion, and complete work as required, including removing packing and backpriming concealed surfaces.

3.2 INSTALLATION

- A. Grade: Install ornamental woodwork to comply with same grade as item to be installed.
- B. Assemble ornamental woodwork, and complete fabrication at Project site to the extent that it was not completed during shop fabrication.
- C. Install ornamental woodwork level, plumb, true in line, and without distortion.
 1. Shim as required with concealed shims.
 2. Install level and plumb to a tolerance of **1/8 inch in 96 inches (3 mm in 2400 mm)**.

- D. Scribe and cut ornamental woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Preservative-Treated Wood: Where cut or drilled, treat cut ends and drilled holes in accordance with AWPA M4.
- F. Fire-Retardant-Treated Wood: Install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- G. Anchor ornamental woodwork to anchors or blocking built in or directly attached to substrates.
 - 1. Secure with countersunk, concealed fasteners and blind nailing.
 - 2. Use fine finishing nails[**or finishing screws**] for exposed fastening, countersunk and filled flush with ornamental woodwork.
 - 3. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced and with adjacent rows staggered.
 - 4. For shop-finished items, use filler matching finish of items being installed.

3.3 FIELD QUALITY CONTROL

- A. Inspections: Provide inspection of installed Work through **[AWI's Quality Certification Program][WI's Certified Compliance Program]** certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
 - 1. Inspection entity is to prepare and submit report of inspection.

3.4 REPAIR

- A. Repair damaged and defective ornamental woodwork, where possible, to eliminate functional and visual defects[**and to result in interior ornamental woodwork being in compliance with requirements of Architectural Woodwork Standards for the specified grade**].
- B. Where not possible to repair, replace defective Work.
- C. Shop Finish: Touch up finishing work specified in this Section after installation of ornamental woodwork.
 - 1. Fill nail holes with matching filler where exposed.
 - 2. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.
- D. Field Finish: See **[Section 099123 "Interior Painting"]**[and]**[Section 099300 "Staining and Transparent Finishing"]** for final finishing of installed ornamental woodwork not indicated to be shop finished.

END OF SECTION 06 44 00 00



Task	Specification	Specification Description
06 44 00 00	06 40 00 00	Exterior Architectural Woodwork
06 44 00 00	06 40 00 00a	Interior Architectural Woodwork
06 44 39 00	06 40 00 00	Exterior Architectural Woodwork
06 44 39 00	06 40 00 00a	Interior Architectural Woodwork
06 44 39 00	06 44 00 00	Ornamental Woodwork
06 46 00 00	06 40 00 00	Exterior Architectural Woodwork
06 46 00 00	06 40 00 00a	Interior Architectural Woodwork
06 46 13 00	06 20 00 00	Exterior Finish Carpentry
06 46 13 00	06 20 00 00a	Interior Finish Carpentry
06 46 13 00	06 40 00 00	Exterior Architectural Woodwork
06 46 13 00	06 40 00 00a	Interior Architectural Woodwork
06 46 19 00	01 11 19 00	No Specification Required
06 46 19 00	06 20 00 00	Exterior Finish Carpentry
06 46 19 00	06 20 00 00a	Interior Finish Carpentry
06 46 19 00	06 40 00 00	Exterior Architectural Woodwork
06 46 19 00	06 40 00 00a	Interior Architectural Woodwork
06 46 23 00	06 40 00 00	Exterior Architectural Woodwork
06 46 23 00	06 40 00 00a	Interior Architectural Woodwork
06 46 26 00	06 40 00 00	Exterior Architectural Woodwork
06 46 26 00	06 40 00 00a	Interior Architectural Woodwork
06 46 29 00	06 40 00 00	Exterior Architectural Woodwork
06 46 29 00	06 40 00 00a	Interior Architectural Woodwork
06 48 00 00	06 40 00 00	Exterior Architectural Woodwork
06 48 00 00	06 40 00 00a	Interior Architectural Woodwork
06 48 13 00	06 40 00 00	Exterior Architectural Woodwork
06 48 13 00	06 40 00 00a	Interior Architectural Woodwork
06 48 16 00	06 40 00 00	Exterior Architectural Woodwork
06 48 16 00	06 40 00 00a	Interior Architectural Woodwork
06 49 00 00	06 40 00 00	Exterior Architectural Woodwork
06 49 00 00	06 40 00 00a	Interior Architectural Woodwork
06 49 19 00	06 40 00 00	Exterior Architectural Woodwork
06 49 19 00	06 40 00 00a	Interior Architectural Woodwork



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SECTION 06 74 13 00 - FIBERGLASS REINFORCED GRATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass-fiber-reinforced plastic gratings.
 - 2. Grating frames and supports.

1.2 COORDINATION

- A. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For glass-fiber-reinforced plastic gratings.
- B. Shop Drawings: Include plans, sections, details, and attachments to other work.
- C. Delegated Design Submittal: For gratings, including **[manufacturer's published load tables] [analysis data signed and sealed by the qualified professional engineer responsible for their preparation]**.

1.4 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design gratings.
- B. Structural Performance: Gratings are to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
 - 1. Uniform load of 125 lbf/sq. ft. (6.00 kN/sq. m) or concentrated load of 2000 lbf (8.90 kN), whichever produces the greater stress.
 - 2. Uniform load of 250 lbf/sq. ft. (11.97 kN/sq. m) or concentrated load of 3000 lbf (13.40 kN), whichever produces the greater stress.
 - 3. Walkways and Elevated Platforms Other Than Exits: Uniform load of 60 lbf/sq. ft. (2.87 kN/sq. m).

4. Walkways and Elevated Platforms Used as Exits: Uniform load of 100 lbf/sq. ft. (4.79 kN/sq. m).
5. Sidewalks and Vehicular Driveways, Subject to Trucking: Uniform load of 250 lbf/sq. ft. (11.97 kN/sq. m) or concentrated load of 8000 lbf (35.60 kN), whichever produces the greater stress.
6. Limit deflection to **[L/360]** **<Insert deflection ratio>** or 1/4 inch (6.4 mm), whichever is less.

C. Seismic Performance: Gratings are to withstand the effects of earthquake motions determined in accordance with **[ASCE/SEI 7]** **<Insert requirement>**.

1. Component Importance Factor: 1.5.

2.2 GLASS-FIBER-REINFORCED PLASTIC GRATINGS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Molded Glass-Fiber-Reinforced Gratings: Bar gratings made by placing glass-fiber strands that have been saturated with thermosetting plastic resin in molds in alternating directions to form interlocking bars without voids and with a high resin content.

1. Configuration: **[1-1/2-inch- (38-mm-) square mesh, 1 inch (25 mm) thick]** **[1-1/2-inch- (38-mm-) square mesh, 1-1/4 inches (32 mm) thick]** **[1-1/2-inch- (38-mm-) square mesh, 1-1/2 inches (38 mm) thick]** **[2-inch- (51-mm-) square mesh, 2 inches (51 mm) thick]** **[1-1/2-inch- (38-mm-) square mesh, thickness as required to comply with structural performance requirements]** **[As required to comply with structural performance requirements]** **<Insert configuration>**.
2. Weight: **[2.5 lb/sq. ft. (12.2 kg/sq. m)]** **[2.7 lb/sq. ft. (13.2 kg/sq. m)]** **[3.2 lb/sq. ft. (15.6 kg/sq. m)]** **[3.5 lb/sq. ft. (17.1 kg/sq. m)]** **[3.7 lb/sq. ft. (18.1 kg/sq. m)]** **[4.1 lb/sq. ft. (20.0 kg/sq. m)]** **[5.0 lb/sq. ft. (24.4 kg/sq. m)]** **<Insert value>**.
3. Resin: **[Polyester]** **[Vinylester]** **<Insert description>**.
 - a. Flame-Spread Index: 25 or less when tested in accordance with ASTM E84.
 - b. USDA Acceptance: Accepted for food-processing applications.
4. Color: **[Beige]** **[Gray]** **[Green]** **[Orange]** **[Yellow]** **[Manufacturer's standard]**.
5. Traffic Surface: **[Plain, meniscus]** **[Applied abrasive finish]** **[As indicated]**.

C. Pultruded Glass-Fiber-Reinforced Gratings: Bar gratings assembled from components made by simultaneously pulling glass fibers and extruding thermosetting plastic resin through a heated die under pressure to produce a product without voids and with a high glass-fiber content.

1. Configuration: **[I4010; 1-inch (25-mm) I-bars spaced 1 inch (25 mm) o.c. (40 percent open)]** **[I6010; 1-inch (25-mm) I-bars spaced 1-1/2 inches (38 mm) o.c. (60 percent open)]** **[I4015; 1-1/2-inch (38-mm) I-bars spaced 1 inch (25 mm) o.c. (40 percent open)]** **[I6015; 1-1/2-inch (38-mm) I-bars spaced 1-1/2 inches (38 mm) o.c. (60 percent open)]** **[T3320; 2-inch (51-mm) T-bars spaced 1-1/2 inches (38 mm) o.c. (33 percent open)]** **[T5020; 2-inch (51-mm) T-bars spaced 2 inches (51 mm) o.c. (50 percent open)]** **[As required to comply with structural performance requirements]** **<Insert configuration>**.
2. Weight: **[2.35 lb/sq. ft. (11.5 kg/sq. m)]** **[2.83 lb/sq. ft. (13.8 kg/sq. m)]** **[3.10 lb/sq. ft. (15.1 kg/sq. m)]** **[3.41 lb/sq. ft. (16.6 kg/sq. m)]** **[4.10 lb/sq. ft. (20.0 kg/sq. m)]** **[4.13 lb/sq. ft. (20.2 kg/sq. m)]** **<Insert value>**.
3. Resin Type: **[Polyester]** **[Vinylester]** **<Insert description>**.
 - a. Flame-Spread Index: 25 or less when tested in accordance with ASTM E84.
 - b. USDA Acceptance: Accepted for food-processing applications.

4. Color: **[Beige] [Gray] [Green] [Orange] [Yellow] [Manufacturer's standard]**.
5. Traffic Surface: **[Plain, grooved] [Applied abrasive finish] [As indicated]**.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide **[Type 304] [Type 316]** stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ISO 898-1, Property Class 4.6); with hex nuts, ASTM A563/A563M; and, where indicated, flat washers.
- C. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, nuts, and, where indicated, flat washers; ASTM F593 (ISO 3506-1) for bolts and ASTM F594 (ISO 3506-1) for nuts, Alloy **[Group 1 (A1)] [Group 2 (A4)]**.
- D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563/A563M; and, where indicated, flat washers.
- E. Post-Installed Anchors: **[Torque-controlled expansion anchors] [or] [chemical anchors]** capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
 1. Material for Interior Locations: Carbon-steel components are zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: ASTM F593 (ISO-3506-1) for bolts and ASTM F594 (ISO 3506-1) for nuts, Alloy **[Group 1 (A1)] [Group 2 (A4)]**.

2.4 FABRICATION

- A. Shop Assembly: Shop fabricate grating sections to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form gratings from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- D. Fit exposed connections accurately together to form hairline joints.
- E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
- F. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.

2.5 GRATING FRAMES AND SUPPORTS

- A. Frames and Supports for Glass-Fiber-Reinforced Plastic Gratings: Fabricate from glass-fiber-reinforced plastic shapes of sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
 - 1. Unless otherwise indicated, use shapes made from same resin as gratings.
 - 2. Equip units indicated to be cast into concrete or built into masonry with integral anchors.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.

3.2 INSTALLATION OF GLASS-FIBER-REINFORCED PLASTIC GRATINGS

- A. Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard stainless steel anchor clips and hold-down devices for bolted connections.

END OF SECTION 06 74 13 00



06 - Wood, Plastics, and Composites

Task	Specification	Specification Description
06 74 13 00	05 53 13 00	Bar Gratings



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SECTION 07 01 50 19 - PREPARATION FOR REROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of This Section Includes:

1. Full roof tear-off.
2. Partial roof tear-off.
3. Temporary roofing.
4. Roof re-cover preparation.
5. Base flashing removal.
6. Fastener pull-out testing.
7. Disposal.

B. Related Requirements:

1. Section 011000 "Summary" for use of premises and for phasing requirements.
2. Section 015000 "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for reroofing preparation.

1.2 ALLOWANCES

- A. Allowance for removal of existing wet insulation, and replacement with new insulation, is specified under Section 012100 "Allowances."
- B. Allowance for removal of existing deteriorated metal roof deck, and replacement with new metal roof deck, is specified under Section 012100 "Allowances."
- C. Allowance for removal of existing deteriorated wood roof deck, and replacement with new wood deck, is specified under Section 012100 "Allowances."
- D. Allowance for removal of existing deteriorated wood nailers and curbs, and replacement with new wood, is specified under Section 012100 "Allowances."
- E. Allowance for removal of existing deteriorated parapet wall sheathing, and replacement with new sheathing, is specified under Section 012100 "Allowances."

1.3 UNIT PRICES

- A. Work of this Section is affected by [insulation removal and replacement unit price][metal deck removal and replacement unit price][roof sheathing removal and replacement unit price][and][parapet wall sheathing removal and replacement unit price]<Insert name of unit price>.

1.4 DEFINITIONS

- A. EPS: Molded (expanded) polystyrene.

- B. Full Roof Tear-off: Removal of existing roofing system down to existing **[roof deck][concrete fill]**.
- C. OSB: Oriented strand board.
- D. Partial Roof Tear-off: Removal of selected components and accessories from existing roofing system.
- E. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.
- F. Roof Re-Cover Preparation: Existing roofing system is to remain and be prepared for new roof installed over it.

1.5 PREINSTALLATION MEETINGS

- A. Preliminary Roofing Conference: Before starting removal Work, conduct conference at **[Project site]<Insert location>**.
 - 1. Meet with Owner, Architect, **[Construction Manager,]** Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing tear-off, including, but not limited to, the following:
 - a. Reroofing preparation, including roofing system manufacturer's written instructions.
 - b. Temporary protection requirements for existing roofing system components that are to remain.
 - c. Existing roof drains and roof drainage during each stage of reroofing, and roof-drain plugging and plug removal.
 - d. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to avoid delays.
 - e. Existing roof deck conditions requiring Architect notification.
 - f. Existing roof deck removal procedures and Owner notifications.
 - g. Condition and acceptance of existing roof deck and base flashing substrate for reuse.
 - h. Structural loading limitations of roof deck during reroofing.
 - i. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that affect reroofing.
 - j. HVAC shutdown and sealing of air intakes.
 - k. Shutdown of fire-suppression, -protection, and -alarm and -detection systems.
 - l. Asbestos removal and discovery of asbestos-containing materials.
 - m. Governing regulations and requirements for insurance and certificates if applicable.
 - n. Existing conditions that may require Architect notification before proceeding.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Temporary Roofing Submittal: Product data and description of temporary roofing system.
 - 1. If temporary roof remains in place, include surface preparation requirements needed to receive permanent roof, and submit a letter from roofing manufacturer stating acceptance of the temporary roof and that its inclusion does not adversely affect the new roofing system's resistance to fire and wind **[or specified special warranty][or its FM Approvals rating]**.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
 - 1. Include certificate that Installer is approved by warrantor of existing roofing system.
 - 2. Include certificate that Installer is licensed to perform asbestos abatement.
- B. Field Test Reports: Fastener pull-out test report.
- C. Photographs or Video: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, that might be misconstrued as having been damaged by reroofing operations.
 - 1. Submit before Work begins.
- D. Landfill Records: Indicate receipt and acceptance of **demolished roofing materials and** hazardous wastes, such as asbestos-containing materials, by a landfill facility licensed to accept them.

1.8 CLOSEOUT SUBMITTALS

- A. Certified statement from **<Insert name of manufacturer for existing warranted roof system>** stating that existing roof warranty has not been affected by Work performed under this Section.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: **[Approved by warrantor of existing roofing system to work on existing roofing][and][licensed to perform asbestos abatement in the state or jurisdiction where Project is located]**.
- B. Regulatory Requirements:
 - 1. Comply with governing EPA notification regulations before beginning roofing removal.
 - 2. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.10 FIELD CONDITIONS

- A. Existing Roofing System: **[Built-up asphalt][Built-up coal-tar][APP-modified bituminous][SBS-modified bituminous][EPDM][CSPE][KEE][PVC][TPO][APP-modified bituminous protected membrane][SBS-modified bituminous protected membrane][Fluid-applied protected membrane][Coated foamed]<Insert roof type>** roofing.
- B. Owner **[will][will not]** occupy portions of building immediately below reroofing area.
 - 1. Conduct reroofing so Owner's operations are not disrupted.
 - 2. Provide Owner with not less than **[72]<Insert number>** hours' written notice of activities that may affect Owner's operations.
 - 3. Coordinate work activities daily with Owner so Owner has adequate advance notice to place protective dust and water-leakage covers over sensitive equipment and furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below work area.
 - 4. Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below affected area.



- a. Verify that occupants below work area have been evacuated before proceeding with work over impaired deck area.
- C. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.
- D. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
- E. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.
 - 1. A roof moisture survey of existing roofing system is available for Contractor's reference.
 - 2. The results of an analysis of test cores from existing roofing system are available for Contractor's reference.
 - 3. Construction Drawings[**and Project Manual**] for existing roofing system are provided for Contractor's convenience and information, but they are not a warranty of existing conditions. They are intended to supplement rather than serve in lieu of Contractor's own investigations. Contractor is responsible for conclusions derived from existing documents.
- F. Limit construction loads on existing roof areas to remain, and existing roof areas scheduled to be reroofed to **<Insert load>** for rooftop equipment wheel loads and **<Insert load>** for uniformly distributed loads.
- G. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.
 - 1. Remove only as much roofing in one day as can be made watertight in the same day.
- H. Hazardous Materials:
 - 1. It is not expected that hazardous materials, such as asbestos-containing materials, will be encountered in the Work.
 - a. Hazardous materials will be removed by Owner before start of the Work.
 - b. Existing roof will be left no less watertight than before removal.
 - 2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.
 - a. Hazardous materials will be removed by Owner under a separate contract.
 - 3. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
 - a. Hazardous material remediation is specified elsewhere in the Contract Documents.
 - b. Do not disturb hazardous materials or items suspected of containing hazardous materials except according to procedures specified elsewhere in the Contract Documents.
 - c. Coordinate reroofing preparation with hazardous material remediation to prevent water from entering existing roofing system or building.

1.11 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during reroofing, by methods and with materials so as not to void existing roofing system warranty issued by

<Insert name of manufacturer for existing warranted roof system>.

1. Notify warrantor before proceeding with the Work.
2. Notify warrantor of existing roofing system on completion of reroofing, and obtain documentation verifying that existing roofing system has been inspected and warranty remains in effect.
 - a. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 TEMPORARY PROTECTION MATERIALS

- A. EPS Insulation: ASTM C578.
- B. Plywood: DOC PS 1, Grade CD, Exposure 1.
- C. OSB: DOC PS 2, Exposure 1.

2.2 TEMPORARY ROOFING MATERIALS

- A. Design and selection of materials for temporary roofing are Contractor's responsibilities.
- B. Sheathing Paper: Red-rosin type, minimum **3 lb/100 sq. ft. (0.16 kg/sq. m)**.
- C. Base Sheet: ASTM D4601/D4601M, Type II, nonperforated, asphalt-impregnated and -coated, glass-fiber sheet.
- D. Glass-Fiber Felts: ASTM D2178/D2178M, Type IV, asphalt-impregnated, glass-fiber felt.
- E. Asphalt Primer: ASTM D41/D41M.
- F. Roofing Asphalt: ASTM D312/D312M, Type III or IV.
- G. Base Sheet Fasteners: Capped head, factory-coated steel fasteners, listed in FM Approvals' RoofNav.

2.3 INFILL AND REPLACEMENT MATERIALS

- A. Use infill materials matching existing roofing system materials unless otherwise indicated.
 1. Infill materials are specified in [Section 075113 "Built-up Asphalt Roofing"] [Section 075116 "Built-up Coal Tar Roofing"] [Section 075213 "Atactic-Polypropylene (APP) Modified Bituminous Membrane Roofing"] [Section 075216 "Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing"] [Section 075316 "Chlorosulfonate-Polyethylene (CSPE) Roofing"] [Section 075323 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing"] [Section 075416 "Ketone Ethylene Ester (KEE) Roofing"] [Section 075419 "Polyvinyl-Chloride (PVC) Roofing"] [Section 075423 "Thermoplastic-Polyolefin (TPO) Roofing"] unless otherwise indicated.
- B. Steel deck is specified in Section 053100 "Steel Decking."
- C. Wood blocking, curbs, and nailers are specified in Section 061000 "Rough Carpentry."

- D. Plywood roof sheathing is specified in Section 061600 "Sheathing."
- E. Parapet Sheathing:
 - 1. ASTM C1177/C1177M or ASTM C1278/C1278M water-resistant gypsum substrate; [1/4 inch (6 mm)][3/8 inch (10 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)] thick.
 - 2. **[Pressure-preservative][Exterior fire-retardant]**-treated plywood wall sheathing, [19/32 inch (15 mm)]<Insert dimension> thick, complying with Section 061600 "Sheathing."
- F. Fasteners: Factory-coated steel fasteners with metal or plastic plates listed in FM Approvals' RoofNav, and acceptable to new roofing system manufacturer.

2.4 AUXILIARY REROOFING MATERIALS

- A. General: Use auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of **[existing and]**new roofing system.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 - 1. Protect existing roofing system that is not to be reroofed.
 - 2. Loosely lay **1-inch- (25-mm-)** minimum thick, EPS insulation over existing roofing in areas not to be reroofed.
 - a. Loosely lay **15/32-inch (12-mm)** plywood or OSB panels over EPS. Extend EPS past edges of plywood or OSB panels a minimum of **1 inch (25 mm)**.
 - 3. Limit traffic and material storage to areas of existing roofing that have been protected.
 - 4. Maintain temporary protection and leave in place until replacement roofing has been completed. Remove temporary protection on completion of reroofing.
 - 5. Comply with requirements of existing roof system manufacturer's warranty requirements.
- B. Seal or isolate windows that may be exposed to airborne substances created in removal of existing materials.
- C. Shut off rooftop utilities and service piping before beginning the Work.
- D. Test existing roof drains to verify that they are not blocked or restricted.
 - 1. Immediately notify Architect of any blockages or restrictions.
- E. Coordinate with Owner to shut down air-intake equipment in the vicinity of the Work.
 - 1. Cover air-intake louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.
- F. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.

- G. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday.
 - 1. Prevent debris from entering or blocking roof drains and conductors.
 - a. Use roof-drain plugs specifically designed for this purpose.
 - b. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.
 - 2. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new roofing system, provide alternative drainage method to remove water and eliminate ponding.
 - a. Do not permit water to enter into or under existing roofing system components that are to remain.

3.2 ROOF TEAR-OFF

- A. Notify Owner each day of extent of roof tear-off proposed for that day[**and obtain authorization to proceed**].
- B. Lower removed roofing materials to ground and onto lower roof levels, using dust-tight chutes or other acceptable means of removing materials from roof areas.
- C. Remove aggregate ballast from roofing.[**Store aggregate ballast for reuse in manner not to exceed structural loading limitations of roof deck.**]
- D. Remove loose aggregate from aggregate-surfaced, built-up bituminous roofing using a power broom.
- E. Remove pavers and accessories from roofing.
 - 1. Store and protect pavers and accessories for reuse in manner not to exceed structural loading limitations of roof deck.
 - 2. Discard cracked pavers.
- F. Remove ballast, protection mat, and EPS insulation from protected roofing membrane.
 - 1. Discard EPS insulation that is damaged or exceeds [8 lb/cu. ft. (128 kg/cu. m)]<Insert value>.
 - 2. Store EPS insulation for reuse and protect it from physical damage.
 - 3. Store ballast for reuse in manner not to exceed structural loading limitations of roof deck.
- G. Full Roof Tear-off: [Where indicated on Drawings, remove][Remove] existing roofing and other roofing system components down to the existing [roof deck][concrete fill].
 - 1. Remove [substrate board][vapor retarder][roof insulation][and][cover board].
 - 2. Remove base flashings and counter flashings.
 - 3. Remove perimeter edge flashing and gravel stops.
 - 4. Remove copings.
 - 5. Remove expansion-joint covers.
 - 6. Remove flashings at pipes, curbs, mechanical equipment, and other penetrations.
 - 7. Remove roof drains indicated on Drawings to be removed.
 - 8. Remove wood blocking, curbs, and nailers.
 - 9. Bitumen and felts that are firmly bonded to concrete decks are permitted to remain if felts are dry.
 - a. Remove unadhered bitumen, unadhered felts, and wet felts.

10. Remove excess asphalt from steel deck.
 - a. A maximum of **15 lb/100 sq. ft. (0.72 kg/sq. m)** of asphalt is permitted to remain on steel decks.
11. Remove fasteners from deck **[or cut fasteners off slightly above deck surface]**.
- H. Partial Roof Tear-off: **[Where indicated on Drawings, remove][Remove]** existing roofing down to **[existing cover board][existing insulation]<Insert substrate>** and immediately check for presence of moisture.
 1. **[Engage][Owner will engage]** a qualified testing agency to perform the following test:
 - a. Coordinate with Owner's testing agency to schedule times for tests and inspections immediately after removal.
 2. Survey exposed substrate that is to remain using infrared color thermography according to ASTM C1153.
 - a. Prepare survey report of initial scan indicating locations of entrapped moisture, if any, and area calculations of locations of entrapped moisture.
 3. Survey exposed substrate that is to remain using electrical capacitance/impedance testing according to ASTM D7954/D7954M.
 - a. Prepare survey report indicating locations of entrapped moisture, if any, and area calculations of locations of entrapped moisture.
 4. Survey exposed substrate that is to remain using nuclear hydrogen detection testing according to SPRI/RCI NT-1.
 - a. Prepare survey report indicating locations of entrapped moisture, if any, and area calculations of locations of entrapped moisture.
 5. Remove wet or damp materials below existing roofing and above deck as directed by Architect.
 - a. **[Removal is paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.]**
 6. Inspect wood blocking, curbs, and nailers for deterioration and damage.
 - a. If wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.
 - b. **[Removal is paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.]**
 7. Bitumen and felts that are firmly bonded to concrete decks are permitted to remain if felts are dry.
 - a. Remove unadhered bitumen, unadhered felts, and wet felts.
 8. Remove excess asphalt from steel deck that is exposed by removal of wet or damp materials.
 - a. A maximum of **15 lb/100 sq. ft. (0.72 kg/sq. m)** of asphalt is permitted to remain on steel decks.

9. Remove fasteners from deck[**or cut fasteners off slightly above deck surface**].

3.3 DECK PREPARATION

- A. Inspect deck after tear-off of roofing system.
- B. If broken or loose fasteners that secure deck panels to one another or to structure are observed, or if deck appears or feels inadequately attached, immediately notify Architect.
 1. Do not proceed with installation until directed by Architect.
- C. If deck surface is unsuitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Architect.
 1. Do not proceed with installation until directed by Architect.
- D. Provide additional deck securement as indicated on Drawings.
- E. Replace steel deck as indicated on Drawings.
- F. Replace steel deck as directed by Architect.
 1. Deck replacement will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.
- G. Prepare and paint steel deck surface.
 1. Painting and preparation for painting is specified in Section 099113 "Exterior Painting."
- H. Replace plywood roof sheathing as indicated on Drawings.
- I. Replace plywood roof sheathing as directed by Architect.
 1. Roof sheathing replacement will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.

3.4 INFILL MATERIALS INSTALLATION

- A. Immediately after roof tear-off, and inspection and repair, if needed, of deck, fill in tear-off areas to match existing roofing system construction.
 1. Installation of infill materials is specified in [**Section 075113 "Built-up Asphalt Roofing."**][**Section 075116 "Built-up Coal Tar Roofing."**][**Section 075213 "Atactic-Polypropylene (APP) Modified Bituminous Membrane Roofing."**][**Section 075216 "Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing."**][**Section 075316 "Chlorosulfonate-Polyethylene (CSPE) Roofing."**][**Section 075323 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing."**][**Section 075416 "Keytone Ethylene Ester (KEE) Roofing."**][**Section 075419 "Polyvinyl-Chloride (PVC) Roofing."**][**Section 075423 "Thermoplastic-Polyolefin (TPO) Roofing."**]
 2. Installation of wood blocking, curbs, and nailers is specified in Section 061000 "Rough Carpentry."
- B. Install new roofing patch over roof infill area.

1. If new roofing is installed the same day tear-off is made, roofing patch is not required.

3.5 TEMPORARY ROOFING

- A. Install approved temporary roofing over area to be reroofed.
- B. Install temporary roofing over area to be reroofed.
 1. **[Install two glass-fiber felts][Mechanically fasten base sheet and install a glass-fiber felt]**, lapping each sheet **19 inches (483 mm)** over preceding sheet.
 2. Embed glass-fiber felt in a solid mopping of hot roofing asphalt applied within equiviscous temperature range.
 3. Glaze-coat completed surface with hot roofing asphalt.
- C. Remove temporary roofing before installing new roofing.
- D. Prepare temporary roof to receive new roofing **[according to approved temporary roofing proposal][by patching and repairing temporary roofing]<Insert preparation method>**.
 1. Restore temporary roofing to watertight condition.
 2. Obtain approval for temporary roof substrate from roofing manufacturer and Architect before installing new roof.

3.6 ROOF RE-COVER PREPARATION

- A. Remove blisters, ridges, buckles, **[mechanically attached roofing fastener buttons projecting above roofing,]** and other substrate irregularities from existing roofing that inhibit new recover boards from conforming to substrate.
 1. Remove loose aggregate from aggregate-surfaced, built-up bituminous roofing with a power broom.
 2. Scarify surface of sprayed polyurethane foam as necessary to achieve a sufficiently uniform plane to receive new recover boards.
 3. Broom clean existing substrate.
 4. Coordinate with Owner's inspector to schedule times for tests and inspections.
 5. Verify that existing substrate is dry.
 - a. Spot check substrates with an electrical capacitance moisture-detection meter.
 6. Remove materials that are wet or damp.
 - a. Removal will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.
- B. Remove blisters, ridges, buckles, **[mechanically attached roofing fastener buttons projecting above roofing,]** and other substrate irregularities from existing roofing that inhibit new **[recover boards][roofing]** from conforming to substrate.
 1. Remove loose aggregate from aggregate-surfaced, built-up bituminous roofing with a power broom.
 2. Shave surface of sprayed polyurethane foam as necessary to achieve a sufficiently uniform plane to receive new **[recover boards][roofing]**.

3. Broom clean existing substrate.
 4. Coordinate with Owner's inspector to schedule times for tests and inspections.
 5. Verify that existing substrate is dry before proceeding with installation.
 - a. Spot check substrates with an electrical capacitance moisture-detection meter.
 6. Remove materials that are wet and damp.
 - a. Removal will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.
 - C. Remove blisters and areas of roofing not fully adhered.
 - D. Remove[**mechanically attached roofing fastener buttons projecting above roofing and other**] substrate irregularities that inhibit new recover boards from conforming to substrate.
 1. Remove loose aggregate from aggregate-surfaced, built-up bituminous roofing with a power broom.
 2. Clean substrate of contaminants, such as dirt, debris, oil, and grease, that can affect adhesion of coated foamed roofing.
 3. Power vacuum the existing roof surface.
 - a. If recommended by foam manufacturer, prime dried surface at recommended rate with recommended primer.
 4. Scarify surface of coated polyurethane roofing as necessary to achieve a suitable substrate for new roofing.
 5. Provide additional uplift securement for existing roofing system with new screws and plates applied to each roof zone at the following densities:
 - a. Field of roof, one fastener for each **<Insert area>**.
 - b. Corners of roof, one fastener for each **<Insert area>**.
 - c. Perimeters of roof, one fastener for each **<Insert area>**. Width of perimeter zone of roof is **<Insert dimension>**.
 6. Verify that surface is dry by pressing litmus paper to surface areas most likely to retain moisture, such as shaded areas and low spots.
 - a. If paper changes color, surface is too wet to apply foam.
 7. Build up isolated low spots on existing roofing with sprayed foam specified in Section 075700 "Coated Foamed Roofing" to prevent ponding.
- 3.7 BASE FLASHING REMOVAL
- A. Remove existing base flashings.
 1. Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.
 - B. Do not damage metal counterflashings that are to remain.
 1. Replace metal counterflashings damaged during removal with counterflashings [**of same metal, weight or thickness, and finish as existing.**][specified in Section 076200 "Sheet Metal Flashing and Trim."][specified in Section 077100 "Roof Specialties."]

- C. Inspect parapet sheathing, wood blocking, curbs, and nailers for deterioration and damage.
 - 1. If parapet sheathing, wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.
- D. Remove existing parapet sheathing and replace with new parapet sheathing to comply with Section 061600 "Sheathing."
 - 1. If parapet framing, wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.
- E. When directed by Architect, replace parapet framing, wood blocking, curbs, and nailers to comply with **[Section 054000 "Cold-Formed Metal Framing."][Section 061000 "Rough Carpentry."]**

3.8 FASTENER PULL-OUT TESTING

- A. **[Perform][Retain independent testing and inspecting agency to conduct]** fastener pull-out tests according to SPRI FX-1, and submit test report to **[Architect][and][roofing manufacturer]** before installing new roofing system.
 - 1. Obtain **[Architect's][roofing manufacturer's]** approval to proceed with specified fastening pattern.
 - a. **[Architect][Roofing manufacturer]** may furnish revised fastening pattern commensurate with pull-out test results.

3.9 DISPOSAL

- A. Collect demolished materials and place in containers.
 - 1. Promptly dispose of demolished materials.
 - 2. Do not allow demolished materials to accumulate on-site.
 - 3. Storage or sale of demolished items or materials on-site is not permitted.
- B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION 07 01 50 19

SECTION 07 01 50 81 - BUILT-UP COAL TAR ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Built-up coal tar roofing.
2. Roofing membrane sheet materials.
3. Base flashing sheet materials.
4. Bitumen materials.
5. Accessory roofing materials.
6. Substrate board.
7. Vapor retarder.
8. Roof insulation.
9. Insulation accessories and cover board.
10. Electronic leak detection (ELD) materials.
11. Coating materials.
12. Walkways.

B. Section includes the installation of sound-absorbing insulation strips in ribs of roof deck. Sound-absorbing insulation strips are furnished under Section 053100 "Steel Decking."

C. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking, and for wood-based, structural-use roof deck panels.
2. Section 061600 "Sheathing" for wood-based, structural-use roof deck panels.
3. Section 072100 "Thermal Insulation" for insulation beneath the roof deck.
4. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
5. Section 077100 "Roof Specialties" for **[premanufactured copings][roof edge fasciae][gravel stops][reglets][roof edge flashings][counterflashings]**.
6. Section 077129 "Manufactured Roof Expansion Joints" for premanufactured roof expansion-joint assemblies.
7. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
8. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at **[Project site]<Insert location>**.

1. Meet with Owner, **[Construction Manager,]** Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative,

- deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

B. Preinstallation Roofing Conference: Conduct conference at **[Project site]<Insert location>**.

1. Meet with Owner, **[Construction Manager,]** Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Built-up coal tar roof system.
2. Roofing membrane sheet materials.
3. Base flashing sheet materials.
4. Bitumen materials.
5. Accessory roofing materials.
6. Substrate board.
7. Vapor retarder.
8. Roof insulation.
9. Insulation accessories and cover board.
10. Electronic leak detection (ELD) materials.
11. Coating materials.
12. Walkways.

B. Product Data Submittals:

1. For insulation and roof system component fasteners, include copy of **[FM Approvals' RoofNav][SPRI's Directory of Roof Assemblies]** listing.

- C. Sustainable Design Submittals:
 - 1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.
- D. Shop Drawings: Include plans, sections, details, and attachments to other work, including the following:
 - 1. Layout and thickness of insulation.
 - 2. Base flashings and built-up terminations.
 - 3. Flashing details at penetrations.
 - 4. Tapered insulation, including slopes.
 - 5. Roof plan showing orientation of steel roof deck and roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
 - 6. Crickets, saddles, and tapered edge strips, including slopes.
 - 7. Insulation-fastening patterns for corner, perimeter, and field-of-roof locations.
 - 8. Tie-in with adjoining air barrier.
- E. Samples for Verification: For the following products:
 - 1. Flashing Sheet: Samples of **[manufacturer's standard colors for selection by Architect][specified color]**.
 - 2. Aggregate surfacing material in gradation **[and color]** required.
 - 3. Walkway Pads or Rolls: Samples of **[manufacturer's standard colors for selection by Architect][specified color]**.
- F. Wind Uplift Resistance Submittal: For roofing system indicating compliance with wind uplift performance requirements.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[Installer][manufacturer][and][testing agency]**.
- B. Manufacturer Certificates:
 - 1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.
 - 2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- C. Product Test Reports: For roof insulation, tests performed by a qualified testing agency, indicating compliance with specified requirements.
- D. Evaluation Reports: For components of roofing system, from ICC-ES.
- E. Field Test Reports:
 - 1. Concrete internal relative humidity test reports.
 - 2. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.
- F. Field quality-control reports.

- G. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.
- B. Certified statement from existing roof membrane manufacturer, stating that existing roof warranty has not been affected by Work performed under this Section.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is **[UL listed][listed in FM Approvals' RoofNav][listed in SPRI's Directory of Roof Assemblies]** for roofing system identical to that used for this Project.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing manufacturer.
 - 1. Protect stored liquid material from direct sunlight.
 - 2. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources.
 - 1. Store in a dry location.
 - 2. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be installed in accordance with manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes roofing membrane, base flashings, [roof insulation,][fasteners,][cover boards,][vapor retarder][substrate board,][roof pavers,] and other components of roofing system.
 - 2. Warranty Period: [10][15][20]<Insert number> years from date of Substantial Completion.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system, such as roofing membrane, base flashing, [roof insulation,][fasteners,][cover boards,][substrate boards,][vapor retarders,][roof pavers] and [walkway products,] for the following warranty period:
 - 1. Warranty Period: [Two]<Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings to remain watertight.
 - 1. Accelerated Weathering: Roof membrane to withstand 2000 hours of exposure when tested in accordance with ASTM G152, ASTM G154, or ASTM G155.
 - 2. Impact Resistance: Roof membrane to resist impact damage when tested in accordance with ASTM D3746/D3746M, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- B. Material Compatibility: Roofing materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested in accordance with FM Approvals 4474, UL 580, or UL 1897:
 - 1. Zone 1 (Roof Area Field): <Insert lbf/sq. ft. (kPa)>.
 - 2. Zone 2 (Roof Area Perimeter): <Insert lbf/sq. ft. (kPa)>.
 - a. Location: From roof edge to <Insert dimension> inside roof edge.
 - 3. Zone 3 (Roof Area Corners): <Insert lbf/sq. ft. (kPa)>.
 - a. Location: <Insert dimension> in each direction from each building corner.
- D. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
 - 1. Fire/Windstorm Classification: [Class 1A-60][Class 1A-75][Class 1A-90][Class 1A-105][Class



1A-120]<Insert class>.

2. Hail-Resistance Rating: FM 1-34 **[MH][SH][VSH]**.

E. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in SPRI's Directory of Roof Assemblies for roof assembly identical to that specified for this Project.

1. Wind Uplift Load Capacity: **[60 psf][75 psf][90 psf][105 psf][120 psf]<Insert capacity>**.

F. Solar Reflectance Index: Not less than **[78][29]** when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

G. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][32]** or initial SRI not less than **[82][39]** when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

H. Solar Reflectance Index: Not less than **[78][29]** when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

I. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][15]** when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

J. Solar Reflectance Index: Not less than **[78][29]** when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

K. Energy Star Listing: Roofing system to be listed on the DOE's Energy Star "Roof Products Qualified Product List" for **[low][steep]**-slope roof products.

L. Energy Performance: Roofing system to have an initial solar reflectance of not less than **[0.70]<Insert value>** and an emissivity of not less than **[0.75]<Insert value>** when tested in accordance with ANSI/CRRS S100.

M. Exterior Fire-Test Exposure: ASTM E108 or UL 790, **[Class A][Class B][Class C]**; for application and roof slopes indicated; testing by a qualified testing agency.

1. Identify products with appropriate markings of applicable testing agency.

N. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated.

1. Identify products with appropriate markings of applicable testing agency.

2.2 BUILT-UP COAL TAR ROOFING

A. Built-up Coal Tar Roof System: See the following articles for individual roof materials required.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

a. **[Durapax LLC]**

b. **[Hickman Engineered Systems]**

- c. **[Koppers Performance Chemicals]**
 - d. **<Insert manufacturer's name>**
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Durapax LLC]**
 - b. **[Hickman Engineered Systems]**
 - c. **[Koppers Performance Chemicals]**
 - d. **<Insert manufacturer's name>**
- B. Source Limitations: Obtain components for roofing system from **[same manufacturer as roofing membrane][or][manufacturer approved by roofing membrane manufacturer]**.

2.3 ROOFING MEMBRANE SHEET MATERIALS

- A. Asphalt-Coated, Glass-Fiber-Mat Base Sheet: ASTM D4601/D4601M, **[Type I][Type II]**, nonperforated, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.
- B. Asphalt-Coated, Glass-Fiber-Mat Venting Base Sheet: ASTM D4897/D4897M, Type II, venting, nonperforated, asphalt-impregnated and -coated, glass-fiber base sheet with mineral granule surfacing on bottom surface.
- C. Asphalt-Coated, Organic-Felt Base Sheet: ASTM D2626/D2626M, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides.
- D. Organic-Felt Ply Sheet: ASTM D227/D227M, coal tar-saturated organic felt.
- E. Glass-Fiber Ply Sheet: ASTM D4990, Type I, coal-tar-impregnated, glass-fiber felt with the physical properties of ASTM D2178/D2178M, **[Type IV][Type VI]**.

2.4 BASE FLASHING SHEET MATERIALS

- A. Asphalt-Impregnated, Glass-Fiber-Mat Backer Sheet: ASTM D2178/D2178M, Type IV, asphalt-impregnated, glass-fiber felt.
- B. Polyester Backer Sheet: Roofing manufacturer's standard spun-bonded, nonwoven, polyester-reinforced fabric, of standard color and weight, suitable for application method specified.
- C. SBS-Modified Bitumen, Granule-Surfaced Flashing Sheet: ASTM D6164/D6164M, Type I or II, Grade G, polyester-reinforced, granule-surfaced base flashing; suitable for application method specified, and as follows:
 - 1. Granule Color: **[White][Gray][Tan]<Insert color>**.
- D. Polyester Flashing Sheet: Roofing manufacturer's standard asphalt-coated, polyester-reinforced fabric, base flashing, suitable for application method specified.
- E. Fabric Termination: Roofing manufacturer's standard polyester cloth, suitable for application and for reinforcing top seal of base flashing.

2.5 BITUMEN MATERIALS

- A. Asphalt Primer: ASTM D41/D41M.
- B. Coal Tar Primer: ASTM D43/D43M.
- C. Coal Tar Pitch: ASTM D450/D450M, Type I.
- D. Roofing Asphalt: ASTM D312/D312M, **[Type III][Type IV][Type III or IV as recommended by roofing system manufacturer for application]<Insert type>**.
- E. SEBS-Modified Roofing Asphalt: ASTM D6152/D6152M.

2.6 ACCESSORY ROOFING MATERIALS

- A. General: Accessory materials recommended by built-up roofing manufacturer for intended use and compatible with roofing components.
 - 1. Adhesives and Sealants: Comply with VOC limits of authorities having jurisdiction.
 - 2. Adhesives and sealants shall comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Other Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Nonmembrane Roof Sealants: 300 g/L.
 - j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - k. Sealant Primers for Porous Substrates: 775 g/L.
 - 3. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 4. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 5. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 - 6. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 7. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- B. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

- C. Roof Vents: As recommended by roof membrane manufacturer.
 - 1. Size: Not less than **4-inch (100-mm)** diameter.
- D. Sheathing Paper: Red-rosin type, minimum **3 lb/100 sq. ft. (0.16 kg/sq. m)**.
- E. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately **1 by 1/8 inch (25 by 3 mm)** thick; with anchors.
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- F. Cold-Applied Trichloroethylene Asphalt Adhesive: ASTM D3019, Type III, roof system manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with roofing system and base flashings.
- G. Cold-Applied Asphalt Adhesive: ASTM D4479/D4479M, Type I or Type II, roof system manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with roofing system and base flashings.
- H. Cold-Applied Polymer-Modified Asphalt Adhesive: Roof membrane manufacturer's standard solvent-and asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with roofing system, base flashings, and aggregate surfacing adhesive.
- I. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required by roofing manufacturer for application.
- J. SBS-Modified Asphalt Flashing Cement: Roofing manufacturer's standard, asbestos free, of consistency required for application.
- K. Coal Tar Roofing Cement: ASTM D5643/D5643M, coal-tar-based roofing cement, asbestos free.
- L. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening built-up roofing components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing manufacturer.
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- M. Aggregate Surfacing: ASTM D1863/D1863M, No. 6 or No. 67, clean, dry, opaque, **[water-worn gravel or crushed stone, free of sharp edges][crushed slag, free of sharp edges]**.
- N. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

2.7 SUBSTRATE BOARD

- A. Gypsum Board, Type X: ASTM C1396/C1396M.
 - 1. Thickness: **5/8 inch (16 mm)**.
 - 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- B. Glass-Mat Gypsum Roof Substrate Board: ASTM C1177/C1177M, water-resistant gypsum board.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[USG Corporation]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[USG Corporation]**
 - d. **<Insert manufacturer's name>**
 3. Thickness: **[1/4 inch (6 mm)][1/2 inch (13 mm)][Type X, 5/8 inch (16 mm)]**.
 4. Surface finish: **[Factory primed][Unprimed]**.
 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- C. Fiber-Reinforced Gypsum Roof Board: ASTM C1278/C1278M, cellulosic-fiber reinforced, water-resistant gypsum board.
1. Thickness: **[1/4 inch (6 mm)][3/8 inch (10 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- D. Perlite Board: ASTM C728, seal coated.
1. Thickness: **[3/4 inch (19 mm)][1 inch (25 mm)]**.
 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.

2.8 VAPOR RETARDER

- A. Polyethylene Film: ASTM D4397, **[6 mils (0.15 mm)][10 mils (0.25 mm)]** thick, minimum, with maximum permeance rating of **[0.13 perm (0.04 metric perm)][0.76 perm (0.050 metric perm)]**.
1. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
 2. Adhesive: Manufacturer's standard lap adhesive, FM Global approved for vapor-retarder application.
- B. Laminated Sheet Vapor Retarder: Two layers, fire-retardant polyethylene laminate, reinforced with cord

grid.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Reef Industries, Inc.]**
 - b. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Reef Industries, Inc.]**
 - b. **<Insert manufacturer's name>**
3. Permeance Rating: Not more than **0.062 perm (3.556 ng/Pa x s x sq. m)** when tested in accordance with ASTM E96/E96M.
4. Flame Spread Index: Not more than 5 when tested in accordance with ASTM E84.
5. Smoke-Developed Index: Not more than 35 when tested in accordance with ASTM E84.
6. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- C. Rubberized Asphalt Sheet Vapor Retarder, Self-Adhering: ASTM D1970/D1970M polyethylene film laminated to layer of rubberized asphalt adhesive, minimum **40-mil (1.0-mm)** total thickness; maximum permeance rating of **0.1 perm (6 ng/Pa x s x sq. m)**; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
- D. Butyl Rubber Sheet Vapor Retarder, Self-Adhering: Polyethylene film laminated to layer of butyl rubber adhesive, minimum **30-mil (0.76-mm)** total thickness; maximum permeance rating of **0.1 perm (6 ng/Pa x s x sq. m)**; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
- E. Glass-Fiber Felts: ASTM D2178/D2178M, Type IV, asphalt impregnated.

2.9 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured **[or approved]** by roof membrane manufacturer, **[approved for use in FM Approvals' RoofNav-listed roof assemblies][, approved for use in SPRI's Directory of Roof Assemblies listed roof assemblies]**.
- B. Polyisocyanurate Board Insulation: ASTM C1289, **[Type II, Class 1, Grade 2][Type II, Class I, Grade 3]**, felt or glass-fiber mat facer on both major surfaces.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[Atlas Polyiso Roof and Wall Insulation]**
 - c. **[Carlisle Syntec Systems]**
 - d. **[CertainTeed; SAINT-GOBAIN]**
 - e. **[Dyplast Products]**

- f. [Elevate; Holcim Building Envelope]
 - g. [GAF]
 - h. [Hunter Panels; a Carlisle company]
 - i. [Insulfoam; a Carlisle Company]
 - j. [Johns Manville; a Berkshire Hathaway company]
 - k. [Rmax, A Business Unit of Sika Corporation]
 - l. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [Atlas Polyiso Roof and Wall Insulation]
 - c. [Carlisle Syntec Systems]
 - d. [CertainTeed; SAINT-GOBAIN]
 - e. [Dyplast Products]
 - f. [Elevate; Holcim Building Envelope]
 - g. [GAF]
 - h. [Hunter Panels; a Carlisle company]
 - i. [Insulfoam; a Carlisle Company]
 - j. [Johns Manville; a Berkshire Hathaway company]
 - k. [Rmax, A Business Unit of Sika Corporation]
 - l. <Insert manufacturer's name>
 3. Compressive strength: [20 psi (138 kPa)][25 psi (172 kPa)].
 4. Size: [48 by 48 inches (1219 by 1219 mm)][48 by 96 inches (1219 by 2438 mm)].
 5. Thickness:
 - a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.
 - b. Upper Layer: <Insert thickness>.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert value> percent.
- C. Composite Polyisocyanurate Board Insulation: ASTM C1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other surface.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [Atlas Polyiso Roof and Wall Insulation]
 - c. [CertainTeed; SAINT-GOBAIN]
 - d. [Elevate; Holcim Building Envelope]
 - e. [GAF]
 - f. [Homasote Company]
 - g. [Hunter Panels; a Carlisle company]
 - h. [Insulfoam; a Carlisle Company]
 - i. [Johns Manville; a Berkshire Hathaway company]
 - j. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert

manufacturer's name; product name or designation> or comparable product by one of the following:

- a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[Atlas Polyiso Roof and Wall Insulation]**
 - c. **[CertainTeed; SAINT-GOBAIN]**
 - d. **[Elevate; Holcim Building Envelope]**
 - e. **[GAF]**
 - f. **[Homasote Company]**
 - g. **[Hunter Panels; a Carlisle company]**
 - h. **[Insulfoam; a Carlisle Company]**
 - i. **[Johns Manville; a Berkshire Hathaway company]**
 - j. **<Insert manufacturer's name>**
3. Facer: **[Type IV, cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch (13 mm) thick][Type V, oriented strand board facer, 7/16 inch (11 mm) thick][Type VII, glass-mat-faced gypsum board facer, 1/4 inch (6 mm) thick]<Insert material>**.
 4. Size: **[48 by 48 inches (1219 by 1219 mm)][48 by 96 inches (1219 by 2438 mm)]**.
 5. Thickness: **<Insert thickness>**.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- D. Perlite Board Insulation: ASTM C728, Type I, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[GAF]**
 - b. **[Johns Manville; a Berkshire Hathaway company]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[GAF]**
 - b. **[Johns Manville; a Berkshire Hathaway company]**
 - c. **<Insert manufacturer's name>**
 3. Thermal Resistance: R-value of 2.78 per 1 inch (25 mm).
 4. Size: **[48 by 48 inches (1219 by 1219 mm)][48 by 96 inches (1219 by 2438 mm)]**.
 5. Thickness:
 - a. Base Layer: **[1-1/2 inches (38 mm)]<Insert thickness>**.
 - b. Upper Layer: **<Insert thickness>**.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- E. Cellulosic-Fiber Board Insulation: ASTM C208, Type II, Grade 1, fibrous-felted, rigid insulation boards of wood fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[GAF]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Homasote Company]**
 - d. **[Huebert Fiberboard Inc]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[GAF]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Homasote Company]**
 - d. **[Huebert Fiberboard Inc]**
 - e. **<Insert manufacturer's name>**
 3. Thermal Resistance: R-value of 2.78 per 1 inch (25 mm).
 4. Size: **[48 by 48 inches (1219 by 1219 mm)][48 by 96 inches (1219 by 2438 mm)]**.
 5. Thickness:
 - a. Base Layer: **[1 inch (25 mm)][2 inches (51 mm)]<Insert thickness>**.
 - b. Upper Layer: **<Insert thickness>**.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- F. Cellular-Glass Board Insulation: ASTM C552, Type IV, rigid, cellular-glass thermal board insulation faced with manufacturer's standard kraft-paper sheets.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Pittsburgh Corning Corporation]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Pittsburgh Corning Corporation]**
 - b. **<Insert manufacturer's name>**
 3. Thermal Resistance: R-value of 3.44 per 1 inch (25 mm).
 4. Size: **24 by 48 inches (600 by 1219 mm)**.
 5. Thickness: **<Insert thickness>**.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.

- G. Mineral Wool Insulation - Multidensity: ASTM C726, Type I, Class 1, comprising monolithic fibrous material having an upper layer with a **11.2-lb/cu. ft. (180-kg/cu. m)** density, and a lower layer of **7.5-lb/cu. ft. (120-kg/cu. m)** density.
1. Thermal Resistance: R-value of 3.8 per 1 inch (25 mm).
 2. Size: **48 by 48 inches (1219 by 1219 mm)**.
 3. Thickness:
 - a. Base Layer: **[2 inches (51 mm)]<Insert thickness>**.
 - b. Upper Layer: **<Insert thickness>**.
 4. Face Treatment: Bitumen coating.
 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- H. Mineral Wool Insulation - Single Density: ASTM C726, Type II, Class 1, comprising monolithic fibrous material having a **12.5-lb/cu. ft. (200-kg/cu. m)** density.
1. Thermal Resistance: R-value of 4.0 per 1 inch (25 mm).
 2. Size: **48 by 48 inches (1219 by 1219 mm)**.
 3. Thickness: **1 inch (25 mm)**.
 4. Face Treatment: Bitumen coating.
 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- I. Tapered Insulation: Provide factory-tapered insulation boards
1. Material: **[Match roof insulation]<Insert material>**.
 2. Minimum Thickness: **1/4 inch (6 mm)**.
 3. Slope:
 - a. Roof Field: **[1/4 inch per foot (1:48)]<Insert slope>** unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: **[1/2 inch per foot (1:24)]<Insert slope>** unless otherwise indicated on Drawings.
 4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.

2.10 INSULATION ACCESSORIES AND COVER BOARD

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with other roofing system components.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation[**and cover board**] to substrate, and acceptable to roofing manufacturer.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
1. Modified asphaltic, asbestos-free, cold-applied adhesive.

2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
3. Full-spread, spray-applied, low-rise, two-component urethane adhesive.
4. Adhesives and sealants shall comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Other Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Nonmembrane Roof Sealants: 300 g/L.
 - j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - k. Sealant Primers for Porous Substrates: 775 g/L.
5. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
6. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
7. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
8. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
9. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- D. Insulation Cant Strips: **[ASTM C728, perlite insulation board][ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board]**.
- E. Wood Nailer Strips: Comply with requirements in Section 061000 "Rough Carpentry."
- F. Tapered Edge Strips: **[ASTM C728, perlite insulation board][ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board]**.
- G. Cellulosic-Fiber Insulation Cover Board: ASTM C208, Type II, Grade 2, high-density cellulosic-fiber insulation board, having a minimum compressive strength of **40 psi (276 kPa)**.
 1. Thickness: **[1/2 inch (13 mm)][1 inch (25 mm)]<Insert thickness>**.
 2. Surface Finish: **[Primed one side][Primed two sides with non-asphaltic primer][Integral coating, six sides][Unprimed]<Insert finish>**.
 3. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- H. Oriented Strand Board: DOC PS 2, Exposure 1, **7/16 inch (11 mm)** thick.
 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content

not less than **<Insert value>** percent.

- I. Glass-Mat Gypsum Cover Board: ASTM C1177/C1177M, water-resistant gypsum board.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[USG Corporation]**
 - d. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[USG Corporation]**
 - d. **<Insert manufacturer's name>**
 - 3. Thickness: **[1/4 inch (6 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
 - 4. Surface Finish: **[Fiberglass facer][Factory primed][Unprimed]**.
 - 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- J. Fiber-Reinforced Gypsum Roof Board: ASTM C1278/C1278M, cellulosic-fiber reinforced, water-resistant gypsum board.
 - 1. Thickness: **[1/4 inch (6 mm)][3/8 inch (10 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
 - 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- K. Fiber-Reinforced Cementitious Cover Board: ASTM C1325.
 - 1. Thickness: **[7/16 inch (11 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
 - 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- L. Fiber-Reinforced Recycled Plastic Cover Board: Cellulose fiber blended with recycled plastic board.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Continuous Materials, LLC]**
 - b. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Continuous Materials, LLC]**

b. <Insert manufacturer's name>

3. Thickness: [1/4 inch (6 mm)][1/2 inch (13 mm)].
4. Surface finish: [Fiberglass facer][Paper facer].
5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert value> percent.

M. Polyisocyanurate Insulation Cover Board: ASTM C1289 Type II, Class 4, Grade 1, 1/2 inch (13 mm) thick, having a minimum compressive strength of 80 psi (551 kPa).

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert value> percent.

N. Joint Tape: 6- or 8-inch- (150- or 200-mm-) wide, coated, glass fiber.

2.11 ELECTRONIC LEAK DETECTION (ELD) MATERIALS

A. Conductive Medium: Materials providing less than 104 ohms per square as determined in accordance with ASTM D4496 and approved by roof membrane manufacturer.

1. Electrically Conductive Primer: Water-based, non-flammable, nonmetallic low-VOC primer[, **UL listed and FM Global approved**].

a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- 1) [Detec Systems]
- 2) <Insert manufacturer's name>

b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- 1) [Detec Systems]
- 2) <Insert manufacturer's name>

2. Grounding Screen: [Welded, stainless steel mesh][Aluminum screen], for use with vector mapping system[, **FM Global approved**].

a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- 1) [ILD International Leak Detection]
- 2) <Insert manufacturer's name>

b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- 1) [ILD International Leak Detection]
 - 2) <Insert manufacturer's name>
 3. Electrically Conductive Fabric: Non-abrasive felt.
 - a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - 1) [ILD International Leak Detection]
 - 2) <Insert manufacturer's name>
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - 1) [ILD International Leak Detection]
 - 2) <Insert manufacturer's name>
 - B. Leak Detection and Moisture-Monitoring System: Permanent, embedded leak detection and moisture-monitoring system.
 1. Sensors measuring moisture content[, temperature, and vapor drive], placed [below roof insulation][over vapor barrier] and connected to a monitoring program, with a notification indicating location of breach.
 2. Sensors measuring moisture content[, temperature, and vapor drive], in a conductive fabric placed below roof membrane and connected to a monitoring program, with a notification indicating location of breach.
 3. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Detec Systems]
 - b. [ILD International Leak Detection]
 - c. <Insert manufacturer's name>
 4. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Detec Systems]
 - b. [ILD International Leak Detection]
 - c. <Insert manufacturer's name>
- 2.12 COATING MATERIALS
- A. Roof Coating:
 1. ASTM D2824/D2824M, [Type I, nonfibered][Type III, fibered, asbestos-free] aluminum-pigmented asphaltic coating.
 2. ASTM D6083, acrylic elastomer emulsion coating, formulated for use on bituminous roof surfaces.

- a. Color: **[White][Gray][Tan]<Insert color>**.

2.13 WALKWAYS

- A. Walkway Pads: **[Mineral-granule-surfaced, reinforced asphaltic composition][Polymer-modified, reconstituted solid-rubber, surface-textured]**, slip-resisting pads, manufactured as a traffic pad for foot traffic and acceptable to built-up roofing manufacturer, **[3/8 inch (10 mm)][1/2 inch (13 mm)][3/4 inch (19 mm)]** thick, minimum.
1. Pad Size: Approximately **[36 by 60 inches (914 mm by 1524 mm)]<Insert size>**.
 2. Color: Contrasting with cap sheet.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
 4. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of **1/16 inch (1.6 mm)** out of plane relative to adjoining deck.
 5. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 6. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than **[75]<Insert number>** percent, or as recommended by roofing system manufacturer, when tested in accordance with ASTM F2170.
 - a. Test Frequency: One test probe per each **[1000 sq. ft. (93 sq. m)]<Insert area>**, or portion thereof, of roof deck, with not less than three test probes.
 - b. Submit test reports within 24 hours of performing tests.
 7. Verify that concrete-curing compounds that impair adhesion of roofing components to roof deck have been removed.
 8. Verify that joints in precast concrete roof decks have been grouted flush with top of concrete.
 9. Verify that minimum curing period recommended by roofing system manufacturer for lightweight insulating concrete roof decks has passed.
 10. Verify that any damaged sections of cementitious wood-fiber decks have been repaired or replaced.
 11. Verify that adjacent cementitious wood-fiber panels are vertically aligned to within **1/8 inch (3 mm)** at top surface.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing manufacturer's written instructions.
 - 1. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.
 - 1. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Prime surface of concrete deck with **[asphalt][coal tar]** primer at a rate of **3/4 gal./100 sq. ft. (0.3 L/sq. m)**, and allow primer to dry.
- D. Perform fastener-pullout tests in accordance with roof system manufacturer's written instructions.
 - 1. Submit test result within 24 hours of performing tests.
 - a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.
- E. Install sound-absorbing insulation strips in ribs of acoustical roof decks in accordance with acoustical roof deck manufacturer's written instructions.

3.3 INSTALLATION OF ROOFING, GENERAL

- A. Install roofing system in accordance with roofing manufacturer's written instructions, **[FM Approvals' RoofNav][SPRI's Directory of Roof Assemblies]** assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast.
 - 1. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition **[and to not void warranty for existing roofing system]**.
- D. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under **[Section 072713 "Modified Bituminous Sheet Air Barriers."][Section 072715 "Nonbituminous Self-Adhering Sheet Air Barriers."][Section 072726 "Fluid-Applied Membrane Air Barriers."]**
- E. Bitumen Heating:
 - 1. Heat bitumen to its equiviscous temperature, measured at the mop cart or mechanical spreader immediately before application.
 - 2. Circulate bitumen during heating.
 - 3. Do not raise bitumen temperature above equiviscous temperature range more than one hour before time of application.
 - 4. Do not exceed bitumen manufacturer's recommended temperature limits during bitumen heating.
 - 5. Do not heat bitumen within **25 deg F (14 deg C)** of flash point.
 - 6. Discard bitumen maintained for more than four hours at a temperature exceeding **325 deg F (163**

deg C) for coal tar pitch[**or finished blowing temperature for roofing asphalt**].

7. Apply hot roofing asphalt within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.

- F. SEBS-Modified Asphalt Heating: Heat and apply roofing asphalt in accordance with roofing manufacturer's written instructions.
- G. Substrate-Joint Penetrations: Prevent coal tar pitch, roofing asphalt, and adhesives from penetrating substrate joints, entering building, or damaging roofing components or adjacent building construction.

3.4 INSTALLATION OF SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than **24 inches (600 mm)** in adjacent rows.
 1. At steel roof decks, install substrate board at right angle to flutes of deck.
 - a. Locate end joints over crests of steel roof deck.
 2. Tightly butt substrate boards together.
 3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 4. Fasten substrate board to top flanges of steel deck in accordance with recommendations in [**FM Approvals' "RoofNav" listed roof assembly requirements for specified Windstorm Resistance Classification**][**SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity**] and FM Global Property Loss Prevention Data Sheet 1-29.
 5. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof in accordance with roofing system manufacturer's written instructions.
 6. Loosely lay substrate board over roof deck.

3.5 INSTALLATION OF VAPOR RETARDER

- A. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum **2 and 6 inches (51 and 150 mm)**, respectively.
 1. Extend vertically up parapet walls and projections to a minimum height equal to height of the insulation and cover board.
 2. Continuously seal side and end laps with [**tape**][**adhesive**].
- B. Laminate Sheet: Loosely lay laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of **2 and 6 inches (51 and 150 mm)**, respectively.
 1. Extend vertically up parapet walls and projections to a minimum height equal to height of the insulation and cover board.
 2. Continuously seal side and end laps with tape.
- C. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of **3-1/2 and 6 inches (90 and 150 mm)**, respectively.

1. Extend vertically up parapet walls and projections to a minimum height equal to height of the insulation and cover board.
 2. Seal laps by rolling.
- D. Built-Up Vapor Retarder: Install two glass-fiber felt plies lapping each felt **19 inches (483 mm)** over preceding felt.
1. Extend vertically up parapet walls and projections to a minimum height equal to height of the insulation and cover board.
 2. Embed each felt in a solid mopping of hot roofing asphalt.
 3. Glaze coat completed surface with hot roofing asphalt.
- E. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.6 INSTALLATION OF INSULATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install one lapped base sheet course and mechanically fasten to substrate in accordance with roofing membrane manufacturer's written instructions.
- D. Nailer Strips: Mechanically fasten **4-inch nominal- (89-mm actual-)** width, wood nailer strips of same thickness as insulation perpendicular to sloped roof deck, spaced **[16 feet (4.88 m)]<Insert dimensions>** apart for roof slopes greater than **[1/4 inch per 12 inches (1:48)][1/2 inch per 12 inches (1:24)]**.
- E. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane with vertical surfaces or angle changes greater than 45 degrees.
- F. Installation Over Metal Decking:
1. Install base layer of insulation with **[joints staggered not less than 24 inches (600 mm) in adjacent rows][end joints staggered not less than 12 inches (300 mm) in adjacent rows][and with long joints continuous at right angle to flutes of decking]**.
 - a. Retain first subparagraph below when insulation is installed directly over metal decking.
 - b. Locate end joints over crests of decking.
 - c. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
 - d. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - e. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 - f. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus **24 inches (600 mm)**.
 - 1) Trim insulation so that the flow of water is not restricted.
 - g. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 - h. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.

- i. Mechanically attach base layer of insulation[**and substrate board**] using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
 - 1) Fasten insulation in accordance with requirements in **[FM Approvals' RoofNav for specified Windstorm Resistance Classification][SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity]**.
 - 2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
2. Install upper layers of insulation[**and tapered insulation**], with joints of each layer offset not less than **12 inches (305 mm)** from previous layer of insulation.
 - a. Staggered end joints within each layer not less than **24 inches (600 mm)** in adjacent rows.
 - b. Install with long joints continuous and with end joints staggered not less than **12 inches (300 mm)** in adjacent rows.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 - e. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus **24 inches (600 mm)**.
 - f. Trim insulation so that water flow of water is unrestricted.
 - g. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 - h. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 - i. Adhere each layer of insulation to substrate using adhesive in accordance with FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:
 - 1) Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
 - 2) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 3) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

G. Installation Over Wood and Wood Panel Decking:

1. Mechanically fasten [**sheathing paper**][**APP-modified bitumen fiberglass-mat base sheet**][**asphalt-coated fiberglass-mat base sheet**] to roof deck using mechanical fasteners specifically designed and sized for fastening slip sheet to [**wood**][**wood panel**] decks.
 - a. Lap edges a minimum of **2 inches (50 mm)**, or as recommended by roof membrane manufacturer
 - b. Lap ends a minimum of **6 inches (150 mm)**, or as recommended by roof membrane manufacturer.
 - c. Fasten [**sheathing paper**][**APP-modified bitumen fiberglass-mat base sheet**][**asphalt-coated fiberglass-mat base sheet**] in accordance with requirements in SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity.
 - d. Fasten [**sheathing paper**][**APP-modified bitumen fiberglass-mat base sheet**][**asphalt-coated fiberglass-mat base sheet**] to resist specified uplift pressure at corners, perimeter, and field of roof.
2. Install base layer of insulation with [**joints staggered not less than 24 inches (600 mm) in adjacent rows**][**end joints staggered not less than 12 inches (300 mm) in adjacent rows**].

- a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 - d. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus **24 inches (600 mm)**.
 - 1) Trim insulation so that the flow of water is not restricted.
 - e. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 - f. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 - g. Mechanically attach base layer of insulation[**and substrate board**] using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to **[wood][wood panel]** decks.
 - 1) Fasten insulation in accordance with requirements in SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity.
 - 2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
 - h. Adhere base layer of insulation to substrate using adhesive as follows:
 - 1) Set base layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
 - 2) Set base layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 3) Set base layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
3. Install upper layers of insulation[**and tapered insulation**], with joints of each layer offset not less than **12 inches (305 mm)** from previous layer of insulation.
- a. Staggered end joints within each layer not less than **24 inches (600 mm)** in adjacent rows.
 - b. Install with long joints continuous and with end joints staggered not less than **12 inches (300 mm)** in adjacent rows.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 - e. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus **24 inches (600 mm)**.
 - 1) Trim insulation so that the flow of water is not restricted.
 - f. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 - g. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 - h. Adhere each layer of insulation to substrate using adhesive in accordance with SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
 - 2) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 3) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive,

firmly pressing and maintaining insulation in place.

H. Installation Over Concrete Decks:

1. Install base layer of insulation with **[joints staggered not less than 24 inches (600 mm) in adjacent rows][end joints staggered not less than 12 inches (300 mm) in adjacent rows]**.
 - a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - b. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 - c. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus **24 inches (600 mm)**.
 - 1) Trim insulation so that the flow of water is not restricted.
 - d. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 - e. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 - f. Adhere base layer of insulation to **[concrete roof deck][vapor retarder]** in accordance with **[FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity]** and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Prime surface of concrete deck with asphalt primer at rate of **3/4 gal./100 sq. ft. (0.3 L/sq. m)**, and allow primer to dry.
 - 2) Set insulation in a solid mopping of hot roofing asphalt, applied within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
 - 3) Set insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 4) Set insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
2. Install upper layers of insulation **[and tapered insulation]**, with joints of each layer offset not less than **12 inches (300 mm)** from previous layer of insulation.
 - a. Staggered end joints within each layer not less than **24 inches (600 mm)** in adjacent rows.
 - b. Install with long joints continuous and with end joints staggered not less than **12 inches (300 mm)** in adjacent rows.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 - e. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus **24 inches (600 mm)**.
 - 1) Trim insulation so that the flow of water is not restricted.
 - f. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 - g. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 - h. Adhere each layer of insulation to substrate using adhesive in accordance with **[FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity]** and FM Global Property Loss Prevention Data Sheet 1-29, as follows:

- 1) Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
- 2) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
- 3) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

I. Installation Over Cementitious Wood-Fiber Decks:

1. Mechanically fasten [**sheathing paper**][**APP-modified bitumen fiberglass-mat base sheet**][**asphalt-coated fiberglass-mat base sheet**] to roof deck using mechanical fasteners specifically designed and sized for fastening slip sheet to cementitious wood fiber decks.
 - a. Fasten [**sheathing paper**][**APP-modified bitumen fiberglass-mat base sheet**][**asphalt-coated fiberglass-mat base sheet**] in accordance with requirements in SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity.
 - b. Fasten [**sheathing paper**][**APP-modified bitumen fiberglass-mat base sheet**][**asphalt-coated fiberglass-mat base sheet**] to resist specified uplift pressure at corners, perimeter, and field of roof.
2. Install base layer of insulation with [**joints staggered not less than 24 inches (600 mm) in adjacent rows**][**end joints staggered not less than 12 inches (300 mm) in adjacent rows**].
 - a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 - d. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus **24 inches (600 mm)**.
 - 1) Trim insulation so that the flow of water is not restricted.
 - e. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 - f. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 - g. Adhere base layer of insulation to slip sheet in accordance with SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set insulation in a solid mopping of hot roofing asphalt, applied within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
 - 2) Set insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 3) Set insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
3. Install upper layers of insulation[**and tapered insulation**], with joints of each layer offset not less than **12 inches (300 mm)** from previous layer of insulation.
 - a. Staggered end joints within each layer not less than **24 inches (600 mm)** in adjacent rows.
 - b. Install with long joints continuous and with end joints staggered not less than **12 inches (300 mm)** in adjacent rows.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.



- e. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus **24 inches (600 mm)**.
 - 1) Trim insulation so that the flow of water is not restricted.
- f. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
- g. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
- h. Adhere each layer of insulation to substrate using adhesive in accordance with SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
 - 2) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 3) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

J. Installation Over Lightweight Insulating Concrete Decks:

- 1. Mechanically fasten vented base sheet to lightweight insulating concrete roof deck, with vented side down, using mechanical fasteners specifically designed and sized for fastening to lightweight insulating concrete decks.
 - a. Fasten vented base sheet in accordance with requirements in **[FM Approvals' RoofNav for specified Windstorm Resistance Classification][SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity]**.
 - b. Fasten vented base sheet to resist uplift pressure at corners, perimeter, and field of roof.
- 2. Install base layer of insulation with **[joints staggered not less than 24 inches (600 mm) in adjacent rows][end joints staggered not less than 12 inches (300 mm) in adjacent rows]**.
 - a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 - d. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus **24 inches (600 mm)**.
 - 1) Trim insulation so that the flow of water is not restricted.
 - e. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 - f. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 - g. Adhere base layer of insulation to vented base sheet in accordance with **[FM Approvals' RoofNav listed roof assembly requirements][SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity]** and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set insulation in a solid mopping of hot roofing asphalt, applied within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
 - 2) Set insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 3) Set insulation in a uniform coverage of full-spread insulation adhesive, firmly

pressing and maintaining insulation in place.

3. Install upper layers of insulation[**and tapered insulation**], with joints of each layer offset not less than **12 inches (300 mm)** from previous layer of insulation.
 - a. Staggered end joints within each layer not less than **24 inches (600 mm)** in adjacent rows.
 - b. Install with long joints continuous and with end joints staggered not less than **12 inches (300 mm)** in adjacent rows.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 - e. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus **24 inches (600 mm)**.
 - 1) Trim insulation so that the flow of water is not restricted.
 - f. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 - g. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 - h. Adhere each layer of insulation to substrate using adhesive in accordance with **[FM Approvals' RoofNav listed roof assembly requirements][SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity]**and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
 - 2) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 3) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.7 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines, with end joints staggered between rows. Offset joints of insulation below a minimum of **6 inches (150 mm)** in each direction.
 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that the flow of water is not restricted.
 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 4. Adhere cover board to substrate using adhesive in accordance with **[FM Approvals' RoofNav listed roof assembly requirements or specified Windstorm Resistance Classification][SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity]** and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - a. Set cover board in a solid mopping of hot roofing asphalt, applied within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
 - b. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - c. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

- B. Install sheathing paper over cover board and immediately beneath roof membrane.

3.8 INSTALLATION OF ELD COMPONENTS

- A. Install conductive medium over **[cover board][insulation][and on vertical locations to receive roof membrane]** in accordance with manufacturer's written instructions.
- B. Install sensors, **[wire loop][conductive fabric]**, connections, and accessory items required for complete system in accordance with manufacturer's written instructions.

3.9 INSTALLATION OF BUILT-UP ROOFING

- A. Install built-up roofing in accordance with roofing manufacturer's written instructions and applicable recommendations of ARMA/NRCA's "Quality Control Guidelines for the Application of Built-up Roofing" and as follows:
 - 1. Base Sheet: **[One][One, installed over sheathing paper]**.
 - 2. Number of Organic Felt Ply Sheets: **[Two][Three][Four]<Insert number>**.
 - 3. Number of Glass-Fiber Ply Sheets: **[One, top ply][Two][Three][Four]<Insert number>**.
 - 4. Surfacing: Aggregate.
- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel **[and Owner's testing and inspection agency]**.
- C. Where roof slope exceeds **[1/4 inch per 12 inches (1:48)][1/2 inch per 12 inches (1:24)]<Insert slope>**, install roofing ply sheets parallel with slope.
 - 1. Backnail roofing ply sheets to **[nailer strips][substrate]** in accordance with roofing system manufacturer's written instructions.
- D. Coordinate installation of roofing, so insulation and other components of roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
 - 1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.
 - 2. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system.
 - 3. Remove and discard temporary seals before beginning work on adjoining roofing.
- E. Loosely lay one course of sheathing paper, lapping edges and ends a minimum of **2 inches (51 mm)** and **6 inches (150 mm)**, respectively.
- F. Install lapped base sheet course, extending sheet over and terminating beyond cants. Attach base sheet as follows:
 - 1. Mechanically fasten to substrate.
 - 2. Spot or strip mop to substrate with hot roofing asphalt.
 - 3. Adhere to substrate **[in a solid mopping of hot roofing asphalt][using cold-applied asphalt adhesive][using cold-applied polymer-modified asphalt adhesive]**.

- G. Monolithic Membrane: Install **[two][three][four]** ply sheets, starting at low point of roof.
1. Align ply sheets without stretching.
 2. Shingle side laps of ply sheets uniformly to achieve required number of plies throughout thickness of roofing membrane.
 - a. Shingle in direction to shed water.
 3. Extend ply sheets over and terminate beyond cants.
 4. Embed each ply sheet in a solid mopping of hot coal tar pitch to form a uniform membrane without ply sheets touching.
 - a. Mopping Weights: For interply and other moppings, unless otherwise indicated, apply solid moppings of hot coal tar pitch between ply sheets at a minimum rate of **20 lb/100 sq. ft. (1 kg/sq. m)**.
- H. Composite Membrane: Install **[two][three][four]** organic-felt ply sheets, starting at low point of roof.
1. Align organic-felt ply sheets without stretching.
 2. Shingle side laps of organic-felt ply sheets uniformly to achieve required number of plies throughout thickness of roofing membrane.
 - a. Shingle in direction to shed water.
 3. Install finish layer of one lapped coal tar, glass-fiber ply sheet course over shingled organic-felt ply sheets, starting at low point of built-up roofing.
 - a. Offset laps from laps of preceding ply sheets and align coal tar, glass-fiber ply sheet without stretching.
 - b. Lap in direction to shed water.
 4. Extend ply sheets over and terminate beyond cants.
 5. Embed each ply sheet in a solid mopping of hot coal tar pitch applied at rate required by roofing system manufacturer, to form a uniform membrane without ply sheets touching.
 - a. Mopping Weights: For interply and other moppings, unless otherwise indicated, apply solid moppings of hot coal tar pitch between ply sheets at a minimum rate of **20 lb/100 sq. ft. (1 kg/sq. m)**.
- I. Glaze coat roofing membrane surface with hot coal tar pitch applied at a rate of **10 to 15 lb/100 sq. ft. (0.5 to 0.75 kg/sq. m)**, if aggregate surfacing is not applied immediately.
- J. Aggregate Surfacing: After installing and testing roofing membrane, base flashing, and stripping, promptly apply flood coat to roof surface with **70 lb/100 sq. ft. (3.5 kg/sq. m)** of hot coal tar pitch. While flood coat is hot and fluid, cast the following average weight of aggregate in a uniform course:
1. Aggregate Weight: **[400 lb/100 sq. ft. (20 kg/sq. m)][300 lb/100 sq. ft. (15 kg/sq. m)]**.

3.10 INSTALLATION OF FLASHING AND STRIPPING

- A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof; secure to substrates in accordance with roofing system manufacturer's written instructions and as follows:

1. Prime substrates with asphalt primer if required by roofing system manufacturer.
 2. Install single backer sheet and adhere to substrate in [a solid mopping of hot roofing asphalt][asphalt roofing cement][SBS-modified asphalt roofing cement][cold-applied adhesive][cold-applied polymer-modified asphalt adhesive].
 3. Install [two][three] backer sheets and adhere to substrate in [a solid mopping of hot roofing asphalt][asphalt roofing cement].
 4. Flashing Sheet Application, Hot: Adhere flashing sheet to substrate in a solid mopping of hot roofing asphalt applied at not less than **425 deg F (218 deg C)**. Apply hot roofing asphalt to back of flashing sheet if recommended by roofing manufacturer.
 5. Flashing Sheet Application, Cold: Adhere flashing sheet to substrate in [SBS-modified asphalt roofing cement][asphalt roofing cement].
- B. Extend base flashing up walls or parapets a minimum of **8 inches (200 mm)** above built-up roofing and **4 inches (100 mm)** onto field of built-up roofing.
- C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
1. Securely fasten top termination of base flashing with continuous metal termination bar anchored into substrate.
 2. Seal top termination of base flashing[**with a strip of glass-fiber fabric set in asphalt roofing cement**].
- D. Install liquid flashing system in accordance with manufacturer's recommendations.
1. Extend liquid flashing not less than **3 inches (76 mm)** in all directions from edges of item being flashed.
 2. Embed granules, matching color of roof membrane, into wet compound.
- E. Apply roof coatings to smooth base flashings in accordance with manufacturer's written instructions, by spray, roller, or other suitable application method.
- F. Install stripping in accordance with roofing system manufacturer's written instructions, where metal flanges and edgings are set on roofing membrane.
1. Install flashing sheet stripping in a cold-applied adhesive or in a solid mopping of hot coal tar pitch, and extend onto roofing membrane.
 2. Install stripping of no fewer than two roofing ply sheets, setting each ply in a continuous coal tar roofing cement or in a solid mopping of hot coal tar pitch, and extend onto roofing membrane **4 inches (100 mm)** and **6 inches (150 mm)**, respectively.
- G. Roof Drains: Set [**30-by-30-inch (760-by-760-mm)**]**<Insert dimensions>** **4-pound (1.8-kg)** lead flashing in bed of asphalt roofing cement on completed built-up roofing.
1. Cover metal flashing with built-up roofing cap sheet stripping, and extend a minimum of [**4 inches (100 mm)**][**6 inches (150 mm)**] beyond edge of metal flashing onto field of built-up roofing.
 2. Clamp built-up roofing, metal flashing, and stripping into roof-drain clamping ring.
 3. Install stripping in accordance with roofing manufacturer's written instructions.

3.11 INSTALLATION OF WALKWAYS

- A. Walkway Pads: Install walkway pads, using units of size indicated or, if not indicated, of manufacturer's standard size, in accordance with walkway pad manufacturer's written instructions.
1. Sweep away loose aggregate surfacing, and set walkway pads in additional flood coat of hot coal

- tar pitch.
2. Install walkways at following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - f. Locations indicated on Drawings.
 - g. As required by roof membrane manufacturer's warranty requirements.
 3. Provide **3-inch (76-mm)** clearance between adjoining pads.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to inspect substrate conditions, surface preparation, roof membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Perform the following tests:
 1. Flood Testing: Flood test each roofing area for leaks, in accordance with recommendations in ASTM D5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - a. Perform tests before overlying construction is placed.
 - b. Flood to an average depth of **[2-1/2 inches (65 mm)]<Insert depth>** with a minimum depth of **[1 inch (25 mm)]<Insert depth>** and not exceeding a depth of **[4 inches (100 mm)]<Insert depth>**. Maintain **2 inches (51 mm)** of clearance from top of base flashing.
 - c. Flood each area for **[24][48][72]** hours.
 - d. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is the responsibility of the Contractor.
 - e. Testing agency to prepare survey report indicating locations of initial leaks, if any, and final survey report.
 2. Infrared Thermography: Testing agency surveys entire roof area using infrared color thermography in accordance with ASTM C1153.
 - a. Perform tests before overlying construction is placed.
 - b. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or nuclear hydrogen detection testing.
 - c. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - d. Testing agency to prepare survey report of initial scan indicating locations of entrapped moisture, if any.

3. Electrical Capacitance/Impedance Testing: Testing agency surveys entire roof area for entrapped water within roof assembly in accordance with ASTM D7954/D7954M.
 - a. Perform tests before overlying construction is placed.
 - b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
 4. Nuclear Hydrogen Detection Testing: Testing agency surveys entire roof area for entrapped water within roof assembly in accordance with ANSI/SPRI/RCI NT-1.
 - a. Perform tests before overlying construction is placed.
 - b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
 5. Low-Voltage ELD Testing: Testing agency surveys entire roof area and flashings to locate discontinuities in the roof membrane using low-voltage **[horizontal membrane scanning platform][membrane electric field vector mapping][or][vertical membrane scanning]** in accordance with ASTM D8231.
 - a. Perform tests before overlying construction is placed.
 - b. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
 6. High-Voltage Membrane Testing: Testing agency surveys entire **[roof area,][flashings,][and][parapet walls]** to locate discontinuity in the roof membrane using an electrically charged metal "broom head."
 - a. Perform tests before overlying construction is placed.
 - b. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
- C. Test Cuts: Remove test specimens to evaluate problems observed during quality-assurance inspections of roofing system as follows:
1. Determine approximate quantities of components within built-up roofing in accordance with ASTM D3617/D3617M.
 2. Examine test specimens for interply voids in accordance with ASTM D3617/D3617M and to comply with criteria established in Appendix 3 in ARMA/NRCA's "Quality Control Guidelines for

- the Application of Built-up Roofing."
3. Repair areas where test cuts were made in accordance with built-up roofing manufacturer's written instructions.
 - D. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
 1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
 - E. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
 - F. Roofing system will be considered defective if it does not pass tests and inspections.
 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.13 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period.
 1. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing components that do not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and in accordance with warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.14 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 1. Owner: **<Insert name of Owner>**.
 2. Owner Address: **<Insert address>**.
 3. Building Name/Type: **<Insert information>**.
 4. Building Address: **<Insert address>**.
 5. Area of Work: **<Insert information>**.
 6. Acceptance Date: _____.
 7. Warranty Period: **<Insert time>**.
 8. Expiration Date: _____.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and

defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding <Insert mph (m/s)>;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 07 01 50 81



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 01 50 81	07 51 13 00	Built-Up Asphalt Roofing
07 01 50 81	07 53 23 00	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing
07 01 70 00	07 51 13 00	Built-Up Asphalt Roofing
07 01 70 00	07 01 50 81	Built-Up Coal Tar Roofing
07 01 70 00	07 53 23 00	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing
07 01 70 00	07 62 00 00	Sheet Metal Flashing And Trim
07 01 70 00	07 71 00 00	Roof Specialties
07 05 13 00	07 01 50 81	Built-Up Coal Tar Roofing
07 05 13 00	07 52 13 00	Atactic-Polypropylene (APP) Modified Bituminous Membrane Roofing
07 05 13 00	07 52 16 00	Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing
07 05 13 00	07 53 16 00	Chlorosulfonate-Polyethylene (CSPE) Roofing
07 05 13 00	07 53 23 00	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing



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SECTION 07 11 13 00 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold-applied, cut-back-asphalt dampproofing.
2. Cold-applied, emulsified-asphalt dampproofing.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for bituminous vapor retarders under slabs-on-grade.
2. **[Section 042000 "Unit Masonry"] [Section 042200 "Concrete Unit Masonry"]** for mortar parge coat on masonry surfaces.
3. **[Section 071326 "Self-Adhering Sheet Waterproofing"] [Section 071353 "Elastomeric Sheet Waterproofing"] [Section 071354 "Thermoplastic Sheet Waterproofing"] [Section 071413 "Hot Fluid-Applied Rubberized Asphalt Waterproofing"] [Section 071416 "Cold Fluid-Applied Waterproofing"]** for waterproofing.

1.2 ACTION SUBMITTALS

- ##### A. Product Data:
- For each type of product.

1.3 FIELD CONDITIONS

- ##### A. Weather Limitations:
- Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed in accordance with to manufacturers' written instructions.
- ##### B. Ventilation:
- Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- ##### A.
- Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide **[protection course] [drainage panels] [and]** auxiliary materials recommended in writing by manufacturer of primary materials.

2.2 PERFORMANCE REQUIREMENTS

- ##### A. VOC Content:
- Products are to comply with VOC content limits of authorities having jurisdiction unless otherwise indicated.

07 - Thermal And Moisture Protection

2.3 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

- A. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Trowel Coats: ASTM D4586/D4586M, Type I, Class 1, fibered.
- C. Brush and Spray Coats: ASTM D4479/D4479M, Type I, fibered[**or nonfibered**].

2.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Trowel Coats: ASTM D1227/D1227M, Type II, Class 1.
- C. Fibered Brush and Spray Coats: ASTM D1227/D1227M, Type II, Class 1.
- D. Brush and Spray Coats: ASTM D1227/D1227M, Type III, Class 1.

2.5 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with each other and with bituminous dampproofing.
- B. Cut-Back-Asphalt Primer: ASTM D41/D41M.
- C. Emulsified-Asphalt Primer: ASTM D1227/D1227M, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.
- D. Asphalt-Coated Glass Fabric: ASTM D1668/D1668M, Type I.
- E. Patching Compound: [**Epoxy or latex-modified repair mortar**] [**Asbestos-free fibered mastic**] of type recommended in writing by dampproofing manufacturer.

2.6 PROTECTION COURSE

- A. Protection Course, Asphaltic: ASTM D6506/D6506M; semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners.
 - 1. Thickness: Nominal [**1/8 inch (3 mm)**] [**1/4 inch (6 mm)**] [**1/8 inch (3 mm) for vertical applications; 1/4 inch (6 mm) elsewhere**].
 - 2. Adhesive: Rubber-based solvent type recommended in writing by dampproofing manufacturer for protection course type.
- B. Protection Course, Extruded-Polystyrene Board Insulation, Faced: Fan folded, faced on [**one side**] [**or both sides**] with plastic film, nominal thickness 1/4 inch (6 mm), with a compressive strength of not less than 8 psi (55 kPa) when tested in accordance with ASTM D1621, and maximum water absorption by volume of 0.6 percent when tested in accordance with ASTM C272/C272M.
- C. Protection Course, Extruded-Polystyrene Board Insulation, Unfaced: ASTM C578, Type X, 1/2 inch (13 mm) thick.

- D. Protection Course, Molded-Polystyrene Board Insulation: ASTM C578, Type I, 0.90 lb/cu. ft. (15 kg/cu. m) minimum density, 1-inch (25-mm) minimum thickness.
- E. Smooth-surfaced roll roofing complying with ASTM D6380/D6380M, Class S, Type III.

2.7 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel acceptable to dampproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to one side of the core, with or without a polymeric film bonded to the other side; and with a vertical flow rate through the core of **[9 to 21 gpm per ft. (112 to 261 L/min. per m)] <Insert value>**.
 - 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.8 INSULATION DRAINAGE PANELS

- A. Insulation Drainage Panels:
 - 1. Comply with Section 072100 "Thermal Insulation" for insulation drainage panels.
 - 2. Unfaced or geotextile-faced, extruded-polystyrene board insulation in accordance with ASTM C578, Type IV, 25-psi (173-kPa), or Type VI, 40-psi (276-kPa), minimum compressive strength; fabricated with shiplap or channel edges and with one side having grooved drainage channels.
 - 3. <Double click here to find, evaluate, and insert list of manufacturers and products.>

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for surface smoothness, maximum surface moisture content, and other conditions affecting performance of the Work.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean, prepare, and treat substrates in accordance with dampproofing manufacturer's written application instructions. Provide clean, dust-free, and dry substrates for dampproofing.
- B. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- C. Clean substrates of projections and substances detrimental to dampproofing work; fill voids, seal joints, and remove bond breakers if any.

- D. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections[; **cover with asphalt-coated glass fabric**].

3.3 INSTALLATION OF BITUMINOUS DAMPPROOFING, GENERAL

- A. Comply with dampproofing manufacturer's written application instructions for cure time between coats and drying time before backfilling unless otherwise indicated.
 - 1. Apply dampproofing to provide continuous plane of protection.
 - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches (150 mm) over outside face of footing.
 - 1. Extend dampproofing 12 inches (300 mm) onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where indicated as "reinforced," by embedding an 8-inch- (200-mm-) wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.
- C. Where dampproofing exterior face of inner wythe of exterior masonry cavity walls, lap dampproofing at least 1/4 inch (6 mm) onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.
 - 1. Extend dampproofing over outer face of structural members and concrete slabs that interrupt inner wythe.
 - 2. Lap dampproofing at least 1/4 inch (6 mm) onto shelf angles supporting veneer.
- D. Where dampproofing interior face of above-grade, exterior [**concrete**] [**and**] [**masonry**] [**single-wythe masonry**] walls, continue dampproofing through intersecting walls by keeping vertical mortar joints at intersection temporarily open or by dampproofing wall before constructing intersecting walls.

3.4 INSTALLATION OF COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

- A. Concrete Foundations and Parged Masonry Foundation Walls: Apply [**two brush or spray coats at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m) for first coat and 1 gal./100 sq. ft. (0.4 L/sq. m) for second coat**] [**or**] [**one trowel coat at not less than 4 gal./100 sq. ft. (1.6 L/sq. m)**].
- B. Unparged Masonry Foundation Walls: Apply [**primer and two brush or spray coats at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m) for first coat and 1 gal./100 sq. ft. (0.4 L/sq. m) for second coat**] [**or**] [**primer and one trowel coat at not less than 4 gal./100 sq. ft. (1.6 L/sq. m)**].
- C. Unexposed Face of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m).
- D. Unexposed Face of Masonry Retaining Walls: Apply primer and one brush or spray coat at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m).
- E. Concrete Backup for Masonry Veneer Assemblies: Apply one brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).

- F. Masonry Backup for Masonry Veneer Assemblies: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).
- G. Exterior Face of Inner Wythe of Cavity Walls: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).

3.5 INSTALLATION OF COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. Concrete Foundations and Parged Masonry Foundation Walls: Apply **[two brush or spray coats at not less than 1.5 gal./100 sq. ft. (0.6 L/sq. m) for first coat and 1 gal./100 sq. ft. (0.4 L/sq. m) for second coat]** **[one fibered brush or spray coat at not less than 3 gal./100 sq. ft. (1.2 L/sq. m)]** **[or]** **[one trowel coat at not less than 4 gal./100 sq. ft. (1.6 L/sq. m)].**
- B. Unparged Masonry Foundation Walls: Apply **[primer and two brush or spray coats at not less than 1.5 gal./100 sq. ft. (0.6 L/sq. m) for first coat and 1 gal./100 sq. ft. (0.4 L/sq. m) for second coat]** **[primer and one fibered brush or spray coat at not less than 3 gal./100 sq. ft. (1.2 L/sq. m)]** **[or]** **[primer and one trowel coat at not less than 5 gal./100 sq. ft. (2 L/sq. m)].**
- C. Unexposed Face of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m).
- D. Unexposed Face of Masonry Retaining Walls: Apply primer and one brush or spray coat at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m).
- E. Concrete Backup for Masonry Veneer Assemblies: Apply one brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).
- F. Masonry Backup for Masonry Veneer Assemblies: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).
- G. Exterior Face of Inner Wythe of Cavity Walls: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).
- H. Interior Face of Exterior Concrete Walls: Where above grade and indicated to be furred and finished, apply one brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).
- I. Interior Face of Exterior Masonry Walls: Where above grade and indicated to be furred and finished, apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft. (0.4 L/sq. m).

3.6 INSTALLATION OF PROTECTION COURSE

- A. Install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.
 - 1. Support protection course over cured coating with spot application of adhesive type recommended in writing by protection-board manufacturer.
 - 2. Install protection course **[on same day]** **[within 24 hours]** of dampproofing installation (while coating is tacky) to ensure adhesion.

3.7 INSTALLATION OF DRAINAGE PANELS

- A. Molded-Sheet Drainage Panels: Install panels over completed-and-cured dampproofing, with geotextile facing away from wall substrate, in accordance with manufacturer's written instructions. Use adhesive or another method that does not penetrate dampproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - 1. Install [thermal insulation specified in Section 072100 "Thermal Insulation,"] [protection course] before installing drainage panels.
- B. Insulation Drainage Panels: Install panels over completed-and-cured dampproofing. Use adhesive or another method that does not penetrate dampproofing. Cut and fit panels to within 3/4 inch (19 mm) of projections and penetrations.
 - 1. Ensure that drainage channels are aligned and free of obstructions.

3.8 PROTECTION

- A. Protect installed drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where panels are subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- B. Correct dampproofing that does not comply with requirements; repair substrates and reapply dampproofing.

END OF SECTION 07 11 13 00



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 11 13 00	07 14 16 00	Cold Fluid-Applied Waterproofing
07 11 19 00	07 53 23 00	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing
07 13 00 00	03 01 30 71	Self-Adhering Sheet Waterproofing
07 13 13 00	07 11 13 00	Bituminous Dampproofing
07 13 13 00	03 01 30 71	Self-Adhering Sheet Waterproofing



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SECTION 07 13 53 00 - ELASTOMERIC SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Elastomeric sheet waterproofing.
2. Accessory waterproofing system materials.
3. Protection course.
4. Molded-sheet drainage panels.
5. Electronic leak-detection (ELD) materials.
6. Plaza-deck pavers.

B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for forms and waterstops.
2. Section 072100 "Thermal Insulation" for below-grade foundation insulation.
3. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
4. Section 079513.16 "Exterior Expansion Joint Cover Assemblies" for exterior-wall expansion-joint assemblies that interface with waterproofing.
5. Section 079513.19 "Parking Deck Expansion Joint Cover Assemblies" for deck expansion-joint assemblies that interface with waterproofing.

1.2 COORDINATION

- A. Coordinate Work under this Section with adjacent concrete foundation work, including fill[, **other waterproofing systems**][, **under-slab vapor retarders**][, **under-slab insulation**][and][, **subdrainage systems**].
- B. Coordinate requirements for concrete formwork to provide suitable substrate for waterproofing and to minimize penetrations through waterproofing.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference [at **Project site**][by **web conference**]<Insert **location**>.
 1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.
 2. Review transitions within waterproofing system and between waterproofing and adjacent air barrier.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, expansion joints, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.
- C. Samples: For the following products:
1. **8-by-8-inch (200-by-200-mm)** square of waterproofing and flashing sheet.
 2. **4-by-4-inch (100-by-100-mm)** square of drainage panel.
 3. Plaza-deck paver, **[4-by-4-inch (100-by-100-mm) square][full sized]**, in each color and texture required.
 4. Paver pedestal assembly.
- D. Sustainable Design Submittals:
1. Product Data: For waterproofing, providing information for testing in compliance with ASHRAE 160-2016.2009.
 2. Product Data: For waterproofing, providing information for testing in compliance with CCR, Title 24, Part 2, Section 1202 and Ch. 14.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Statements: For Installer.
- B. Field quality control reports.
- C. Sample warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Entity that employs installers and supervisors who are trained and **[certified][approved]** by waterproofing manufacturer.

1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals and to set quality standards for installation.
 1. Build for each typical waterproofing installation including **pavers and** accessories to demonstrate surface preparation, crack and joint treatments, inside and outside corner treatments, and protection.
 - a. Size: **[100 sq. ft. (9.3 sq. m) in area][As indicated on Drawings]**.
 - b. Description: Each type of **[wall][deck][and][plaza]<Insert description>** installation.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.9 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
 1. Warranty Period: [10][20]<Insert number> years from date of Substantial Completion.
- B. Installer's Special Warranty: Specified form, [**on warranty form at end of this Section,**] signed by Installer, covering Work of this Section, for warranty period of [two]<Insert number> years.
 1. Warranty includes removing and reinstalling protection board, drainage panels, insulation, [and][plaza-deck pavers][, including paver pedestal assembly].

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Waterproofing System: Obtain waterproofing materials [and][**protection course**][**drainage panels**] from [**same manufacturer as waterproofing membrane**][or][**manufacturer approved by waterproofing membrane manufacturer**].
- B. Plaza-Deck Paving: Obtain plaza-deck pavers[**and paver pedestals**] from single source from single manufacturer.

2.2 ELASTOMERIC SHEET WATERPROOFING

- A. EPDM Rubber Sheet: ASTM D6134/D6134M, Type I, **60-mil- (1.5-mm-)** thick flexible sheet, unreinforced, formed from EPDM.
 1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

- a. [Carlisle Coatings & Waterproofing Inc]
- b. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Carlisle Coatings & Waterproofing Inc]
- b. <Insert manufacturer's name>

2.3 ACCESSORY WATERPROOFING SYSTEM MATERIALS

- A. General: Accessory materials as recommended in writing by waterproofing manufacturer for intended use and compatibility with one another and with sheet waterproofing.
 - 1. Furnish liquid-type accessory materials that comply with VOC limits of authorities having jurisdiction.
- B. Concealed Sheet Flashing: Same material, construction, and thickness as sheet waterproofing or **60-mil- (1.5-mm-)** thick, uncured EPDM, as required by manufacturer.
- C. Exposed Sheet Flashing: **60-mil- (1.5-mm-)** thick EPDM, cured or uncured, as required by manufacturer.
- D. Bonding Adhesives: For bonding waterproofing sheets and sheet flashings to substrates and projections.
- E. Splicing Cement and Cleaner: Single-component butyl splicing cement and solvent-based splice cleaner.
 - 1. Butyl Gum Tape: **30-mil- (0.76-mm-)** thick by **6-1/4-inch- (160-mm-)** wide, uncured butyl with polyethylene release film.
- F. Lap Sealant: Single-component sealant.
- G. In-Seam Sealant: Single-component sealant.
- H. Water-Cutoff Mastic: Butyl mastic sealant.
- I. Waterproofing and Sheet-Flashing Accessories: Sealants, pourable sealers, cone and vent flashings, inside and outside corner flashings, termination reglets, and other accessories recommended by waterproofing manufacturer for intended use.
- J. Metal Termination Bars: Manufacturer's standard aluminum bars, approximately **1 inch (25 mm)** wide, prepunched, with fasteners.

2.4 PROTECTION COURSE

- A. Protection course material of type and thickness as recommended in writing by waterproofing manufacturer for each Project condition.

2.5 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel with Polymeric Film: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding **No. 70 (0.21-mm)** sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate through the core of **[9 to 21 gpm per ft. (112 to 261 L/min. per m)]<Insert values>**.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[American Hydrotech, Inc.]**
 - b. **[Carlisle Coatings & Waterproofing Inc]**
 - c. **[CETCO is a subsidiary of Minerals Technologies Inc.]**
 - d. **[GCP Applied Technologies Inc.]**
 - e. **[ISI Building Products]**
 - f. **[Polyguard Products, Inc.]**
 - g. **[Urethane Polymers International, Inc. (UPI)]**
 - h. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[American Hydrotech, Inc.]**
 - b. **[Carlisle Coatings & Waterproofing Inc]**
 - c. **[CETCO is a subsidiary of Minerals Technologies Inc.]**
 - d. **[GCP Applied Technologies Inc.]**
 - e. **[ISI Building Products]**
 - f. **[Polyguard Products, Inc.]**
 - g. **[Urethane Polymers International, Inc. (UPI)]**
 - h. **<Insert manufacturer's name>**
- B. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel without Polymeric Film: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding **No. 70 (0.21-mm)** sieve laminated to one side of the core, without a polymeric film bonded to the other side; and with a vertical flow rate through the core of **[9 to 21 gpm per ft. (112 to 261 L/min. per m)]<Insert values>**.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[American Hydrotech, Inc.]**
 - b. **[Carlisle Coatings & Waterproofing Inc]**
 - c. **[CETCO is a subsidiary of Minerals Technologies Inc.]**
 - d. **[GCP Applied Technologies Inc.]**
 - e. **[Hyload; IKO Industries, Inc.]**
 - f. **[ISI Building Products]**
 - g. **[Polyguard Products, Inc.]**
 - h. **[Soprema, Inc.]**

- i. **[Urethane Polymers International, Inc. (UPI)]**
 - j. **[W. R. Meadows, Inc]**
 - k. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[American Hydrotech, Inc.]**
 - b. **[Carlisle Coatings & Waterproofing Inc]**
 - c. **[CETCO is a subsidiary of Minerals Technologies Inc.]**
 - d. **[GCP Applied Technologies Inc.]**
 - e. **[Hyload; IKO Industries, Inc.]**
 - f. **[ISI Building Products]**
 - g. **[Polyguard Products, Inc.]**
 - h. **[Soprema, Inc.]**
 - i. **[Urethane Polymers International, Inc. (UPI)]**
 - j. **[W. R. Meadows, Inc]**
 - k. **<Insert manufacturer's name>**
- C. Woven-Geotextile-Faced, Molded-Sheet Drainage Panel with Polymeric Film: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a woven-geotextile facing with an apparent opening size not exceeding **No. 40 (0.43-mm)** sieve, laminated to one side of the core and a polymeric film bonded to the other side; and with a horizontal flow rate through the core of not less than **[2.8 gpm per ft. (35 L/min. per m)]<Insert value>**.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[GCP Applied Technologies Inc.]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[GCP Applied Technologies Inc.]**
 - b. **<Insert manufacturer's name>**
- D. Woven-Geotextile-Faced, Molded-Sheet Drainage Panel without Polymeric Film: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a woven-geotextile facing with an apparent opening size not exceeding **No. 40 (0.425-mm)** sieve laminated to one side of the core, without a polymeric film bonded to the other side; and with a horizontal flow rate through the core of not less than **[2.8 gpm per ft. (35 L/min. per m)]<Insert value>**.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[American Hydrotech, Inc.]**

- b. [Carlisle Coatings & Waterproofing Inc]
 - c. [CETCO is a subsidiary of Minerals Technologies Inc.]
 - d. [Hyload; IKO Industries, Inc.]
 - e. [Polyguard Products, Inc.]
 - f. [Soprema, Inc.]
 - g. [Urethane Polymers International, Inc. (UPI)]
 - h. [W. R. Meadows, Inc]
 - i. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [American Hydrotech, Inc.]
 - b. [Carlisle Coatings & Waterproofing Inc]
 - c. [CETCO is a subsidiary of Minerals Technologies Inc.]
 - d. [Hyload; IKO Industries, Inc.]
 - e. [Polyguard Products, Inc.]
 - f. [Soprema, Inc.]
 - g. [Urethane Polymers International, Inc. (UPI)]
 - h. [W. R. Meadows, Inc]
 - i. <Insert manufacturer's name>
- E. Molded-Sheet Collector-Panel System with Polymeric Film: Composite subsurface collector-panel system by same manufacturer as primary molded-sheet drainage panels; consisting of a high-profile, studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven-geotextile facing with an apparent opening size not exceeding **No. 40 (0.425-mm)** sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate through the core of **[9 to 17 gpm per ft. (112 to 211 L/min. per m)]<Insert values>** and a minimum horizontal, in-plane flow rate **[as indicated on Drawings]<Insert requirement>**. Provide system with manufacturer's outlets, connectors, tapes, and other accessories to connect primary molded-sheet drainage panels with piped subdrainage system.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
- a. [GCP Applied Technologies Inc.]
 - b. [ISI Building Products]
 - c. [Polyguard Products, Inc.]
 - d. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [GCP Applied Technologies Inc.]
 - b. [ISI Building Products]
 - c. [Polyguard Products, Inc.]
 - d. <Insert manufacturer's name>
- F. Molded-Sheet Collector-Panel System Wrapped with Geotextile: Composite subsurface collector-panel system by same manufacturer as primary molded-sheet drainage panels; consisting of a high-profile, studded, nonbiodegradable, molded-plastic-sheet drainage core; wrapped with a nonwoven-geotextile facing with an apparent opening size not exceeding **No. 40 (0.425-mm)** sieve; and with a vertical flow

rate through the core of [21 to 82 gpm per ft. (261 to 1018 L/min. per m)]<Insert values> and a minimum horizontal, in-plane flow rate [as indicated on Drawings][of 21 gpm per ft. (261 L/min. per m)]<Insert value>. Provide system with manufacturer's outlets, connectors, tapes, and other accessories to connect primary molded-sheet drainage panels with piped subdrainage system.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Carlisle Coatings & Waterproofing Inc]
 - b. [CETCO is a subsidiary of Minerals Technologies Inc.]
 - c. [W. R. Meadows, Inc]
 - d. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Carlisle Coatings & Waterproofing Inc]
 - b. [CETCO is a subsidiary of Minerals Technologies Inc.]
 - c. [W. R. Meadows, Inc]
 - d. <Insert manufacturer's name>

2.6 ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Conductive Medium: Electrically conductive material specifically designed to enable ELD testing procedures as approved in writing by waterproofing membrane manufacturer.
 1. Conductive medium to be located directly under waterproofing membrane in accordance with ASTM D7877 and ASTM D8231.
- B. Moisture-Monitoring System: Permanently embedded, continuously monitored moisture-detection system.
 1. Sensors measuring moisture content to be placed within waterproofing system and connected to a monitoring program, with a notification indicating location of breach.

2.7 PLAZA-DECK PAVERS

- A. Plaza-Deck Pavers: [Brick][Concrete][Asphalt-block] pavers specified in Section 321400 "Unit Paving."
- B. Stone Plaza-Deck Pavers: [Granite][Limestone][Marble][Quartz-based stone][Slate][Travertine]<Insert type> pavers specified in Section 321400 "Unit Paving."
- C. Concrete Plaza-Deck Pavers: Solid, hydraulically pressed, standard-weight concrete units, [square edged][with top edges beveled 3/16 inch (5 mm)], manufactured for use as plaza-deck pavers; [7500 psi (52 MPa)][6500 psi (45 MPa)]<Insert value> minimum compressive strength, ASTM C140/C140M; absorption not greater than 5 percent, ASTM C140/C140M; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance in accordance with ASTM C67/C67M.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Carlisle Coatings & Waterproofing Inc]
 - b. [Hanover Architectural Products]
 - c. [Hastings Pavement Company, LLC]
 - d. [Roofblok Limited]
 - e. [Sunny Brook Pressed Concrete, Co.]
 - f. [Tile Tech Pavers]
 - g. [Wausau Tile, Inc.]
 - h. [Westile Roofing Products; an Oldcastle company]
 - i. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Carlisle Coatings & Waterproofing Inc]
 - b. [Hanover Architectural Products]
 - c. [Hastings Pavement Company, LLC]
 - d. [Roofblok Limited]
 - e. [Sunny Brook Pressed Concrete, Co.]
 - f. [Tile Tech Pavers]
 - g. [Wausau Tile, Inc.]
 - h. [Westile Roofing Products; an Oldcastle company]
 - i. <Insert manufacturer's name>
 3. Thickness: [2 inches (51 mm)][2-3/8 inches (60 mm)]<Insert dimension>.
 4. Face Size: [12 inches (305 mm) square][12 by 24 inches (305 by 610 mm)][18 inches (457 mm) square][24 inches (610 mm) square][As indicated]<Insert dimension(s) and shape>.
 5. Color and Texture: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert requirement>.
- D. Plaza-Deck Paver Metal Straps: Securement strapping fabricated from stainless steel, a minimum of **3 inches (75 mm)** wide by **0.031 inch (0.8 mm)** thick with stainless steel anchors.
- E. Paver Pedestals: Paver-support assembly, [standard with paver manufacturer][or][as named below], including [fixed-height][adjustable or stackable] pedestals, shims, and spacer tabs for joint spacing of [1/8 inch (3 mm)][3/16 inch (5 mm)][1/8 to 3/16 inch (3 to 5 mm)].
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Envirospec, Inc.]
 - b. [Hanover Architectural Products]
 - c. [Roofblok Limited]
 - d. [Sunny Brook Pressed Concrete, Co.]
 - e. [Wausau Tile, Inc.]
 - f. [Westile Roofing Products; an Oldcastle company]
 - g. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Envirospec, Inc.]**
 - b. **[Hanover Architectural Products]**
 - c. **[Roofblok Limited]**
 - d. **[Sunny Brook Pressed Concrete, Co.]**
 - e. **[Wausau Tile, Inc.]**
 - f. **[Westile Roofing Products; an Oldcastle company]**
 - g. **<Insert manufacturer's name>**
3. Fill: As recommended in writing by pedestal manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate preparations and other conditions affecting performance of waterproofing.
 1. Verify that concrete substrate has cured and aged for minimum time recommended in writing by waterproofing manufacturer.
 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by waterproofing manufacturer. Test for capillary moisture by plastic sheet method in accordance with ASTM D4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean, prepare, and treat substrates in accordance with manufacturer's written installation instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks in accordance with ASTM D4258.
- F. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions.

3.3 INSTALLATION OF ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Install conductive medium directly under waterproofing membrane in accordance with ASTM D7877 and ASTM D8231.
- B. Install sensors, connections, and accessory items required for complete continuously monitored moisture-detection system in accordance with waterproofing manufacturer's written installation instructions.

3.4 INSTALLATION OF ELASTOMERIC SHEET WATERPROOFING

A. Fully Adhered Elastomeric Sheet Waterproofing:

- 1. Install fully adhered sheets over entire area to receive waterproofing in accordance with manufacturer's written installation instructions and in accordance with recommendations in ASTM D6134/D6134M.
- 2. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required. Stagger end laps.
- 3. Apply bonding adhesive to substrates at required rate and allow it to partially dry.
- 4. Apply bonding adhesive to sheets and firmly adhere sheets to substrates. Do not apply bonding adhesive to splice area of sheet.
- 5. Install fully adhered sheets and accessory materials to tie into existing waterproofing.
- 6. Repair tears, voids, and lapped seams in waterproofing that do not comply with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending beyond repaired areas in all directions.
- 7. Horizontal Application: Apply sheets with side laps shingled with slope of deck where possible.
 - a. Spread sealant bed over deck drain flange at deck drains and securely seal sheet waterproofing in place with clamping ring.

B. Partially Adhered Elastomeric Sheet Waterproofing:

- 1. Install partially adhered sheets over entire area to receive waterproofing in accordance with manufacturer's written installation instructions.
- 2. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required. Stagger end laps.
- 3. Apply bonding adhesive to the following areas of substrates and to each sheet at required rate and allow it to partially dry:
 - a. Upper 25 percent of length of each sheet and **18 inches (457 mm)** around perimeter of each sheet.
- 4. Firmly adhere sheets to substrate. Do not apply bonding adhesive to splice area of sheet.
- 5. Install partially adhered sheets and accessory materials to tie into existing waterproofing.
- 6. Repair tears, voids, and lapped seams in waterproofing that do not comply with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending beyond repaired areas in all directions.

C. Compartmented, Loosely Laid Elastomeric Sheet Waterproofing:

- 1. Install compartmented, loosely laid sheets over entire area to receive waterproofing in accordance with manufacturer's written installation instructions.
- 2. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required. Stagger end laps.
- 3. Apply continuous beads of water-cutoff mastic, of size recommended in writing by waterproofing

manufacturer, to substrates in a **60-by-60-inch (1500-by-1500-mm)** grid pattern before installing sheet.

4. Apply sheets with side laps shingled with slope of deck where possible.
5. Spread sealant bed over deck drain flange at deck drains and securely seal sheet waterproofing in place with clamping ring.
6. Install compartmented, loosely laid sheets and accessory materials to tie into existing waterproofing.
7. Repair tears, voids, and lapped seams in waterproofing that do not comply with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending beyond repaired areas in all directions.

- D. Cement Splice: Clean splice areas, apply splicing cement and in-seam sealant, and firmly roll side and end laps of overlapping sheets in accordance with manufacturer's written instructions to produce a splice not less than **6 inches (150 mm)** wide and to ensure a watertight seam installation. Apply lap sealant and seal edges of sheet terminations.
- E. Cement and Tape Splice: Clean splice areas, apply splicing cement and butyl gum tape, and firmly roll side and end laps of overlapping sheets in accordance with manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal edges of sheet terminations.
- F. Install sheet flashings and preformed flashing accessories and adhere to substrates in accordance with waterproofing manufacturer's written installation instructions.
- G. Form wall flashings using exposed sheet flashing.
- H. Extend deck sheet waterproofing to form wall flashings.
1. Flash penetrations and field-formed inside and outside corners with uncured sheet flashing.
 2. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight installation. Apply lap sealant and seal edges of sheet-flashing terminations.
- I. Cover expansion joints and discontinuous deck-to-wall or deck-to-deck joints by extending deck sheet waterproofing over joints.
- J. Terminate and seal top of sheet flashings[**with mechanically anchored termination bars**].

3.5 INSTALLATION OF PROTECTION COURSE

- A. Install protection course over waterproofing membrane in accordance with manufacturer's written instructions and before beginning subsequent construction operations. Minimize exposure of membrane.
1. Molded-sheet drainage panels may be used in place of a separate protection course for vertical applications when approved by waterproofing manufacturer.

3.6 INSTALLATION OF MOLDED-SHEET DRAINAGE PANELS

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, in accordance with manufacturer's written instructions. Use adhesive or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

1. For vertical applications, install protection course before installing drainage panels.

3.7 INSTALLATION OF PLAZA-DECK PAVERS

- A. Install pavers in accordance with manufacturer's written instructions.
- B. Install paver pedestals and accessories to required elevations. Adjust for final level and slope of paved surfaces.
- C. Loosely lay pavers on pedestals, maintaining a uniform open joint width. Tightly seat pavers against spacers to eliminate lateral movement or drift of paving assembly. Align joint patterns parallel in each direction.
 1. Lay out pavers to avoid less-than-half-width pavers at perimeter or other terminations.
- D. Install pavers to vary no more than **1/16 inch (1.6 mm)** in elevation between adjacent pavers and no more than **1/16 inch (1.6 mm)** from surface plane elevation of individual paver.
- E. Limit variation in paving installation to within **1/4 inch in 10 ft. (6 mm in 3 m)]<Insert dimensions>** of surface plane in any direction; noncumulative.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests.
- B. Perform the following tests before overlying construction is placed:
 1. ELD Testing: Testing agency surveys entire horizontal waterproofed area and flashings to locate discontinuities in the system assembly using ELD in accordance with ASTM D7877 and ASTM D8231.
 - a. After testing, repair areas of discontinuities, repeat tests, and make further repairs until waterproofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
 2. Flood Testing: Flood test each completed horizontal waterproofed area for leaks, in accordance with recommendations in ASTM D5957. Install temporary containment assemblies, plug, or dam drains, and flood with potable water.
 - a. Flood to an average depth of **[2-1/2 inches (63 mm)]<Insert depth>** with a minimum depth of **[1 inch (25 mm)]<Insert depth>** and not exceeding a depth of **[4 inches (100 mm)]<Insert depth>**. Maintain **2 inches (50 mm)** of clearance from top of base flashing.
 - b. Flood each area for **[24][48][72]** hours.
 - c. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing and flashing installations are watertight.
 - 1) Cost of retesting is the responsibility of Contractor.
 - d. Testing agency to prepare survey report indicating locations of initial leaks, if any, and final

survey report.

- C. Manufacturer's Field Service: Engage a[**full-time**] site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components; and to furnish daily reports to Architect.
 - 1. Final Inspection: Arrange for waterproofing system manufacturer's technical personnel to inspect system installation on completion, in presence of Architect, and to prepare inspection report.
 - 2. Notify Architect[**and Owner**] 48 hours in advance of date and time of inspection.
 - 3. Repair or remove and replace components of waterproofing system where inspections indicate that they do not comply with specified requirements.
- D. Additional Tests and Inspections:
 - 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.
 - 2. Waterproofing system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.9 PROTECTION, REPAIR, AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Protect installed waterproofing from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- D. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- E. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 07 13 53 00



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 13 53 00	03 01 30 71	Self-Adhering Sheet Waterproofing



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SECTION 07 13 54 00 - THERMOPLASTIC SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermoplastic sheet waterproofing.
2. Accessory waterproofing system materials.
3. Protection course.
4. Drainage panels.
5. Electronic leak-detection (ELD) materials.
6. Plaza-deck pavers.

B. Related Requirements:

1. Section 072100 "Thermal Insulation" for general building insulation.
2. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
3. Section 079513.16 "Exterior Expansion Joint Cover Assemblies" for exterior-wall expansion-joint assemblies that interface with waterproofing.
4. Section 079513.19 "Parking Deck Expansion Joint Cover Assemblies" for deck expansion-joint assemblies that interface with waterproofing.

1.2 COORDINATION

- A. Coordinate Work under this Section with adjacent concrete substrate work, including fill[, **other waterproofing systems**][, **under-slab vapor retarders**][, **under-slab insulation**][and][, **subdrainage systems**].
- B. Coordinate requirements for concrete formwork to provide suitable substrate for waterproofing and to minimize penetrations through waterproofing.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at [at Project site][by web conference]<Insert location>.
 1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.
 2. Review transitions within waterproofing system and between waterproofing and adjacent air barrier.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and tested physical and performance

- properties of waterproofing.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, expansion joints, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1. Include layout drawings showing locations of submembrane containment strips[**and control test drains**].
2. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.

C. Samples: For the following products:

1. **8-by-8-inch (200-by-200-mm)** square of waterproofing and flashing sheet.
2. **4-by-4-inch (100-by-100-mm)** square of drainage panel.
3. Plaza-deck paver, **[4-by-4-inch (100-by-100-mm) square][full sized]**, in each color and texture required.
4. Paver pedestal assembly.

D. Sustainable Design Submittals:

1. Product Data: For waterproofing, providing information for testing in compliance with ASHRAE 160-2016.2009.
2. Product Data: For waterproofing, providing information for testing in compliance with CCR, Title 24, Part 2, Section 1202 and Ch. 14.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Statements: For Installer.
- B. Field quality control reports.
- C. Sample warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Entity that employs installers and supervisors who are trained and **[certified][approved]** by waterproofing manufacturer.

1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals and to set quality standards for installation.
 1. Build for each typical waterproofing installation including[**pavers and**] accessories to demonstrate surface preparation, crack and joint treatments, inside and outside corner treatments, and protection.
 - a. Size: **[100 sq. ft. (9.3 sq. m) in area][As indicated on Drawings]**.
 - b. Description: Each type of **[deck][and][plaza]<Insert description>** installation.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Do not permit asphaltic materials or polystyrene insulation to contact PVC materials.
- C. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.9 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
 1. Warranty Period: **[Five][10][20]<Insert number>** years from date of Substantial Completion.
- B. Installer's Special Warranty: Specified form, **[on warranty form at end of this Section,]** signed by Installer, covering Work of this Section, for warranty period of **[two]<Insert number>** years.
 1. Warranty includes removing and reinstalling protection board, drainage panels, insulation, **[and][plaza-deck pavers][, including paver pedestal assembly].**

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Waterproofing System: Obtain waterproofing materials **[and][protection course][drainage panels]** from **[same manufacturer as waterproofing membrane][or][manufacturer approved by waterproofing membrane manufacturer].**
- B. Plaza-Deck Paving: Obtain plaza-deck pavers **[and paver pedestals]** from single source from single manufacturer.

2.2 THERMOPLASTIC SHEET WATERPROOFING

- A. PVC Sheet: **[60-mil- (1.5-mm-)][80-mil- (2.0-mm-)]** thick, PVC membrane with integral pigments, stabilizers, UV absorbers, biocide, and nonwoven fiberglass reinforcement; with the following properties measured in accordance with standard test methods referenced:
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering**

products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [CETCO is a subsidiary of Minerals Technologies Inc.]
- b. [Sika Corporation]
- c. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [CETCO is a subsidiary of Minerals Technologies Inc.]
- b. [Sika Corporation]
- c. <Insert manufacturer's name>

3. Tensile Strength: **1500 psi (10.3 MPa)** minimum; ASTM D638.
4. Elongation at Break: 240 percent minimum, machine direction; ASTM D638.
5. Seam Strength: 90 percent minimum of tensile strength; ASTM D638.
6. Retention of Properties after Heat Aging: 95 percent minimum retention of tensile strength and elongation; ASTM D638 after 168 hours at **194 deg F (90 deg C)**; ASTM D3045.
7. Tear Resistance: **21 lbf (95 N)** minimum; ASTM D1004.
8. Low-Temperature Bend: Pass at **minus 40 deg F (minus 40 deg C)**; ASTM D2136.
9. Linear Dimension Change: 0.002 percent maximum after 6 hours at **176 deg F (80 deg C)**; ASTM D1204.
10. Water Absorption: 2.5 percent maximum weight gain after 168 hours' immersion at **158 deg F (70 deg C)**; ASTM D570.
11. Dynamic Puncture Resistance: **117.7 ft. pdl (5 J)** minimum; ASTM D5635/D5635M.

- B. Self-Adhered PVC Sheet: **120-mil- (3.0-mm-)** thick, composite sheet composed of **60-mil- (1.5-mm-)** thick, PVC membrane with integral pigments, stabilizers, biocide, and nonwoven fiberglass reinforcement; a **60-mil- (1.5-mm-)** thick, nonpermeable, closed-cell-foam backing layer; and a pressure-sensitive adhesive coating; with the following properties measured in accordance with standard test methods referenced:

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Sika Corporation]
- b. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Sika Corporation]
- b. <Insert manufacturer's name>

3. Tensile Strength: **1500 psi (10.3 MPa)** minimum; ASTM D638.
4. Elongation at Break: 240 percent minimum, machine direction; ASTM D638.
5. Seam Strength: 90 percent minimum of tensile strength; ASTM D638.
6. Retention of Properties after Heat Aging: 95 percent minimum retention of tensile strength and elongation; ASTM D638 after 168 hours at **194 deg F (90 deg C)**; ASTM D3045.
7. Tear Resistance: **21 lbf (95 N)** minimum; ASTM D1004.

8. Linear Dimension Change: 0.002 percent maximum after 6 hours at **176 deg F (80 deg C)**; ASTM D1204.
9. Dynamic Puncture Resistance: **949.2 ft. pdl (40 J)** minimum; ASTM D5635/D5635M.

2.3 ACCESSORY WATERPROOFING SYSTEM MATERIALS

- A. General: Furnish accessory materials as recommended in writing by waterproofing manufacturer for intended use and compatibility with one another and with sheet waterproofing.
 1. Furnish liquid-type accessory materials that comply with VOC limits of authorities having jurisdiction.
- B. Concealed Sheet Flashing: Same material, construction, and thickness as sheet waterproofing.
- C. Exposed PVC Sheet Flashing: PVC-sheet flashing [**60 mils (1.5 mm)**][**80 mils (2.0 mm)**][**96 mils (2.4 mm)**] thick; PVC with integral pigments, stabilizers, UV absorbers, and biocide; reinforced with nonwoven fiberglass.
- D. Surface Conditioner: Manufacturer's standard waterborne surface treatment to bind residual surface dust and efflorescence to substrate.
- E. Bonding Adhesives: For bonding waterproofing sheets[, **containment strips**,] and sheet flashings to substrates.
- F. Containment Strip: Manufacturer's standard asphalt-resistant, **60-mil- (1.5-mm-)** thick, containment strip; reinforced with nonwoven fiberglass; **12 inches (300 mm)** wide.
- G. Geotextile Leveling Layer: Manufacturer's standard **0.22-inch- (5.59-mm-)** thick, nonwoven polypropylene fabric.
- H. Separation Layer: Manufacturer's standard **0.16-inch- (4.06-mm-)** thick, nonwoven polypropylene fabric.
- I. Waterproofing and Sheet-Flashing Accessories: Sealants, pourable sealers, termination reglets, clamps, compression bars, tapes, preformed cone and stack flashings, and other accessories recommended in writing by waterproofing manufacturer for intended use.
- J. Control Test Drain: Manufacturer's standard assembly to verify the absence or presence of leaks from underside of waterproofed slab.
- K. Metal Termination Bars: Manufacturer's standard stainless steel or aluminum bars, prepunched, with noncorrosive fasteners.

2.4 PROTECTION COURSE

- A. Protection course material of type and thickness as recommended in writing by waterproofing manufacturer for each Project condition.

2.5 DRAINAGE PANELS

- A. Composite Drainage Panels: Drainage panel acceptable to waterproofing manufacturer and consisting of a nonbiodegradable core of fused, entangled filaments or a three-dimensional drainage net; with a

geotextile facing on both sides.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[CETCO is a subsidiary of Minerals Technologies Inc.]**
 - b. **[Sika Corporation]**
 - c. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CETCO is a subsidiary of Minerals Technologies Inc.]**
 - b. **[Sika Corporation]**
 - c. **<Insert manufacturer's name>**

2.6 ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Conductive Medium: Electrically conductive material specifically designed to enable ELD testing procedures as approved in writing by waterproofing membrane manufacturer.
 1. Conductive medium to be located directly under waterproofing membrane in accordance with ASTM D7877 and ASTM D8231.
- B. Moisture-Monitoring System: Permanently embedded, continuously monitored moisture-detection system.
 1. Sensors measuring moisture content to be placed within waterproofing system and connected to a monitoring program, with a notification indicating location of breach.

2.7 PLAZA-DECK PAVERS

- A. Plaza-Deck Pavers: **[Brick][Concrete][Asphalt-block]** pavers specified in Section 321400 "Unit Paving."
- B. Stone Plaza-Deck Pavers: **[Granite][Limestone][Marble][Quartz-based stone][Slate][Travertine]<Insert type>** pavers specified in Section 321400 "Unit Paving."
- C. Concrete Plaza-Deck Pavers: Solid, hydraulically pressed, standard-weight concrete units, **[square edged][with top edges beveled 3/16 inch (5 mm)]**, manufactured for use as plaza-deck pavers; **[7500 psi (52 MPa)][6500 psi (45 MPa)]<Insert value>** minimum compressive strength, ASTM C140/C140M; absorption not greater than 5 percent, ASTM C140/C140M; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance in accordance with ASTM C67/C67M.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. [Carlisle Coatings & Waterproofing Inc]
 - b. [Hanover Architectural Products]
 - c. [Hastings Pavement Company, LLC]
 - d. [Roofblok Limited]
 - e. [Sunny Brook Pressed Concrete, Co.]
 - f. [Tile Tech Pavers]
 - g. [Wausau Tile, Inc.]
 - h. [Westile Roofing Products; an Oldcastle company]
 - i. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Carlisle Coatings & Waterproofing Inc]
 - b. [Hanover Architectural Products]
 - c. [Hastings Pavement Company, LLC]
 - d. [Roofblok Limited]
 - e. [Sunny Brook Pressed Concrete, Co.]
 - f. [Tile Tech Pavers]
 - g. [Wausau Tile, Inc.]
 - h. [Westile Roofing Products; an Oldcastle company]
 - i. <Insert manufacturer's name>
 3. Thickness: [2 inches (51 mm)][2-1/2 inches (64 mm)]<Insert dimension>.
 4. Face Size: [12 inches (305 mm) square][12 by 24 inches (305 by 610 mm)][18 inches (457 mm) square][24 inches (610 mm) square][As indicated]<Insert dimension(s) and shape>.
 5. Color and Texture: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert requirement>.
- D. Plaza-Deck Paver Metal Straps: Securement strapping fabricated from stainless steel, a minimum of 3 inches (75 mm) wide by 0.031 inch (0.8 mm) thick with stainless steel anchors.
- E. Paver Pedestals: Paver-support assembly, [standard with paver manufacturer][or][named below], including [fixed-height][adjustable or stackable] pedestals, shims, and spacer tabs for joint spacing of [1/8 inch (3 mm)][3/16 inch (5 mm)][1/8 to 3/16 inch (3 to 5 mm)].
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Envirospec, Inc.]
 - b. [Hanover Architectural Products]
 - c. [Roofblok Limited]
 - d. [Sunny Brook Pressed Concrete, Co.]
 - e. [Wausau Tile, Inc.]
 - f. [Westile Roofing Products; an Oldcastle company]
 - g. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Envirospec, Inc.]

- b. [Hanover Architectural Products]
- c. [Roofblok Limited]
- d. [Sunny Brook Pressed Concrete, Co.]
- e. [Wausau Tile, Inc.]
- f. [Westile Roofing Products; an Oldcastle company]
- g. <Insert manufacturer's name>

- 3. Fill: As recommended in writing by pedestal manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of waterproofing.
 - 1. Verify that concrete substrate has cured and aged for minimum time recommended in writing by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by waterproofing manufacturer. Test for capillary moisture by plastic sheet method in accordance with ASTM D4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean, prepare, and treat substrates in accordance with waterproofing manufacturer's written installation instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks in accordance with ASTM D4258.
- F. Prepare, treat, and seal surfaces at terminations and penetrations through waterproofing and at drains and protrusions.

3.3 INSTALLATION OF ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Install conductive medium directly under waterproofing membrane in accordance with ASTM D7877 and ASTM D8231.
- B. Install sensors, connections, and accessory items required for complete continuously monitored

moisture-detection system in accordance with waterproofing manufacturer's written installation instructions.

3.4 INSTALLATION OF THERMOPLASTIC SHEET WATERPROOFING

A. Fully Adhered Thermoplastic Sheet Waterproofing:

1. Install self-adhered sheets over entire area to receive waterproofing in accordance with manufacturer's written installation instructions.
 - a. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required. Stagger end laps.
 - b. Install laps shingled with slope of deck where possible.
 - c. Install flashings concurrently with deck sheet.
 - d. Perform hot-air welding to ensure a watertight seam installation. Inspect outside edge of seams with pointed metal probe and ensure completed laps lay flat and are free of voids, fishmouths, or wrinkles.
 - e. Install temporary cut-offs if work is interrupted. Remove the cut-offs completely before proceeding with the installation.
 - f. Install sheets and auxiliary materials to tie into adjoining waterproofing.
2. Apply surface conditioner, at required rate, to substrates to receive waterproofing. Apply only at temperatures greater than **25 deg F (minus 4 deg C)** and rising.
3. Apply and firmly adhere sheets to substrate; butt adjoining sheets tightly. Apply only when the membrane, air, and substrate temperatures are greater than **40 deg F (5 deg C)** and rising. Apply a minimum **8-inch- (203-mm-)** wide cover strip centered over joints and lap edges; hot-air weld cover strip to deck sheet.
4. Hot-air weld three-way overlaps or T-joints with a **4-inch- (102-mm-)** round or square patch.
5. Unless terminations and deck-sheet waterproofing perimeter are sealed with flashings, secure them with mechanically anchored metal termination bar. Seal edge of termination with sealant.
6. Install flashing at deck drains. Spread sealant bed over deck drain flange, lap flashing membrane into drain flange and over deck sheet in accordance with membrane manufacturer's written instructions, and hot-air-weld flashing to deck sheet; securely seal flashing sheet in place with clamping ring.
7. Perform field quality-control testing before subsequent work.

B. Loosely Laid Thermoplastic Sheet Waterproofing:

1. Install loosely laid sheets over entire area to receive waterproofing in accordance with manufacturer's written installation instructions.
 - a. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required. Stagger end laps.
 - b. Install laps shingled with slope of deck where possible.
 - c. Install flashings concurrently with deck sheet.
 - d. Perform hot-air welding to ensure a watertight seam installation. Inspect outside edge of seams with pointed metal probe and ensure completed laps lay flat and are free of voids, fishmouths, or wrinkles.
 - e. Install temporary cut-offs if work is interrupted. Remove the cut-offs completely before proceeding with the installation.
 - f. Install sheets and auxiliary materials to tie into adjoining waterproofing.
2. Install geotextile leveling layer over entire area to receive deck sheet. Lap edges at least **4 inches (102 mm)** and spot adhere fabric to deck as required to keep in position as waterproofing sheet is placed in position. Trim fabric using scissors or utility blades; do not use

- welding equipment to cut fabric.
- 3. Apply deck sheet over area, lapping edges at least **3 inches (76 mm)** for machine welding or at least **4 inches (102 mm)** for hand welding. Hot-air weld sheets.
- 4. Hot-air weld three-way overlaps or T-joints with a **4-inch- (102-mm-)** round or square patch.
- 5. Secure perimeter of deck sheet with manufacturer's standard metal termination bars and accessories as recommended by manufacturer for each condition.
- 6. At deck drains, spread sealant bed over drain flange and lap membrane into drain flange in accordance with membrane manufacturer's written installation instructions; securely seal sheets in place with clamping ring.
- 7. Perform field quality-control testing before subsequent work.

C. Compartmented, Loosely Laid Thermoplastic Sheet Waterproofing:

- 1. Install compartmented, loosely laid sheets over entire area to receive waterproofing in accordance with manufacturer's written installation instructions.
 - a. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required. Stagger end laps.
 - b. Install laps shingled with slope of deck where possible.
 - c. Install flashings concurrently with deck sheet.
 - d. Perform hot-air welding to ensure a watertight seam installation. Inspect outside edge of seams with pointed metal probe and ensure completed laps lay flat and are free of voids, fishmouths, or wrinkles.
 - e. Install temporary cut-offs if work is interrupted. Remove the cut-offs completely before proceeding with the installation.
 - f. Install sheets and auxiliary materials to tie into adjoining waterproofing.
- 2. Construct a test containment grid before beginning installation. Perform manufacturer's recommended peel test on the test containment grid and on each day's completed waterproofing work before resuming the following day's installation.
- 3. Install submembrane containment grid to form compartments secured by containment strips. Also, install containment strips at the base of walls, curbs, penetrations, terminations, and transitions and at the perimeter of the installation. Secure containment grid to substrate with bonding adhesive.
- 4. Install geotextile leveling layer over entire area between containment strips. Lap edges at least **4 inches (102 mm)** and spot adhere fabric to deck as required to keep in position as waterproofing sheet is placed in position. Trim fabric even with edges of containment strips using scissors or utility blades; do not use welding equipment to cut fabric.
- 5. Control-Test-Drain Installation: Drill **1-inch- (25-mm-)** diameter hole through the substrate at or near the low point of each compartment and install control test drain, in accordance with manufacturer's written instructions, so as to enable verification of the absence or presence of leaks from underside of waterproofed slab.
- 6. Apply deck sheet over area, lapping edges at least **3 inches (76 mm)** for machine welding or at least **4 inches (102 mm)** for hand welding. Hot-air weld the sheet to containment strips.
- 7. Hot-air weld three-way overlaps or T-joints with a **4-inch- (102-mm-)** round or square patch.
- 8. Install flashing at deck drains. Spread sealant bed over deck drain flange, lap flashing membrane into drain flange and over containment strips in accordance with membrane manufacturer's written instructions, and hot-air weld flashing to containment strips; securely seal flashing sheet in place with clamping ring.
- 9. Perform field quality-control testing before subsequent work.
- 10. Repair tears, voids, and lapped seams in waterproofing that do not comply with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending beyond repaired areas in all directions.

D. Form wall flashings exposed in final construction using exposed sheet flashing; otherwise, use

concealed sheet flashing.

- E. Lap sheet flashings over deck sheet or containment strips. Flash penetrations and field-formed inside and outside corners with sheet flashing.
- F. Extend flashings a minimum of **8 inches (203 mm)** above the overburden unless otherwise indicated on Drawings and acceptable to waterproofing manufacturer.
- G. Hot-air weld joints with deck sheet or containment strips and end laps of overlapping sheet flashings and accessories to ensure a watertight seam installation.
- H. Hot-air weld three-way overlaps or T-joints with a **4-inch- (102-mm-)** round or square patch.
- I. Secure flashings along top edge with mechanically anchored metal termination bar or with mechanically anchored metal reglet for subsequent metal counterflashing. Seal top of termination with sealant.
- J. Terminate deck sheet at expansion joints and discontinuous deck-to-wall or deck-to-deck joints. Bridge and cover joints with sheet flashing and joint accessories in accordance with manufacturer's written instructions for each type of joint.

3.5 INSTALLATION OF PROTECTION COURSE

- A. Install protection course immediately after waterproofing-membrane manufacturer's inspection and acceptance of the waterproofing installation.
- B. Install protection course over sheet waterproofing in accordance with manufacturer's written installation instructions and before beginning subsequent construction operations. Minimize exposure of membrane.

3.6 INSTALLATION OF DRAINAGE PANELS

- A. Install drainage panels immediately after waterproofing-membrane manufacturer's inspection and acceptance of the waterproofing installation. Minimize exposure of membrane.
- B. Place and secure drainage panels directly over the waterproofing membrane, in accordance with waterproofing manufacturer's written installation instructions.
- C. Trim drainage panels to fit closely around penetrations and at the base of drains to ensure that water flows freely from composite into drain openings.

3.7 INSTALLATION OF PLAZA-DECK PAVERS

- A. Install pavers in accordance with manufacturer's written installation instructions.
- B. Install paver pedestals and accessories to required elevations. Adjust for final level and slope of paved surfaces.
- C. **[Loosely lay pavers on pedestals][Seat pavers on pedestals and install bolted plate in accordance with manufacturer's written installation instructions]**, maintaining a uniform open joint width. Tightly seat pavers against spacers to eliminate lateral movement or drift of paving assembly. Align joint patterns parallel in each direction.

1. Lay out pavers to avoid less-than-half-width pavers at perimeter or other terminations.
- D. Install pavers to vary no more than **1/16 inch (1.6 mm)** in elevation between adjacent pavers and no more than **1/16 inch (1.6 mm)** from surface plane elevation of individual paver.
- E. Limit variation in paving installation to within [**1/4 inch in 10 ft. (6 mm in 3 m)**]**<Insert dimensions>** of surface plane in any direction; noncumulative.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests.
- B. Perform the following tests before overlying construction is placed:
 1. ELD Testing: Testing agency surveys entire horizontal waterproofed area and flashings to locate discontinuities in the system assembly using ELD in accordance with ASTM D7877 and ASTM D8231.
 - a. After testing, repair areas of discontinuities, repeat tests, and make further repairs until waterproofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
 2. Flood Testing: Flood test each completed horizontal waterproofed area for leaks, in accordance with recommendations in ASTM D5957. Install temporary containment assemblies, plug, or dam drains, and flood with potable water.
 - a. Flood to an average depth of [**2-1/2 inches (63 mm)**]**<Insert depth>** with a minimum depth of [**1 inch (25 mm)**]**<Insert depth>** and not exceeding a depth of [**4 inches (100 mm)**]**<Insert depth>**. Maintain **2 inches (50 mm)** of clearance from top of base flashing.
 - b. Flood each area for [**24**][**48**][**72**] hours.
 - c. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing and flashing installations are watertight.
 - 1) Cost of retesting is the responsibility of Contractor.
 - d. Testing agency to prepare survey report indicating locations of initial leaks, if any, and final survey report.
- C. Manufacturer's Field Service: Engage a **[full-time]** site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components; and to furnish daily reports to Architect.
 1. Final Inspection: Arrange for waterproofing system manufacturer's technical personnel to inspect system installation on completion, in presence of Architect, and to prepare inspection report.
 2. Notify Architect **[and Owner]** 48 hours in advance of date and time of inspection.
 3. Repair or remove and replace components of waterproofing system where inspections indicate that they do not comply with specified requirements.
- D. Additional Tests and Inspections:



1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.
2. Waterproofing system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.9 PROTECTION, REPAIR, AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

END OF SECTION 07 13 54 00



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SECTION 07 14 13 00 - HOT FLUID-APPLIED RUBBERIZED ASPHALT WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hot fluid-applied rubberized asphalt waterproofing.
2. Accessory waterproofing system materials.
3. Protection course.
4. Molded-sheet drainage panels.
5. Insulation drainage panels.
6. Electronic leak detection (ELD) materials.
7. Plaza-deck pavers.

B. Related Requirements:

1. Section 072100 "Thermal Insulation" for below-grade foundation insulation.
2. Section 075556 "Fluid-Applied Protected Membrane Roofing" for hot fluid-applied rubberized asphalt roofing system.
3. Section 079100 "Preformed Joint Seals" for foundation-wall expansion joints that interface with waterproofing.
4. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
5. Section 079513.16 "Exterior Expansion Joint Cover Assemblies" for exterior-wall expansion-joint assemblies that interface with waterproofing.
6. Section 079513.19 "Parking Deck Expansion Joint Cover Assemblies" for plaza expansion-joint assemblies that interface with waterproofing.
7. Section 221423 "Storm Drainage Piping Specialties" for plaza-deck drains.
8. Section 321400 "Unit Paving" for plaza-deck pavers set on setting beds.
9. Section 334600 "Subdrainage" for molded-sheet drainage panel.

1.2 DEFINITIONS

- A. Compatible: Material that will not adversely affect adjacent materials, is chemically compatible with adjacent materials, and where required for bond, achieves adhesive compatibility with adjacent materials.
- B. Chemical Compatibility: Material that will not breakdown, deteriorate, degrade, or prematurely fail when in contact with another material. Material that will not cause chemical breakdown, deterioration, degradation, staining, or premature failure of another material.
- C. Adhesive Compatibility: Material that will develop bond strength or provide a suitable surface for another material to develop bond strength complying with requirements when in contact with another material.

1.3 COORDINATION

- A. Coordinate Work under this Section with adjacent concrete foundation work, including fill[, **other waterproofing systems**] [, **under-slab vapor retarders**] [, **under-slab insulation**] [**and**] [, **subdrainage systems**].

- B. Coordinate requirements for concrete formwork to provide suitable substrate for waterproofing and to minimize penetrations through waterproofing.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]** **<Insert location>**.
 - 1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.
 - 2. Review transitions within waterproofing system and between waterproofing and adjacent air barrier.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings:
 - 1. Indicate locations and extent of waterproofing.
 - 2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, expansion-joint conditions, tie-ins with adjoining waterproofing, and other termination conditions.
 - 3. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported plaza-deck pavers.
- C. Samples: For the following materials:
 - 1. Drainage panel, 4 by 4 inch (100 by 100 mm).
 - 2. Plaza-deck paver, **[4 by 4 inch (100 by 100 mm)] [full sized]**.
 - 3. Paver pedestal assembly.
- D. Sustainable Design Submittals:
 - 1. <Double click to insert sustainable design text for moisture control>

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Statements: For **[Installer]** **[and]** **[testing agency]**.
- B. Field quality control reports.
- C. Sample warranties.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Entity that employs installers and supervisors who are trained and **[certified]** **[approved]** by waterproofing manufacturer.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals and to set quality standards for installation.
1. Build mockups for each typical waterproofing installation including **[pavers and]** accessories to demonstrate surface preparation, crack and joint treatments, inside and outside corner treatments, and protection.
 - a. Size: **[100 sq. ft. (9.3 sq. m) in area]** **[As indicated on Drawings]**.
 - b. Description: Each type of **[wall]** **[deck]** **[and]** **[plaza]** **<Insert description>** installation.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by waterproofing manufacturer. Protect stored materials in accordance with manufacturer's written instructions.
- B. Remove and replace materials that cannot be applied within their stated shelf life.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer.
1. Do not apply waterproofing to frozen, damp, or wet substrates, or when temperature is below 0 deg F (minus 18 deg C).
 2. Do not apply waterproofing when snow, rain, fog, or mist are present, or when such weather conditions are imminent during application and curing period.
- B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.11 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or remove and replace waterproofing that fails to remain watertight within specified warranty period.
1. Warranty includes leak remediation, including repair, removal, and replacement of **[protection boards]** **[drainage panels]** **[and]** **[pedestals and pavers on plaza decks]**.
 2. Pavers Warranty: Pavers must not dish or warp, nor crack, split, or disintegrate in freeze-thaw conditions.

3. Warranty Period: **[Five]** **[10]** **<Insert number>** years from date of Substantial Completion.
- B. Installer's Special Warranty: Submit warranty**[, on warranty form at end of this Section,]** signed by Installer, covering the Work of this Section, for warranty period of **[two]** **<Insert number>** years from date of Substantial Completion.
 1. Warranty includes leak remediation, including repair, removal, and replacement of **[protection boards]** **[drainage panels]** **[and]** **[pedestals and pavers on plaza decks]**.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Waterproofing System: Obtain waterproofing materials **[and]** **[protection course]** **[molded-sheet drainage panels]** **[insulation drainage panels]** from **[same manufacturer as waterproofing membrane]** **[or]** **[manufacturer approved by waterproofing membrane manufacturer]**.
- B. Plaza-Deck Paving: Obtain plaza-deck pavers**[and paver pedestal assembly]** from single source from single manufacturer for consistent quality in appearance and physical properties.

2.2 HOT FLUID-APPLIED RUBBERIZED ASPHALT WATERPROOFING

- A. Single-Component Waterproofing: **[Reinforced]** **[Unreinforced]**; 100 percent solids rubberized asphalt membrane.
 1. **<Double click here to find, evaluate, and insert list of manufacturers and products.>**
 2. Flow: 1/8 inch (3.2 mm) maximum at 140 deg F (60 deg C) in accordance with ASTM D5329.
 3. Flash Point: Not less than 500 deg F (260 deg C) and not less than 77 deg F (25 deg C) above the manufacturer's maximum recommended application temperature in accordance with ASTM D92.
 4. Water-Vapor Permeance: 0.027 perm in accordance with ASTM E96/E96M, Procedure E.
 5. Crack Bridging Capability: No cracking, splitting, or loss of adhesion in accordance with ASTM C1305/C1305M.
 6. **<Insert requirements>**.

2.3 ACCESSORY WATERPROOFING SYSTEM MATERIALS

- A. General: Accessory materials as recommended in writing by waterproofing manufacturer for intended use and compatible with one another and with waterproofing.
- B. Asphalt Primer: ASTM D41/D41M.
- C. Elastomeric Sheet Flashing: Manufacturer's standard uncured neoprene flashing sheet.
 1. Adhesive: Manufacturer's standard contact adhesive.
- D. SBS-Modified Bituminous Sheet Flashing: ASTM D6164/D6164M, Grade G, Type I or Type II, polyester-reinforced, SBS-modified asphalt sheet; granular surfaced; suitable for application method specified, **[white]** **[gray]** **[tan]** **<Insert color>**.

1. Backer Sheet: ASTM D6164/D6164M, Grade S, Type I or Type II, polyester-reinforced, SBS-modified asphalt sheet; smooth surfaced; suitable for application method specified.
- E. Metal Termination Bars: Manufacturer's standard, predrilled, stainless steel or aluminum termination bars; approximately 1 by 1/8 inch (25 by 3.2 mm) thick; with stainless steel anchors.
- F. Reinforcing Fabric: Manufacturer's standard fiberglass mesh or spun-bonded polyester fabric.

2.4 PROTECTION COURSE

- A. Protection Course, Asphaltic: ASTM D6506/D6506M; semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners and as follows:
 1. Thickness: Nominal **[1/8 inch (3.2 mm)] [1/4 inch (6.4 mm)] [1/8 inch (3.2 mm) for vertical applications; 1/4 inch (6.4 mm) elsewhere]**.
- B. Protection Course, Extruded-Polystyrene Board Insulation, Faced: Fan folded, faced on **[one side] [or] [both sides]** with plastic film, nominal thickness 1/4 inch (6.4 mm), with compressive strength of not less than 8 psi (55 kPa) when tested in accordance with ASTM D1621, and maximum water absorption by volume of 0.6 percent when tested in accordance with ASTM C272/C272M.
- C. Protection Course, Extruded-Polystyrene Board Insulation, Unfaced: ASTM C578, Type X, 1/2 inch (13 mm) thick.
- D. Protection Course, Molded-Polystyrene Board Insulation: ASTM C578, Type I, 0.90 lb/cu. ft. (15 kg/cu. m) minimum density, 1-inch (25-mm) minimum thickness.

2.5 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panels with Polymeric Film: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21 mm) sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate through the core of **[9 to 21 gpm per ft. (112 to 261 L/min. per m)] <Insert values>**.
 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- B. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panels: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21 mm) sieve laminated to one side of the core, without a polymeric film bonded to the other side; and with a vertical flow rate through the core of **[9 to 21 gpm per ft. (112 to 261 L/min. per m)] <Insert values>**.
 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- C. Woven-Geotextile-Faced, Molded-Sheet Drainage Panels with Polymeric Film: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a woven-geotextile facing with an apparent opening size not exceeding No. 40 (0.43 mm) sieve, laminated to one side of the core and a polymeric film bonded to the other side; and with a horizontal flow rate through the core of not less than **[2.8 gpm per ft. (35 L/min. per m)] <Insert value>**.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

- D. Woven-Geotextile-Faced, Molded-Sheet Drainage Panels: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a woven-geotextile facing with an apparent opening size not exceeding No. 40 (0.43 mm) sieve, laminated to one side of the core, without a polymeric film bonded to the other side; and with a horizontal flow rate through the core of not less than **[2.8 gpm per ft. (35 L/min. per m)] <Insert value>**.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

- E. Molded-Sheet Collector-Panel System with Polymeric Film: Composite subsurface collector-panel system by same manufacturer as primary molded-sheet drainage panels; consisting of a high-profile, studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven-geotextile facing with an apparent opening size not exceeding No. 40 (0.425 mm) sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate through the core of **[9 to 17 gpm per ft. (112 to 211 L/min. per m)] <Insert values>** and a minimum horizontal, in-plane flow rate **[as indicated on Drawings] <Insert requirement>**. Provide system with manufacturer's outlets, connectors, tapes, and other accessories to connect primary molded-sheet drainage panels with piped subdrainage system.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

- F. Molded-Sheet Collector-Panel System Wrapped with Geotextile: Composite subsurface collector-panel system by same manufacturer as primary molded-sheet drainage panels; consisting of a high-profile, studded, nonbiodegradable, molded-plastic-sheet drainage core; wrapped with a nonwoven-geotextile facing with an apparent opening size not exceeding No. 40 (0.425 mm) sieve; and with a vertical flow rate through the core of **[21 to 97 gpm per ft. (261 to 1197 L/min. per m)] <Insert values>** and a minimum horizontal, in-plane flow rate **[as indicated on Drawings] [of 21 gpm per ft. (261 L/min. per m)] <Insert requirement>**. Provide system with manufacturer's outlets, connectors, tapes, and other accessories to connect primary molded-sheet drainage panels with piped subdrainage system.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.6 INSULATION DRAINAGE PANELS

- A. Unfaced, Wall-Insulation Drainage Panels, Type IV: ASTM C578, 25 psi (173 kPa) minimum compressive strength; unfaced extruded-polystyrene board insulation; fabricated with shiplapped or channel edges and with one side having grooved drainage channels.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

- B. Geotextile-Faced, Wall-Insulation Drainage Panels, Type IV: ASTM C578, 25 psi (173 kPa) minimum compressive strength extruded-polystyrene board insulation, fabricated with tongue-and-groove edges and with one side having grooved drainage channels faced with nonwoven geotextile filter fabric.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

- C. Unfaced, Wall-Insulation Drainage Panels, Type VI: ASTM C578, 40 psi (276 kPa) minimum compressive strength; unfaced extruded-polystyrene board insulation; fabricated with shiplapped or channel edges and with one side having grooved drainage channels.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

- D. Geotextile-Faced, Wall-Insulation Drainage Panels, Type VI: ASTM C578, 40 psi (276 kPa) minimum compressive strength extruded-polystyrene board insulation, fabricated with tongue-and-groove edges and with one side having grooved drainage channels faced with nonwoven geotextile filter fabric.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- E. Unfaced, Plaza-Deck, Insulation Drainage Panels, Type VI: ASTM C578, 40 psi (276 kPa) minimum compressive strength; unfaced extruded-polystyrene board insulation, fabricated with shiplapped, channel, or tongue-and-groove edges and with one side having ribbed drainage channels.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- F. Geotextile-Faced, Plaza-Deck, Insulation Drainage Panels, Type VI: ASTM C578, 40 psi (276 kPa) minimum compressive strength extruded-polystyrene board insulation, fabricated with tongue-and-groove edges, with one side having grooved drainage channels, and faced with manufacturer's standard, nonwoven geotextile filter fabric.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- G. Unfaced, Plaza-Deck, Insulation Drainage Panels, Type VII: ASTM C578, 60 psi (414 kPa) minimum compressive strength; unfaced extruded-polystyrene board insulation, fabricated with shiplapped, channel, or tongue-and-groove edges and with one side having ribbed drainage channels.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- H. Geotextile-Faced, Plaza-Deck, Insulation Drainage Panels, Type VII: ASTM C578, 60 psi (414 kPa) minimum compressive strength; extruded-polystyrene board insulation, fabricated with tongue-and-groove edges, with one side having grooved drainage channels, and faced with manufacturer's standard, nonwoven geotextile filter fabric.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- I. Mortar-Faced, Extruded-Polystyrene Board Insulation: ASTM C578, Type VI, 1.8 lb/cu. ft. (29 kg/cu. m) minimum density, 40 psi (276 kPa) minimum compressive strength, with tongue-and-groove edges on long dimension, and latex-modified cement mortar topping, **[3/8 inch (9 mm) thick, 4.5 lb/sq. ft. (19.5 kg/sq. m)] [15/16 inch (23 mm) thick, 11 lb/sq. ft. (53.7 kg/sq. m)]**.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

2.7 ELECTRONIC LEAK DETECTION (ELD) MATERIALS

- A. Conductive Medium: Electrically conductive material specifically designed to enable ELD testing procedures as approved in writing by waterproofing membrane manufacturer.
1. Conductive medium to be located directly under waterproofing membrane in accordance with ASTM D7877 and ASTM D8231.
- B. Moisture-Monitoring System: Permanently embedded, continuously monitored moisture-detection system.
1. Sensors measuring moisture content to be placed within waterproofing system and connected to a monitoring program, with a notification indicating location of breach.

2.8 PLAZA-DECK PAVERS

- A. Plaza-Deck Pavers: **[Brick]** **[Concrete]** **[Asphalt-block]** **<Insert type>** pavers specified in Section 321400 "Unit Paving."
- B. Stone Plaza-Deck Pavers: **[Granite]** **[Limestone]** **[Marble]** **[Quartz-based stone]** **[Slate]** **[Travertine]** **<Insert type>** pavers specified in Section 321400 "Unit Paving."
- C. Concrete Plaza-Deck Pavers: Solid, hydraulically pressed, standard-weight concrete units, **[square edged]** **[with top edges beveled 3/16 inch (5 mm)]**, manufactured for use as plaza-deck pavers; **[7500 psi (52 MPa)]** **[6500 psi (45 MPa)]** **<Insert value>** minimum compressive strength when tested in accordance with ASTM C140/C140M; absorption not greater than 5 percent when tested in accordance with ASTM C140/C140M; and no breakage and maximum 1 percent mass loss, freeze-thaw resistance, when tested in accordance with ASTM C67/C67M.
 - 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 - 2. Thickness: **[2 inches (51 mm)]** **[2-3/8 inches (60 mm)]** **<Insert dimension>**.
 - 3. Face Size: **[12 inches (305 mm) square]** **[12 by 24 inches (305 by 610 mm)]** **[18 inches (457 mm) square]** **[24 inches (610 mm) square]** **[As indicated]** **<Insert dimension(s) and shape>**.
 - 4. Color and Texture: **[As indicated by manufacturer's designations]** **[Match Architect's sample]** **[As selected by Architect from manufacturer's full range]** **<Insert requirement>**.
 - 5. Provide pavers with holes or slots to permit rain flowing across plaza to drain through grate into roof drains.
- D. Plaza-Deck Paver Metal Straps: Securement strapping fabricated from stainless steel, a minimum of 3 inches (75 mm) wide by 0.031 inch (0.8 mm) thick with stainless steel anchors.
- E. Paver Pedestals: Paver-support assembly, **[standard with paver manufacturer]** **[or]** **[as named below]**, including **[fixed-height]** **[adjustable or stackable]** pedestals, shims, and spacer tabs for joint spacing of **[1/8 inch (3.2 mm)]** **[3/16 inch (5 mm)]** **[1/8 to 3/16 inch (3.2 to 5 mm)]**.
 - 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 - 2. Fill: As recommended in writing by pedestal manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that concrete has cured and aged for minimum time period as recommended in writing by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and within the moisture limits as recommended in writing by waterproofing manufacturer. Test for capillary moisture by plastic sheet method in accordance with ASTM D4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and prepare substrates in accordance with waterproofing manufacturer's written instructions. Provide clean, dust-free, and dry substrate for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.
- D. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.
 - 1. Abrasive blast clean concrete surfaces uniformly to expose top surface of fine aggregate in accordance with ASTM D4259 with a self-contained, recirculating, blast-cleaning apparatus. Remove material to provide a sound surface free of laitance, glaze, efflorescence, curing compounds, concrete hardeners, or form-release agents. Remove remaining loose material and clean surfaces in accordance with ASTM D4258.
- E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids.
- F. Coordinate with Owner for impact to air-intake equipment in the vicinity of the Work. Cover or filter air-intake louvers before proceeding with work that could affect indoor air quality or that could activate smoke detectors in the ductwork.

3.3 PREPARATION AT TERMINATIONS, PENETRATIONS, AND CORNERS

- A. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners in accordance with waterproofing manufacturer's written instructions and to recommendations in **[ASTM C898/C898M]** **[and]** **[ASTM C1471/C1471M]**.

3.4 TREATMENT OF JOINTS AND CRACKS

- A. Prepare, treat, rout, and fill joints and cracks in substrate in accordance with waterproofing manufacturer's written instructions and to recommendations in **[ASTM C898/C898M]** **[and]** **[ASTM C1471/C1471M]**. Before coating surfaces, remove dust and dirt from joints and cracks in accordance with ASTM D4258.
 - 1. Adhere strip of elastomeric sheet to substrate in a layer of hot rubberized asphalt. Extend elastomeric sheet a minimum of 6 inches (150 mm) on each side of moving joints and cracks, or joints and cracks exceeding 1/8 inch (3.2 mm) thick, and beyond deck drains and penetrations. Apply second layer of hot fluid-applied rubberized asphalt over elastomeric sheet.
 - 2. Embed strip of reinforcing fabric into a layer of hot rubberized asphalt. Extend reinforcing fabric a minimum of 6 inches (150 mm) on each side of nonmoving joints and cracks not exceeding 1/8 inch (3.2 mm) thick, and beyond roof drains and penetrations.
 - a. Apply second layer of hot fluid-applied rubberized asphalt over reinforcing fabric.
- B. At expansion joints and discontinuous deck-to-wall or deck-to-deck joints, bridge joints with elastomeric sheet extended a minimum of 6 inches (150 mm) on each side of joints and adhere to substrates in a layer of hot rubberized asphalt. Apply second layer of hot fluid-applied rubberized asphalt over elastomeric sheet.

3.5 INSTALLATION OF ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Install conductive medium directly under waterproofing membrane in accordance with ASTM D7877 and ASTM D8231.
- B. Install sensors, connections, and accessory items required for complete continuously monitored moisture-detection system in accordance with waterproofing manufacturer's written installation instructions.

3.6 INSTALLATION OF SHEET FLASHING

- A. Install sheet flashing at terminations of waterproofing membrane in accordance with manufacturer's written instructions.
- B. Prime substrate with asphalt primer.
- C. Install sheet flashing and adhere to deck and wall substrates in a layer of hot rubberized asphalt.
- D. Bond modified bituminous flashing sheet to substrate as follows:
 - 1. Adhere SBS-modified bituminous[**backer sheet and**] flashing sheet to substrate in a layer of hot fluid-applied rubberized asphalt, or torch apply APP-modified bituminous flashing sheet to substrate as standard with manufacturer.
- E. Extend sheet flashing up walls or parapets a minimum of 8 inches (200 mm) above plaza-deck pavers and 6 inches (150 mm) onto deck to be waterproofed.
- F. Install termination bars and mechanically fasten to top of sheet flashing at terminations and perimeter of waterproofing.

3.7 INSTALLATION OF HOT FLUID-APPLIED RUBBERIZED ASPHALT WATERPROOFING

- A. General: Apply waterproofing in accordance with manufacturer's written instructions.
- B. Start installing waterproofing in presence of manufacturer's technical representative.
- C. Apply primer over prepared substrate at manufacturer's recommended rate and allow it to dry.
- D. Heat rubberized asphalt in accordance with manufacturer's written instructions.
 - 1. Heat rubberized asphalt in an oil- or air-jacketed melter with mechanical agitator specifically designed for heating rubberized asphalt.
- E. Unreinforced Waterproofing Membrane Applications: Apply hot rubberized asphalt to substrates and adjoining surfaces indicated. Spread to form a uniform, unreinforced, seamless membrane, **[180-mil (4.5-mm) minimum thickness] [180-mil (4.5-mm) average thickness, but not less than 125 mils (3.2 mm) thick]**.
- F. Reinforced Waterproofing Membrane Applications: Apply hot rubberized asphalt to substrates and adjoining surfaces indicated. Spread to a thickness of 90 mils (2.3 mm); embed reinforcing fabric, overlapping sheets 2 inches (50 mm); spread another 125-mil- (3.2-mm-) thick layer to provide a uniform, reinforced, seamless membrane 215 mils (5.5 mm) thick.

- G. Cure waterproofing, taking care to prevent contamination and damage to membrane.

3.8 INSTALLATION OF PROTECTION COURSE

- A. Cover waterproofing with protection course with overlapped joints before membrane is subject to **[backfilling] [construction or vehicular traffic]**.
 - 1. For horizontal applications, install protection course loose laid over fully cured membrane.
 - 2. For vertical applications, set protection course in nominally cured membrane, which will act as an adhesive. If membrane cures before application of protection course, use adhesive.

3.9 INSTALLATION OF MOLDED-SHEET DRAINAGE PANELS

- A. Place and secure molded-sheet drainage panels in accordance with waterproofing manufacturer's written instructions. Use adhesive or another method that does not penetrate waterproofing.
- B. Molded-Sheet Collector-Panel System: Install in accordance with waterproofing manufacturer's written instructions. Connect to piped subdrainage system specified in Section 334600 "Subdrainage."

3.10 INSTALLATION OF INSULATION DRAINAGE PANELS

- A. Install insulation drainage panels over waterproofed surfaces. Cut and fit to within 3/4 inch (19 mm) of projections and penetrations.
- B. Ensure that drainage channels are aligned and free of obstructions.
- C. On vertical surfaces, set insulation drainage panel in adhesive or tape applied in accordance with manufacturer's written instructions.
- D. On horizontal surfaces, loosely lay insulation drainage panel in accordance with manufacturer's written instructions. Stagger end joints and tightly abut board insulation.

3.11 INSTALLATION OF PLAZA-DECK PAVERS

- A. Install pavers in accordance with manufacturer's written instructions.
- B. Install paver pedestals and accessories to required elevations in accordance with manufacturer's written installation instructions. Adjust for final level and slope of paved surfaces.
- C. **[Loosely lay pavers on pedestals] [Seat pavers on pedestals and install bolted plate in accordance with manufacturer's written installation instructions]**, maintaining a uniform open joint width. Tightly seat pavers against spacers to eliminate lateral movement or drift of paving assembly. Align joint patterns parallel in each direction.
 - 1. Lay out pavers to avoid less-than-half-width pavers at perimeter or other terminations.
- D. Install pavers to not vary more than 1/16 inch (1.6 mm) in elevation between adjacent pavers or more than 1/16 inch (1.6 mm) from surface plane elevation of individual paver.
- E. Limit variation in paving installation to within **[1/4 inch in 10 ft. (6.4 mm in 3 m)] <Insert dimensions>** of surface plane in any direction; noncumulative.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage]** **[Engage]** a qualified testing agency to perform tests and inspections.
 - 1. Testing agency to verify thickness of waterproofing during application for each **[600 sq. ft. (56 sq. m)]** **<Insert dimension>** of installed waterproofing or part thereof.
- B. Perform the following tests before overlying construction is placed:
 - 1. ELD Testing: Testing agency surveys entire horizontal waterproofed area and flashings to locate discontinuities in the system assembly using ELD in accordance with ASTM D7877 and ASTM D8231.
 - a. After testing, repair areas of discontinuities, repeat tests, and make further repairs until waterproofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
 - 2. Flood Testing: Flood test each completed horizontal waterproofed area for leaks, in accordance with recommendations in ASTM D5957. Install temporary containment assemblies, plug, or dam drains, and flood with potable water.
 - a. Flood to an average depth of **[2-1/2 inches (63 mm)]** **<Insert depth>** with a minimum depth of **[1 inch (25 mm)]** **<Insert depth>** and not exceeding a depth of **[4 inches (100 mm)]** **<Insert depth>**. Maintain 2 inches (50 mm) of clearance from top of base flashing.
 - b. Flood each area for **[24]** **[48]** **[72]** hours.
 - c. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - d. Testing agency to prepare survey report indicating locations of initial leaks, if any, and final survey report.
- C. Manufacturer's Field Service: Engage a **[full-time]** site representative qualified by waterproofing system manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components and to furnish daily reports to Architect.
 - 1. Final Inspection: Arrange for waterproofing system manufacturer's technical personnel to inspect system installation on completion, in presence of Architect, and to prepare inspection report.
 - 2. Notify Architect **[and Owner]** 48 hours in advance of date and time of inspection.
 - 3. Repair or remove and replace components of waterproofing system where inspections indicate that they do not comply with specified requirements.
- D. Additional Tests and Inspections:
 - 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.
 - 2. Waterproofing system will be considered defective if it does not pass tests and inspections.



- E. Prepare test and inspection reports.

3.13 PROTECTION, REPAIR, AND CLEANING

- A. Protect waterproofing system from damage and wear during remainder of construction period.
- B. Protect installed [**protection course**] [**drainage panels**] from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where material is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- C. Correct deficiencies in or remove waterproofing system that does not comply with requirements, repair substrates, and repair or reinstall waterproofing system to a condition free of damage and deterioration at time of Substantial Completion and in accordance with warranty requirements.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 14 13 00



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SECTION 07 14 16 00 - COLD FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polyether waterproofing.
2. Polyurethane waterproofing.
3. Polymer rubber gel waterproofing.
4. Rubber waterproofing.
5. Cold-applied rubberized asphalt waterproofing.
6. Latex waterproofing.
7. Accessory waterproofing system materials.
8. Protection course.
9. Molded-sheet drainage panels.
10. Insulation drainage panels.
11. Electronic leak-detection (ELD) materials.
12. Plaza-deck pavers.

B. Related Requirements:

1. Section 071800 "Traffic Coatings" for exposed, fluid-applied membrane with an integral wearing surface.
2. Section 072100 "Thermal Insulation" for below-grade foundation insulation.
3. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
4. Section 079513.16 "Exterior Expansion Joint Cover Assemblies" for exterior expansion-joint assemblies that interface with waterproofing.
5. Section 079513.19 "Parking Deck Expansion Joint Cover Assemblies" for deck expansion-joint assemblies that interface with waterproofing.
6. Section 221423 "Storm Drainage Piping Specialties" for plaza-deck drains.
7. Section 321400 "Unit Paving" for plaza-deck pavers set on setting beds.
8. Section 334600 "Subdrainage" for molded-sheet drainage panels.

1.2 DEFINITIONS

- A. **Compatible:** Material that will not adversely affect adjacent materials, is chemically compatible with adjacent materials, and where required for bond, achieves adhesive compatibility with adjacent materials.
- B. **Chemical Compatibility:** Material that will not break down, deteriorate, degrade, or prematurely fail when in contact with another material. Material that will not cause chemical breakdown, deterioration, degradation, staining, or premature failure of another material.
- C. **Adhesive Compatibility:** Material that will develop bond strength or provide a suitable surface for another material to develop bond strength complying with requirements when in contact with another material.

1.3 COORDINATION

- A. Coordinate Work under this Section with adjacent concrete foundation work, including fill[, **other waterproofing systems**] [, **under-slab vapor retarders**] [, **under-slab insulation**] [and] [, **subdrainage systems**].
- B. Coordinate requirements for concrete formwork to provide suitable substrate for waterproofing and to minimize penetrations in waterproofing.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at [**Project site**] <Insert location>.
 - 1. Review waterproofing requirements, including, but not limited to, the following:
 - a. Surface preparation specified in other Sections.
 - b. Minimum concrete curing period.
 - c. Forecasted weather conditions.
 - d. Special details and sheet flashings.
 - e. Repairs.
 - f. Field quality control.
 - g. <Insert agenda items>.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings:
 - 1. Indicate locations and extent of waterproofing.
 - 2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, expansion-joint conditions, tie-ins with adjoining waterproofing, and other termination conditions.
 - 3. Include setting drawings indicating layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.
- C. Samples: For the following materials:
 - 1. Cured sample of waterproofing membrane on suitable rigid substrate, 8 by 8 inches (200 by 200 mm).
 - 2. Flashing sheet, 8 by 8 inches (200 by 200 mm).
 - 3. Membrane-reinforcing fabric, 8 by 8 inches (200 by 200 mm).
 - 4. Drainage panel, 4 by 4 inches (100 by 100 mm).
 - 5. Plaza-deck paver, [**4 by 4 inches (100 by 100 mm)**] [**full sized**].
 - 6. Paver pedestal assembly.
- D. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for moisture control>

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[Installer]** **[and]** **[testing agency]**.
- B. Field quality control reports.
- C. Sample warranties.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Entity that employs installers and supervisors who are trained and **[certified]** **[approved]** by waterproofing manufacturer.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals and to set quality standards for installation.
 1. Build mockup for each typical waterproofing installation, including **[pavers and]** accessories to demonstrate surface preparation, crack and joint treatments, inside and outside corner treatments, and protection.
 - a. Size: **[100 sq. ft. (9.3 sq. m) in area]** **[As indicated on Drawings]**.
 - b. Description: Each type of **[wall]** **[deck]** **[and]** **[plaza deck]** **<Insert description>** installation.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by waterproofing manufacturer. Protect stored materials in accordance with manufacturer's written instructions.
- B. Remove and replace materials that cannot be applied within their stated shelf life.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer.
 1. Do not apply waterproofing to frozen, damp, or wet substrates, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F (3 deg C) above dew point.
 2. Do not apply waterproofing when snow, rain, fog, or mist are present, or when such weather conditions are imminent during application and curing period.

- B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.11 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or remove and replace waterproofing that fails to remain watertight within specified warranty period.
 - 1. Warranty includes leak remediation, including repair, removal, and replacement of **[protection course] [drainage panels] [and] [pedestals and pavers on plaza decks]**.
 - 2. Pavers Warranty: Pavers must not dish or warp, nor crack, split, or disintegrate in freeze-thaw conditions.
 - 3. Warranty Period: **[Five] [10] <Insert number>** years from date of Substantial Completion.
- B. Installer's Special Warranty: Submit warranty[, **on warranty form at end of this Section,**] signed by Installer, covering the Work of this Section, for warranty period of **[two] <Insert number>** years from date of Substantial Completion.
 - 1. Warranty includes leak remediation, including repair, removal, and replacement of **[protection course] [drainage panels] [and] [pedestals and pavers on plaza decks]**.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Waterproofing System: Obtain waterproofing materials **[and] [protection course] [molded-sheet drainage panels] [insulation drainage panels]** from **[same manufacturer as waterproofing membrane] [or] [manufacturer approved by waterproofing membrane manufacturer]**.
- B. Plaza-Deck Paving: Obtain plaza-deck pavers~~]~~ **and paver pedestal assembly]** from single source from single manufacturer for consistent quality in appearance and physical properties.

2.2 POLYETHER WATERPROOFING

- A. STPE Waterproofing: Single-component, silyl-terminated polyether~~]~~ **complying with ASTM C836/C836M]**.
 - 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 - 2. Tensile Strength: 900 psi (6.2 MPa) minimum; ASTM D638.
 - 3. Elongation at Break: 300 percent minimum; ASTM D638.
 - 4. Water Vapor Permeance: 0.1 perm (5.7 ng/Pa x s x sq. m), maximum, ASTM E96/E96M.
 - 5. Hydrostatic-Head Resistance: **[200 ft. (60 m)] <Insert dimension>** of water, minimum; ASTM D5385/D5385M.

2.3 POLYURETHANE WATERPROOFING

- A. Single-Component, Modified Polyurethane Waterproofing: **[ASTM C836/C836M] [and] [coal-tar free]**.
 - 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

- B. Single-Component, Reinforced, Modified Polyurethane Waterproofing: **[ASTM C836/C836M]** **[and]** **[coal-tar free]**.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- C. Two-Component, Polyurethane Waterproofing:**[ASTM C836/C836M.]**
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- D. Two-Component, Reinforced, Polyurethane Waterproofing:**[ASTM C836/C836M.]**
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- E. PUMA Waterproofing: Two-component, polyurethane methacrylate; ASTM C1305/C1305M.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
 2. Tensile Strength: 900 psi (6.2 MPa) minimum; ASTM D638.
 3. Elongation at Break: 400 percent minimum; ASTM D638.
 4. Water Vapor Permeance: 0.003 perm (0.172 ng/Pa x s x sq. m), maximum, ASTM E96/E96M.
- F. PMMA Waterproofing: Two-component, polymethyl methacrylate; ASTM C836/C836M, reinforced with polyester fleece layer.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
 2. Thickness: Not less than 90 mils; ASTM D5147/D5147M (Section 6).
 3. Elongation at Peak Load: Average 35%; ASTM D5147/D5147M (Section 7).
 4. Tear Strength: Not less than 90 lbf (0.4 kN); ASTM D5147/D5147M (Section 8).
 5. Low-Temperature Flexibility: Minus 4 deg F (minus 20 deg C); ASTM D5147/D5147M (Section 12).

2.4 POLYMER RUBBER GEL WATERPROOFING

- A. Single-Component, Polymer-Modified Rubber Gel (PRG) Waterproofing: Spray-applied, composite system composed of non-Newtonian thixotropic, noncuring, flexible, self-healing polymer rubberized bituminous emulsion, polyethylene sheet membrane, and other proprietary ancillary components.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
 2. Solids Content: 99 percent minimum; ASTM D1353/D1353M.
 3. Puncture Resistance: Minimum 90 lb.; ASTM D1709.
 4. Hardness: Minimum 100; ASTM C836/C836M.
 5. Tensile Strength: Minimum 50 lb., ASTM D412.
 6. Elongation Percentage: Minimum 300; ASTM C1135.
 7. Adhesion to Concrete: Rating of 1 (Excellent); ASTM D412.
 8. Water Vapor Permeance: 0.005 perm, maximum, ASTM E96/E96M.
- B. Single-Component, Polymer-Modified Rubber Gel (PRG) Injection Restorative Membrane Waterproofing System: Elastomeric, noncuring, flexible, self-healing, chemical-resistant polymer rubberized bituminous emulsion formulated for repairing and restoring damaged waterproofing membrane systems.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
 2. Solids Content: Minimum 75 percent; ASTM D1353/D1353M.
 3. Viscosity at Application: Minimum 150,000 cP; ASTM D2196.

2.5 RUBBER WATERPROOFING

- A. Single-Component, Rubber Waterproofing: ASTM C836/C836M; solvent based; coal-tar free.
1. Hydrostatic-Head Resistance: 69.3 ft. (21.1 m) minimum; **[ASTM C1306/C1306M]** **[ASTM E154/E154M]**.
- B. Two-Component, Rubber Waterproofing: ASTM C836/C836M; coal-tar free.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 2. Hydrostatic-Head Resistance: **[200 ft. (60 m)]** **<Insert dimension>** of water, minimum; ASTM D5385/D5385M.
- C. Two-Component, Reinforced, Rubber Waterproofing: ASTM C836/C836M; coal-tar free.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 2. Hydrostatic-Head Resistance: **[200 ft. (60 m)]** **<Insert dimension>** of water, minimum; ASTM D5385/D5385M.

2.6 COLD-APPLIED RUBBERIZED ASPHALT WATERPROOFING

- A. Single-Component, Rubberized Asphalt Waterproofing: **[ASTM C836/C836M]**; water-based, polymer-modified rubberized asphalt waterproofing.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 2. Elongation at Break: 360 percent minimum; ASTM D412.
 3. Water Vapor Permeance: 0.03 perm (1.72 ng/Pa x s x sq. m), maximum, ASTM E96/E96M.
 4. Hydrostatic-Head Resistance: **[200 ft. (60 m)]** **<Insert dimension>** of water, minimum; ASTM D5385/D5385M.
- B. Single-Component, Reinforced, Rubberized Asphalt Waterproofing: **[ASTM C836/C836M]**; water-based, polymer-modified rubberized asphalt waterproofing.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 2. Elongation at Break: 360 percent minimum; ASTM D412.
 3. Water Vapor Permeance: 0.03 perm (1.72 ng/Pa x s x sq. m), maximum, ASTM E96/E96M.
 4. Hydrostatic-Head Resistance: **[200 ft. (60 m)]** **<Insert dimension>** of water, minimum; ASTM D5385/D5385M.
- C. Two-Component, Rubberized Asphalt Waterproofing: Water-based, polymer-modified rubberized asphalt.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 2. Elongation at Break: 360 percent minimum; ASTM D412.

2.7 LATEX WATERPROOFING

- A. Latex-Based Waterproof Coating with Biocide:
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 2. Hydrostatic Pressure Resistance: **[10 psi (69 kPa)]** **[12 psi (83 kPa)]** **[15 psi (103 kPa)]** **[20 psi (140 kPa)]** **<Insert value>** minimum; ASTM D7088.

3. Resistance to Wind-Driven Rain: **[98 mph (44 m/s)] [140 mph (63 m/s)]** <Insert value> minimum; ASTM D6904.

2.8 ACCESSORY WATERPROOFING SYSTEM MATERIALS

- A. General: Accessory materials as recommended in writing by waterproofing manufacturer for intended use and compatible with one another and with waterproofing.
- B. Primer: Liquid **[waterborne] [solvent-borne]** primer as recommended in writing for substrate by waterproofing manufacturer.
- C. Surface Conditioner: Liquid, waterborne surface conditioner as recommended in writing for substrate by waterproofing manufacturer.
- D. Sheet Flashing: Manufacturer's standard flashing sheet.
 1. Adhesive: Manufacturer's standard contact adhesive.
- E. Metal Termination Bars: Manufacturer's standard, predrilled, stainless steel or aluminum termination bars; approximately 1 by 1/8 inch (25 by 3.2 mm) thick; with stainless steel anchors.
- F. Reinforcing Fabric: Manufacturer's standard fiberglass mesh or spun-bonded polyester fabric.
- G. Detailing Seam Tape: Manufacturer's standard detailing tape.
- H. Joint Sealant: **[Single-component] [Multicomponent]** polyurethane sealant, compatible with waterproofing; **[ASTM C920, Type M, Class 25 or greater; Grade NS for sloping and vertical applications and Grade P for deck applications; Use NT exposure] [as specified in Section 079200 "Joint Sealants"]** <Insert requirement>; and as recommended in writing by waterproofing manufacturer for substrate and joint conditions.
- I. Backer Rod: Closed-cell polyethylene foam.

2.9 PROTECTION COURSE

- A. Protection Course, Asphaltic: ASTM D6506/D6506M; semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners:
 1. Thickness: Nominal **[1/8 inch (3.2 mm)] [1/4 inch (6.4 mm)] [1/8 inch (3.2 mm) for vertical applications; 1/4 inch (6.4 mm) elsewhere]**.
- B. Protection Course, Extruded-Polystyrene Board Insulation, Faced: Fan folded, faced on **[one side] [or] [both sides]** with plastic film, nominal thickness 1/4 inch (6.4 mm), with compressive strength of not less than 8 psi (55 kPa) when tested in accordance with ASTM D1621/D1621M, and maximum water absorption by volume of 0.6 percent when tested in accordance with ASTM C272/C272M.
- C. Protection Course, Extruded-Polystyrene Board Insulation, Unfaced: ASTM C578, Type X, 1/2 inch (13 mm) thick.
- D. Protection Course, Molded-Polystyrene Board Insulation: ASTM C578, Type I, 0.90 lb/cu. ft. (15 kg/cu. m) minimum density, 1-inch (25-mm) minimum thickness.

2.10 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panels with Polymeric Film: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21 mm) sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate through the core of **[9 to 21 gpm per ft. (112 to 261 L/min. per m)] <Insert values>**.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- B. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panels: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a needle-punched nonwoven-geotextile facing with an apparent opening size not exceeding No. 70 (0.21 mm) sieve laminated to one side of the core, without a polymeric film bonded to the other side; and with a vertical flow rate through the core of **[9 to 21 gpm per ft. (112 to 261 L/min. per m)] <Insert values>**.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- C. Woven-Geotextile-Faced, Molded-Sheet Drainage Panels with Polymeric Film: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a woven-geotextile facing with an apparent opening size not exceeding No. 40 (0.43 mm) sieve, laminated to one side of the core and a polymeric film bonded to the other side; and with a horizontal flow rate through the core of not less than **[2.8 gpm per ft. (35 L/min. per m)] <Insert value>**.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- D. Woven-Geotextile-Faced, Molded-Sheet Drainage Panels: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a woven-geotextile facing with an apparent opening size not exceeding No. 40 (0.43 mm) sieve, laminated to one side of the core, without a polymeric film bonded to the other side; and with a horizontal flow rate through the core of not less than **[2.8 gpm per ft. (35 L/min. per m)] <Insert value>**.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- E. Molded-Sheet Collector-Panel System with Polymeric Film: Composite subsurface collector-panel system by same manufacturer as primary molded-sheet drainage panels; consisting of a high-profile, studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven-geotextile facing with an apparent opening size not exceeding No. 40 (0.425 mm) sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate through the core of **[9 to 17 gpm per ft. (112 to 211 L/min. per m)] <Insert values>** and a minimum horizontal, in-plane flow rate **[as indicated on Drawings] <Insert requirement>**. Provide system with manufacturer's outlets, connectors, tapes, and other accessories to connect primary molded-sheet drainage panels with piped subdrainage system.
1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
- F. Molded-Sheet Collector-Panel System Wrapped with Geotextile: Composite subsurface collector-panel system by same manufacturer as primary molded-sheet drainage panels; consisting of a high-profile, studded, nonbiodegradable, molded-plastic-sheet drainage core; wrapped with a nonwoven-geotextile facing with an apparent opening size not exceeding No. 40 (0.425 mm) sieve; and with a vertical flow rate through the core of **[21 to 97 gpm per ft. (261 to 1197 L/min. per m)] <Insert values>** and a

minimum horizontal, in-plane flow rate [as indicated on Drawings] [of 21 gpm per ft. (261 L/min. per m)] <Insert requirement>. Provide system with manufacturer's outlets, connectors, tapes, and other accessories to connect primary molded-sheet drainage panels with piped subdrainage system.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.11 INSULATION DRAINAGE PANELS

- A. Unfaced, Wall-Insulation Drainage Panels, Type IV: ASTM C578, 25 psi (173 kPa) minimum compressive strength; unfaced extruded-polystyrene board insulation; fabricated with shiplapped or channel edges and with one side having grooved drainage channels.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

- B. Geotextile-Faced, Wall-Insulation Drainage Panels, Type IV: ASTM C578, 25 psi (173 kPa) minimum compressive strength; extruded-polystyrene board insulation, fabricated with tongue-and-groove edges and with one side having grooved drainage channels faced with nonwoven-geotextile filter fabric.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

- C. Unfaced, Wall-Insulation Drainage Panels, Type VI: ASTM C578, 40 psi (276 kPa) minimum compressive strength; unfaced extruded-polystyrene board insulation; fabricated with shiplapped or channel edges and with one side having grooved drainage channels.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

- D. Geotextile-Faced, Wall-Insulation Drainage Panels, Type VI: ASTM C578, 40 psi (276 kPa) minimum compressive strength; extruded-polystyrene board insulation, fabricated with tongue-and-groove edges and with one side having grooved drainage channels faced with nonwoven-geotextile filter fabric.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

- E. Unfaced, Plaza-Deck, Insulation Drainage Panels, Type VI: ASTM C578, 40 psi (276 kPa) minimum compressive strength; unfaced extruded-polystyrene board insulation, fabricated with shiplapped, channel, or tongue-and-groove edges and with one side having ribbed drainage channels.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

- F. Geotextile-Faced, Plaza-Deck, Insulation Drainage Panels, Type VI: ASTM C578, 40 psi (276 kPa) minimum compressive strength; extruded-polystyrene board insulation, fabricated with tongue-and-groove edges, with one side having grooved drainage channels, and faced with manufacturer's standard, nonwoven-geotextile filter fabric.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

- G. Unfaced, Plaza-Deck, Insulation Drainage Panels, Type VII: ASTM C578, 60 psi (414 kPa) minimum compressive strength; unfaced extruded-polystyrene board insulation, fabricated with shiplapped, channel, or tongue-and-groove edges and with one side having ribbed drainage channels.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

- H. Geotextile-Faced, Plaza-Deck, Insulation Drainage Panels, Type VII: ASTM C578, 60 psi (414 kPa) minimum compressive strength; extruded-polystyrene board insulation, fabricated with tongue-and-

groove edges, with one side having grooved drainage channels, and faced with manufacturer's standard, nonwoven-geotextile filter fabric.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

- I. Mortar-Faced, Extruded-Polystyrene Board Insulation: ASTM C578, Type VI, 1.8 lb/cu. ft. (29 kg/cu. m) minimum density, 40 psi (276 kPa) minimum compressive strength, with tongue-and-groove edges on long dimension, and latex-modified cement mortar topping, **[3/8 inch (9 mm) thick, 4.5 lb/sq. ft. (19.5 kg/sq. m)] [15/16 inch (23 mm) thick, 11 lb/sq. ft. (53.7 kg/sq. m)]**.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.12 ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Conductive Medium: Electrically conductive material specifically designed to enable ELD testing procedures as approved in writing by waterproofing membrane manufacturer.

1. Conductive medium to be located directly under waterproofing membrane in accordance with ASTM D7877 and ASTM D8231.

- B. Moisture-Monitoring System: Permanently embedded, continuously monitored moisture-detection system.

1. Sensors measuring moisture content to be placed within waterproofing system and connected to a monitoring program, with a notification indicating location of breach.

2.13 PLAZA-DECK PAVERS

- A. Plaza-Deck Pavers: **[Brick] [Concrete] [Asphalt-block]** <Insert type> pavers specified in Section 321400 "Unit Paving."

- B. Stone Plaza-Deck Pavers: **[Granite] [Limestone] [Marble] [Quartz-based stone] [Slate] [Travertine]** <Insert type> pavers specified in Section 321400 "Unit Paving."

- C. Concrete Plaza-Deck Pavers: Solid, hydraulically pressed, standard-weight concrete units, **[square edged] [with top edges beveled 3/16 inch (5 mm)]**, manufactured for use as plaza-deck pavers; **[7500 psi (52 MPa)] [6500 psi (45 MPa)]** <Insert value> minimum compressive strength when tested in accordance with ASTM C140/C140M; absorption not greater than 5 percent when tested in accordance with ASTM C140/C140M; and no breakage and maximum 1 percent mass loss, freeze-thaw resistance, when tested in accordance with ASTM C67/C67M.

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2. Thickness: **[2 inches (50 mm)] [2-3/8 inches (60 mm)]** <Insert dimension>.

3. Face Size: **[12 inches (305 mm) square] [12 by 24 inches (305 by 610 mm)] [18 inches (457 mm) square] [24 inches (610 mm) square] [As indicated]** <Insert dimension(s) and shape>.

4. Color and Texture: **[As indicated by manufacturer's designations] [Match Architect's sample] [As selected by Architect from manufacturer's full range]** <Insert requirement>.

5. Provide pavers with holes or slots to permit rain flowing across plaza to drain through grate into roof drains.

- D. Plaza-Deck Paver Metal Straps: Securement strapping fabricated from stainless steel, a minimum of 3 inches (75 mm) wide by 0.031 inch (0.8 mm) thick with stainless steel anchors.
- E. Paver Pedestals: Paver-support assembly, **[standard with paver manufacturer] [or] [as named below]**, including **[fixed-height] [adjustable or stackable]** pedestals, shims, and spacer tabs for joint spacing of **[1/8 inch (3.2 mm)] [3/16 inch (5 mm)] [1/8 to 3/16 inch (3.2 to 5 mm)]**.
 - 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 - 2. Fill: As recommended in writing by pedestal manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that concrete has cured and aged for minimum time period as recommended in writing by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and within the moisture limits as recommended in writing by waterproofing manufacturer. Test for capillary moisture by plastic sheet method in accordance with ASTM D4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean, prepare, and treat substrates in accordance with waterproofing manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.
- D. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.
 - 1. Abrasive blast clean concrete surfaces uniformly to expose top surface of fine aggregate in accordance with ASTM D4259 with a self-contained, recirculating, blast-cleaning apparatus. Remove material to provide a sound surface free of laitance, glaze, efflorescence, curing compounds, concrete hardeners, or form-release agents. Remove remaining loose material and clean surfaces in accordance with ASTM D4258.
- E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids.
- F. Coordinate with Owner for impact to air-intake equipment in the vicinity of the Work. Cover or filter air-intake louvers before proceeding with work that could affect indoor air quality or that could activate smoke detectors in the ductwork.

3.3 PREPARATION AT TERMINATIONS, PENETRATIONS, AND CORNERS

- A. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners in accordance with waterproofing manufacturer's written instructions and to recommendations in **[ASTM C898/C898M]** **[and]** **[ASTM C1471/C1471M]**.

3.4 TREATMENT OF JOINTS AND CRACKS

- A. Prepare, treat, rout, and fill joints and cracks in substrate in accordance with waterproofing manufacturer's written instructions and recommendations in **[ASTM C898/C898M]** **[and]** **[ASTM C1471/C1471M]**. Before coating surfaces, remove dust and dirt from joints and cracks in accordance with ASTM D4258.
 - 1. Comply with ASTM C1193 for joint-sealant installation.
 - 2. Apply bond breaker on sealant surface, beneath preparation strip.
 - 3. Prime substrate along each side of joint and apply a single thickness of preparation strip at least 6 inches (150 mm) wide along each side of joint. Apply waterproofing in two separate applications and embed a joint-reinforcing strip in first preparation coat.
- B. Install sheet flashing and bond to deck and wall substrates where required in accordance with waterproofing manufacturer's written instructions.
 - 1. Extend sheet flashings for **[4 inches (100 mm)]** **<Insert dimension>** onto perpendicular surfaces and items penetrating substrate.

3.5 INSTALLATION OF ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Install conductive medium directly under waterproofing membrane in accordance with ASTM D7877 and ASTM D8231.
- B. Install sensors, connections, and accessory items required for complete continuously monitored moisture-detection system in accordance with waterproofing manufacturer's written installation instructions.

3.6 INSTALLATION OF COLD FLUID-APPLIED WATERPROOFING

- A. General: Apply waterproofing in accordance with manufacturer's written instructions and to recommendations in **[ASTM C898/C898M]** **[and]** **[ASTM C1471/C1471M]**.
- B. Start installing waterproofing in presence of manufacturer's technical representative.
- C. Apply primer over prepared substrate at manufacturer's recommended rate and allow it to dry.
- D. Unreinforced Waterproofing Membrane Applications: Mix materials and apply waterproofing by spray, roller, notched squeegee, trowel, or other application method suitable to slope of substrate.
 - 1. Apply one or more coats of waterproofing to obtain a seamless membrane free of entrapped gases and pinholes, with a minimum dry film thickness of **[60 mils (1.5 mm)]** **[90 mils (2.25 mm)]** **[120 mils (3 mm)]** **<Insert dimension>**.
 - 2. Apply waterproofing to prepared wall terminations and vertical surfaces.

3. Verify manufacturer's recommended wet film thickness of waterproofing every 100 sq. ft. (9.3 sq. m).
- E. Reinforced Waterproofing Membrane Applications: Mix materials and apply waterproofing by roller, notched squeegee, trowel, or other suitable application method.
 1. Apply first coat of waterproofing, embed membrane-reinforcing fabric, and apply second coat of waterproofing to completely saturate reinforcing fabric and to obtain a seamless reinforced membrane free of entrapped gases and pinholes, with an average dry film total thickness of **[70 mils (1.8 mm)] [80 mils (2 mm)] [90 mils (2.3 mm)] [120 mils (3 mm)] <Insert dimension>**.
 2. Apply reinforced waterproofing to prepared wall terminations and vertical surfaces.
 3. Verify manufacturer's recommended wet film thickness of waterproofing every 100 sq. ft. (9.3 sq. m).
- F. Cure waterproofing, taking care to prevent contamination and damage to membrane.

3.7 INSTALLATION OF PROTECTION COURSE

- A. Cover waterproofing with protection course with butted joints before membrane is subject to **[backfilling] [construction or vehicular traffic]**.
 1. For horizontal applications, install protection course loose laid over fully cured membrane.
 2. For vertical applications, set protection course in nominally cured membrane, which will act as an adhesive. If membrane cures before application of protection course, use adhesive.

3.8 INSTALLATION OF MOLDED-SHEET DRAINAGE PANELS

- A. Place and secure molded-sheet drainage panels in accordance with waterproofing manufacturer's written instructions. Use adhesive or another method that does not penetrate waterproofing.
- B. Molded-Sheet Collector-Panel System: Install in accordance with waterproofing manufacturer's written instructions. Connect to piped subdrainage system specified in Section 334600 "Subdrainage."

3.9 INSTALLATION OF INSULATION DRAINAGE PANELS

- A. Install insulation drainage panels over waterproofed surfaces. Cut and fit to within 3/4 inch (19 mm) of projections and penetrations.
- B. Ensure that drainage channels are aligned and free of obstructions.
- C. On vertical surfaces, set insulation drainage panels in adhesive or tape applied in accordance with manufacturer's written instructions.
- D. On horizontal surfaces, loosely lay insulation drainage panels in accordance with manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.10 INSTALLATION OF PLAZA-DECK PAVERS

- A. Install pavers in accordance with manufacturer's written instructions.

- B. Install paver pedestals and accessories to required elevations. Adjust for final level and slope of paved surface.
- C. **[Loosely lay pavers on pedestals] [Seat pavers on pedestals and install bolted plate in accordance with manufacturer's written installation instructions]**, maintaining a uniform open joint width. Tightly seat pavers against spacers to eliminate lateral movement or drift of paver assembly. Align joint patterns parallel in each direction.
 - 1. Lay out pavers to avoid less-than-half-width pavers at perimeter or other terminations.
- D. Install pavers to vary no more than 1/16 inch (1.6 mm) in elevation between adjacent pavers and no more than 1/16 inch (1.6 mm) from surface plane elevation of individual paver.
- E. Limit variation in paver installation to within **[1/4 inch in 10 ft. (6.4 mm in 3 m)] <Insert dimensions>** of surface plane in any direction; noncumulative.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage] [Engage]** a qualified testing agency to perform tests and inspections:
 - 1. Testing agency to verify thickness of waterproofing during application for each **[600 sq. ft. (56 sq. m)] <Insert dimension>** of installed waterproofing or part thereof.
- B. Perform the following tests before overlying construction is placed:
 - 1. ELD Testing: Testing agency surveys entire horizontal waterproofed area and flashings to locate discontinuities in the system assembly using ELD in accordance with ASTM D7877 and ASTM D8231.
 - a. After testing, repair areas of discontinuities, repeat tests, and make further repairs until waterproofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
 - 2. Flood Testing: Flood test each completed horizontal waterproofed area for leaks, in accordance with recommendations in ASTM D5957. Install temporary containment assemblies, plug, or dam drains, and flood with potable water.
 - a. Flood to an average depth of **[2-1/2 inches (63 mm)] <Insert depth>** with a minimum depth of **[1 inch (25 mm)] <Insert depth>** and not exceeding a depth of **[4 inches (100 mm)] <Insert depth>**. Maintain 2 inches (50 mm) of clearance from top of base flashing.
 - b. Flood each area for **[24] [48] [72]** hours.
 - c. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing and flashing installations are watertight.
 - 1) Cost of retesting is the responsibility of Contractor.
 - d. Testing agency to prepare survey report indicating locations of initial leaks, if any, and final survey report.

- C. Manufacturer's Field Service: Engage a **[full-time]** site representative qualified by waterproofing system manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components and to furnish daily reports to Architect.
 - 1. Final Inspection: Arrange for waterproofing system manufacturer's technical personnel to inspect system installation on completion, in presence of Architect, and to prepare inspection report.
 - 2. Notify Architect **and Owner** 48 hours in advance of date and time of inspection.
 - 3. Repair or remove and replace components of waterproofing system where inspections indicate that they do not comply with specified requirements.
- D. Additional Tests and Inspections:
 - 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.
 - 2. Waterproofing system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.12 PROTECTION, REPAIR, AND CLEANING

- A. Protect waterproofing system from damage and wear during remainder of construction period.
- B. Protect installed **[protection course]** **[drainage panels]** from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where material is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- C. Correct deficiencies in or remove waterproofing system that does not comply with requirements, repair substrates, and repair or reinstall waterproofing system to a condition free of damage and deterioration at time of Substantial Completion and in accordance with warranty requirements.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 07 14 16 00



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SECTION 07 16 13 00 - POLYMER MODIFIED CEMENT WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Prepackaged, polymer-modified cement waterproofing.
2. Field-mixed, polymer-modified cement waterproofing.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for [**concrete slabs serving as protective topping for waterproofing and**]the finishing of concrete walls and slabs to receive waterproofing.
2. Section 099726 "Cementitious Coatings" for polymer-modified cementitious coatings used primarily for decorative purposes.

1.2 DEFINITIONS

- A. Compatible: Material that will not adversely affect adjacent materials, is chemically compatible with adjacent materials, and where required for bond, achieves adhesive compatibility with adjacent materials.
- B. Chemically Compatible: Material that will not break down, deteriorate, degrade, or prematurely fail when in contact with another material. Material that will not cause chemical breakdown, deterioration, degradation, staining, or premature failure of another material.
- C. Adhesive Compatibility: Material that will develop bond strength or provide a suitable surface for another material to develop bond strength, complying with specified performance requirements when in contact with another material.

1.3 COORDINATION

- A. Coordinate Work under this Section with adjacent concrete foundation Work, including other waterproofing systems.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at [**Project site**]<Insert location>.
 1. Review waterproofing requirements including, but not limited to, the following:
 - a. Minimum concrete curing period.
 - b. Forecasted weather conditions.
 - c. Repairs.
 - d. Field quality control.
 - e. <Insert agenda items>.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and installation instructions.
- B. Samples for Initial Selection: For each type of exposed product.
 - 1. Include Samples of available color selection.
- C. Samples for Verification: For each type of exposed waterproofing indicated, in manufacturer's standard sizes.
- D. Sustainable Design Submittals:
 - 1. Product Data: For waterproofing, providing information for testing in compliance with ASHRAE 160-2016.2009.
 - 2. Product Data: For waterproofing, providing information for testing in compliance with CCR, Title 24, Part 2, Section 1202 and Ch. 14.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Statement: For Applicator.
- B. Product Test Reports: For each product formulation, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Applicator Qualifications: Entity that employs applicators and supervisors who are trained[**and approved**] by waterproofing manufacturer in applying polymer-modified cement waterproofing similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup [**as indicated on Drawings**]**<Insert mockup requirements>**.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver packaged waterproofing materials in original undamaged containers, with manufacturer's labels

and seals intact.

- B. Take necessary precautions to keep products clean, dry, and free of damage.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit polymer-modified cement waterproofing to be applied in accordance with manufacturer's written instructions.
- B. Proceed with waterproofing work only after installation of pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.
- C. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at **40 deg F (4.4 deg C)** or above for at least 48 hours before, during work, and cure period, and space is well ventilated and kept free of water.

PART 2 - PRODUCTS

2.1 PREPACKAGED, POLYMER-MODIFIED CEMENT WATERPROOFING

- A. Negative-Side, Polymer-Modified Cement Waterproofing: Manufacturer's proprietary blend of dry cementitious and other ingredients for mixing with **[water][or][polymer admixture]** to produce a waterproof coating that is suitable for vertical and horizontal applications below or above grade, is breathable, resists negative-side hydrostatic pressure, and has properties complying with or exceeding the criteria specified below.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Anti-Hydro International, Inc]**
 - b. **[AQUAFIN, Inc]**
 - c. **[ChemMasters, Inc]**
 - d. **[EDCO Products Inc.]**
 - e. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - f. **[Five Star Products, Inc.]**
 - g. **[Gemite Products Inc., a W.R. Meadows company]**
 - h. **[International Chem-Crete, Inc.]**
 - i. **[Master Builders Solutions]**
 - j. **[Metalcrete Industries]**
 - k. **[Sakrete; CRH Americas, Oldcastle APG]**
 - l. **[Sika Corporation]**
 - m. **[SpecChem, LLC]**
 - n. **[Specco Industries, Inc]**
 - o. **[United Gilsonite Laboratories (UGL)]**
 - p. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the

following:

- a. **[Anti-Hydro International, Inc]**
 - b. **[AQUAFIN, Inc]**
 - c. **[ChemMasters, Inc]**
 - d. **[EDCO Products Inc.]**
 - e. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - f. **[Five Star Products, Inc.]**
 - g. **[Gemite Products Inc., a W.R. Meadows company]**
 - h. **[International Chem-Crete, Inc.]**
 - i. **[Master Builders Solutions]**
 - j. **[Metalcrete Industries]**
 - k. **[Sakrete; CRH Americas, Oldcastle APG]**
 - l. **[Sika Corporation]**
 - m. **[SpecChem, LLC]**
 - n. **[Specco Industries, Inc]**
 - o. **[United Gilsonite Laboratories (UGL)]**
 - p. **<Insert manufacturer's name>**
3. Water Permeability: Maximum **[zero for water at 30 ft. (9 m)]<Insert requirement>** when tested in accordance with COE CRD-C 48.
 4. Compressive Strength: Minimum **[4000 psi (27.6 MPa)]<Insert value>** at 28 days when tested in accordance with ASTM C109/C109M.
 5. Flexural Strength: Minimum **[710 psi (4.8 MPa)]<Insert value>** at 28 days when tested in accordance with ASTM C348.
 6. Potable Water Containment: Products of this Section must be certified to NSF 61 for use with potable water.
 7. Color: **[White][Gray][Match Architect's samples][As selected by Architect from full range][As indicated in a color schedule]<Insert color>**.
 8. VOC Content: **[100]** g/L or less.
 9. Low-Emitting Materials: Verify interior coatings comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 10. VOC Content: **[100]** g/L or less.
 11. Low-Emitting Materials: Verify VOC emissions of interior coatings comply with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 12. VOC Emissions: Verify interior coatings contain no more than half of the chronic REL of VOCs when tested in accordance with the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.
- B. Positive-Side, Polymer-Modified Cement Waterproofing: Manufacturer's proprietary blend of dry cementitious and other ingredients for mixing with **[water][or][polymer admixture]** to produce a waterproof coating that is suitable for vertical and horizontal applications below or above grade, is breathable, resists positive-side hydrostatic pressure, and has properties complying with or exceeding the criteria specified below.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. [Anti-Hydro International, Inc]
 - b. [AQUAFIN, Inc]
 - c. [Conproco Corporation]
 - d. [Damtite Waterproofing, Inc.]
 - e. [EDCO Products Inc.]
 - f. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - g. [Five Star Products, Inc.]
 - h. [Gemite Products Inc., a W.R. Meadows company]
 - i. [International Chem-Crete, Inc.]
 - j. [Master Builders Solutions]
 - k. [Metalcrete Industries]
 - l. [Sakrete; CRH Americas, Oldcastle APG]
 - m. [Sika Corporation]
 - n. [SpecChem, LLC]
 - o. [Specco Industries, Inc]
 - p. [United Gilsonite Laboratories (UGL)]
 - q. [Wall Firma, Inc]
 - r. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Anti-Hydro International, Inc]
 - b. [AQUAFIN, Inc]
 - c. [Conproco Corporation]
 - d. [Damtite Waterproofing, Inc.]
 - e. [EDCO Products Inc.]
 - f. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - g. [Five Star Products, Inc.]
 - h. [Gemite Products Inc., a W.R. Meadows company]
 - i. [International Chem-Crete, Inc.]
 - j. [Master Builders Solutions]
 - k. [Metalcrete Industries]
 - l. [Sakrete; CRH Americas, Oldcastle APG]
 - m. [Sika Corporation]
 - n. [SpecChem, LLC]
 - o. [Specco Industries, Inc]
 - p. [United Gilsonite Laboratories (UGL)]
 - q. [Wall Firma, Inc]
 - r. <Insert manufacturer's name>
3. Water Permeability: Maximum [zero for water at 30 ft. (9 m)]<Insert requirement> when tested in accordance with COE CRD-C 48.
4. Compressive Strength: Minimum [4000 psi (27.6 MPa)]<Insert value> at 28 days when tested in accordance with ASTM C109/C109M.
5. Flexural Strength: Minimum [710 psi (4.8 MPa)]<Insert value> at 28 days when tested in accordance with ASTM C348.
6. Color: [White][Gray][Match Architect's samples][As selected by Architect from full range][As indicated in a color schedule]<Insert color>.

2.2 FIELD-MIXED, POLYMER-MODIFIED CEMENT WATERPROOFING

- A. Admixture for Field Mixing: Manufacturer's standard polymer admixture for mixing with portland cement and sand to produce a waterproof coating that is suitable for vertical and horizontal applications below

or above grade, is breathable, resists **[positive][negative]**-side hydrostatic pressure and has properties complying with or exceeding the criteria specified below.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Anti-Hydro International, Inc]**
 - b. **[United Gilsonite Laboratories (UGL)]**
 - c. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Anti-Hydro International, Inc]**
 - b. **[United Gilsonite Laboratories (UGL)]**
 - c. **<Insert manufacturer's name>**
3. Water Permeability: Maximum **[zero for water at 30 ft. (9 m)]<Insert requirement>** when tested in accordance with COE CRD-C 48.
4. Compressive Strength: Minimum **[4000 psi (27.6 MPa)]<Insert value>** at 28 days when tested in accordance with ASTM C109/C109M.
5. Flexural Strength: Minimum **[710 psi (4.8 MPa)]<Insert value>** at 28 days when tested in accordance with ASTM C348.
6. VOC Content: **[100]** g/L or less.
7. Low-Emitting Materials: Verify interior coatings comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
8. VOC Content: **[100]** g/L or less.
9. Low-Emitting Materials: Verify VOC emissions of interior coatings comply with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
10. VOC Emissions: Verify interior coatings contain no more than half of the chronic REL of VOCs when tested in accordance with the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.

2.3 ACCESSORY MATERIALS

- A. General: Accessory materials as recommended in writing by waterproofing manufacturer for intended use.
- B. Patching Compound: Factory-premixed cementitious repair mortar, crack filler, or sealant recommended in writing by waterproofing manufacturer for filling and patching tie holes, honeycombs, reveals, and other imperfections, and compatible with substrate and other materials indicated.
- C. Plugging Compound: Factory-premixed cementitious compound with hydrophobic properties and recommended in writing by waterproofing manufacturer; resistant to water and moisture but vapor permeable for all standard applications (vertical, overhead, and horizontal surfaces not exposed to

vehicular traffic); and compatible with substrate and other materials indicated.

- D. Portland Cement: ASTM C150/C150M, Type I.
- E. Slurry-Coat Sand: ASTM C144.
- F. Trowel-Coat Sand: ASTM C33/C33M, fine aggregate.
- G. Water: Potable.

2.4 MIXES

- A. Prepackaged, Polymer-Modified Cement Waterproofing: Add prepackaged dry ingredients to mixing liquid in accordance with manufacturer's written instructions. Blend together with mechanical mixer or by hand to required consistency.
- B. Field-Mixed, Polymer-Modified Cement Waterproofing: Add polymer admixture to portland cement and sand in accordance with manufacturer's written instructions. Blend together with mechanical mixer or by hand to required consistency.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for suitable conditions where waterproofing is to be applied.
- B. Confirm water stops and other primary joint seals have been installed in concrete joints.
- C. Confirm waterproofing thickness to be applied to substrate face locations will not interfere with required operating and service clearances for elevators and other equipment to be installed within pits.
- D. Proceed with application only after unsatisfactory conditions have been corrected.
- E. Notify Architect in writing of active leaks or defects that would affect system performance.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions.
- B. Protect other work from damage caused by cleaning, preparation, and application of waterproofing. Provide temporary enclosure[**to confine spraying operation and**] to ensure adequate ambient temperatures and ventilation conditions for application.
- C. Do not allow waterproofing, patching, and plugging materials to enter reveals or annular spaces intended for resilient sealants or gaskets, such as joint spaces between pipes and pipe sleeves.
- D. Stop active water leaks with plugging compound.
- E. Repair damaged or unsatisfactory substrate with patching compound.

1. At holes and cracks **1/16 inch (1.6 mm)** wide or larger in substrate, remove loosened chips and cut reveal with sides perpendicular to surface, not tapered, and minimum **1 inch (25 mm)** deep. Fill reveal with patching compound flush with surface.
- F. Surface Preparation: Remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, paint, curing compounds, and form-release agents to ensure that waterproofing bonds to surfaces.
1. Clean concrete surfaces in accordance with ASTM D4258.
 - a. Scratch- and Float-Finished Concrete: Etch with 10 percent muriatic acid solution in accordance with ASTM D4260.
 - b. Smooth-Formed and Trowel-Finished Concrete: Prepare by mechanical abrading or abrasive-blast cleaning in accordance with ASTM D4259.
 2. Clean concrete unit masonry surfaces in accordance with ASTM D4261.
 - a. Lightweight Concrete Unit Masonry: Etch with 10 percent muriatic acid solution or abrade surface by wire brushing. Remove acid residue until pH readings of water after rinse are not more than 1.0 pH lower or 2.0 pH higher than pH of water before rinse.
 - b. Medium- and Normal-Weight Concrete Unit Masonry: Sandblast or bushhammer to a depth of **1/16 inch (1.6 mm)**.
 3. Clean clay masonry surfaces in accordance with ASTM D5703.
 4. Concrete Joints: Clean reveals.

3.3 APPLICATION OF POLYMER-MODIFIED CEMENT WATERPROOFING

- A. General: Comply with waterproofing manufacturer's written instructions for application and curing.
1. Saturate surface with water[**for several hours**] and maintain damp condition until applying waterproofing. Remove standing water.
 2. Apply waterproofing to surfaces, and extend waterproofing onto adjacent surfaces as follows:
 - a. Onto columns integral with treated walls.
 - b. Onto interior nontreated walls intersecting exterior treated walls, for a distance of **[24 inches (600 mm) for cast-in-place concrete][and][48 inches (1200 mm) for masonry]**.
 - c. Onto exterior walls and onto both exterior and interior columns, for a height of **12 inches (300 mm)**, where floors, but not walls, are treated.
 - d. Onto every substrate in areas indicated for treatment, including **[pipe trenches][pipe chases][pits][sumps]<Insert area>[and][similar offsets and features]**.
 3. Number of Coats: **[Number required for specified water permeability][Two][Three]<Insert number>**.
 - a. Coating Thickness: Maximum application thickness of **[47 mils (1.2 mm)][60 mils (1.5 mm)]<Insert value>** per coat for total thickness **[as required for specified water permeability][of 100 mils (2.5 mm)][of 120 mils (3.0 mm)]<Insert requirement>**.
 - b. Apply first coat as a slurry with brush or roller, and apply subsequent coats with brush, roller, spray, or trowel.
 - c. Vigorously work first coat onto the substrate, forcing the material into surface voids. Apply each subsequent coat into full contact with previous coat.
 - d. Allow manufacturer's recommended time between coats. Dampen surface between coats.



- B. Final Coat Finish: [**Smooth troweled**][**Brushed**][**Textured**]<Insert requirement>.
- C. Curing:
 - 1. Air-cure waterproofing for not less than [**five**]<Insert number> days immediately after application and prior to being placed in service.
 - 2. Moist-cure waterproofing for not less than [**three**]<Insert number> days immediately after application has set, followed by air drying prior to being placed in service unless otherwise recommended in writing by manufacturer.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed application of waterproofing.
- B. Prepare test and inspection reports.

3.5 PROTECTION AND CLEANING

- A. Protect surfaces from hot, dry, and windy weather conditions. Prevent rapid drying through manufacturer-approved methods.

END OF SECTION 07 16 13 00



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SECTION 07 16 16 00 - CRYSTALLINE WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Crystalline waterproofing.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for concrete slabs serving as protective topping for waterproofing and the finishing of concrete walls and slabs to receive waterproofing.

1.2 DEFINITIONS

- A. Compatible: Material that will not adversely affect adjacent materials, is chemically compatible with adjacent materials, and where required for bond, achieves adhesive compatibility with adjacent materials.
- B. Chemically Compatible: Material that will not break down, deteriorate, degrade, or prematurely fail when in contact with another material. Material that will not cause chemical breakdown, deterioration, degradation, staining, or premature failure of another material.
- C. Adhesive Compatibility: Material that will develop bond strength or provide a suitable surface for another material to develop bond strength, complying with specified performance requirements when in contact with another material.

1.3 COORDINATION

- A. Coordinate Work under this Section with adjacent concrete foundation Work, including other waterproofing systems.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1. Review waterproofing requirements including, but not limited to, the following:
 - a. Minimum concrete curing period.
 - b. Forecasted weather conditions.
 - c. Repairs.
 - d. Field quality control.
 - e. **<Insert agenda items>**.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and installation instructions.
- B. Sustainable Design Submittals:
 - 1. Product Data: For waterproofing, providing information for testing in compliance with ASHRAE 160-2016.2009.
 - 2. Product Data: For waterproofing, providing information for testing in compliance with CCR, Title 24, Part 2, Section 1202 and Ch. 14.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Statement: For **[Applicator][and][testing agency]**.
- B. Product Test Reports: For each product formulation, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample warranties.

1.7 QUALITY ASSURANCE

- A. Applicator Qualifications: Entity that employs applicators and supervisors who are trained[**and approved**] by waterproofing manufacturer in applying crystalline waterproofing similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

1.8 MOCKUPS

- A. Build mockups to set quality standards for materials and execution.
 - 1. Build mockup [**as indicated on Drawings**]**<Insert mockup requirements>**.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver packaged waterproofing materials in original undamaged containers, with manufacturer's labels and seals intact.
- B. Store materials in dry environment at a temperature above **45 degrees F (7 degrees C)**.
- C. Do not use materials stored for more than 24 months from date of manufacture.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit crystalline waterproofing to be applied in accordance with manufacturer's written instructions and warranty requirements.
- B. Proceed with waterproofing work only after installation of pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.

1.11 WARRANTY

- A. Manufacturer's Material Warranty: Manufacturer agrees to replace waterproofing that fails to remain watertight within specified warranty period.
 - 1. Warranty includes replacement of waterproofing system.
 - 2. Warranty Period: **[Five][Ten]<Insert number>** years from date of Substantial Completion.
- B. Applicator's Special Warranty: Submit warranty signed by Applicator, to replace waterproofing that fails to remain watertight within specified warranty period covering Work of this Section.
 - 1. Warranty includes leak remediation, and coverage for failure to meet specified requirements, including defects caused by faulty workmanship.
 - 2. Warranty Period: **[Five]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WATERPROOFING MATERIALS

- A. Crystalline Waterproofing: Prepackaged, **[gray][white]**-colored proprietary blend of portland cement, specially treated sand, and active chemicals that, when mixed with water and applied, penetrates into concrete and concrete unit masonry and reacts chemically with the byproducts of cement hydration in the presence of water to develop crystalline growth within substrate capillaries to produce an impervious, dense, waterproof substrate; with properties complying with or exceeding the criteria specified below.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Anti-Hydro International, Inc]**
 - b. **[AQUAFIN, Inc]**
 - c. **[ChemMasters, Inc]**
 - d. **[Conproco Corporation]**
 - e. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - f. **[Gemite Products Inc., a W.R. Meadows company]**
 - g. **[International Chem-Crete, Inc.]**
 - h. **[IPA Systems, Inc.]**
 - i. **[KOSTER American Corporation]**
 - j. **[Kryton International, Inc.]**
 - k. **[Master Builders Solutions]**

- l. **[Penetron USA, Inc.]**
 - m. **[Sika Corporation]**
 - n. **[Tremco Incorporated]**
 - o. **[Xypex Chemical Corporation]**
 - p. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[Anti-Hydro International, Inc]**
 - b. **[AQUAFIN, Inc]**
 - c. **[ChemMasters, Inc]**
 - d. **[Conproco Corporation]**
 - e. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - f. **[Gemite Products Inc., a W.R. Meadows company]**
 - g. **[International Chem-Crete, Inc.]**
 - h. **[IPA Systems, Inc.]**
 - i. **[KOSTER American Corporation]**
 - j. **[Kryton International, Inc.]**
 - k. **[Master Builders Solutions]**
 - l. **[Penetron USA, Inc.]**
 - m. **[Sika Corporation]**
 - n. **[Tremco Incorporated]**
 - o. **[Xypex Chemical Corporation]**
 - p. **<Insert manufacturer's name>**
3. Water Permeability: Maximum **[zero for water at 30 ft. (9 m)]<Insert requirement>** when tested in accordance with COE CRD-C 48.
 4. Compressive Strength: Minimum **[4000 psi (27.6 MPa)]<Insert value>** at 28 days when tested in accordance with ASTM C109/C109M.
 5. Self-Sealing: Autogenous crack sealing of treated concrete for cracks with width of **0.02 inch (0.5 mm)** or greater when subjected to hydrostatic pressure of **65 psi (0.44 MPa)**.
 6. Sulfate Resistance: The waterproofing treatment must improve concrete resistance to sulfates by reducing permeability without affecting compressive strength; performance to be verified by independent testing.
 7. Potable Water Containment: Products of this Section must be certified to NSF 61 for use with potable water.

2.2 ACCESSORY MATERIALS

- A. General: Accessory materials as recommended in writing by waterproofing manufacturer for intended use.
- B. Patching Compound: Factory-premixed cementitious repair mortar, crack filler, or sealant recommended in writing by waterproofing manufacturer for filling and patching tie holes, honeycombs, reveals, and other imperfections; and compatible with substrate and other materials indicated.
- C. Plugging Compound: Factory-premixed cementitious compound with hydrophobic properties and recommended in writing by waterproofing manufacturer; resistant to water and moisture but vapor permeable for all standard applications (vertical, overhead, and horizontal surfaces not exposed to vehicular traffic); and compatible with substrate and other materials indicated.
- D. Water: Potable.

2.3 MIXES

- A. Crystalline Waterproofing: Add prepackaged dry ingredients to water in accordance with manufacturer's written instructions. Blend together with mechanical mixer or by hand to required consistency.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for suitable conditions where waterproofing is to be applied.
- B. Proceed with application only after unsatisfactory conditions have been corrected.
- C. Notify Architect in writing of active leaks or defects that would affect system performance.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions.
- B. Protect other work from damage caused by cleaning, preparation, and application of waterproofing. Provide temporary enclosure[**to confine spraying operation and**] to ensure adequate ambient temperatures and ventilation conditions for application.
- C. Do not allow waterproofing, patching, and plugging materials to enter reveals or annular spaces intended for resilient sealants or gaskets, such as joint spaces between pipes and pipe sleeves.
- D. Stop active water leaks with plugging compound.
- E. Repair damaged or unsatisfactory substrate with patching compound.
 - 1. At holes and cracks **1/16 inch (1.6 mm)** wide or larger in substrate, remove loosened chips and cut reveal with sides perpendicular to surface, not tapered, and minimum **1 inch (25 mm)** deep. Fill reveal with patching compound flush with surface.
- F. Surface Preparation: Remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, paint, curing compounds, and form-release agents to ensure that waterproofing bonds to surfaces.
 - 1. Clean concrete surfaces in accordance with ASTM D4258.
 - a. Scratch- and Float-Finished Concrete: Etch with 10 percent muriatic acid solution in accordance with ASTM D4260.
 - b. Smooth-Formed and Trowel-Finished Concrete: Prepare by mechanical abrading or abrasive-blast cleaning in accordance with ASTM D4259.
 - 2. Clean concrete unit masonry surfaces in accordance with ASTM D4261.
 - a. Lightweight Concrete Unit Masonry: Etch with 10 percent muriatic acid solution or abrade surface by wire brushing. Remove acid residue until pH readings of water after rinse are not more than 1.0 pH lower or 2.0 pH higher than pH of water before rinse.
 - b. Medium- and Normal-Weight Concrete Unit Masonry: Sandblast or bushhammer to a depth of **1/16 inch (1.6 mm)**.

3. Concrete Joints: Clean reveals.

3.3 APPLICATION OF CRYSTALLINE WATERPROOFING

- A. General: Comply with waterproofing manufacturer's written instructions for application and curing.
 1. Saturate surface with water for several hours and maintain damp condition until applying waterproofing. Remove standing water.
 2. Apply waterproofing to surfaces, and extend waterproofing onto adjacent surfaces as follows:
 - a. Onto columns integral with treated walls.
 - b. Onto interior nontreated walls intersecting exterior treated walls, for a distance of **[24 inches (600 mm) for cast-in-place concrete][and][48 inches (1200 mm) for masonry]**.
 - c. Onto exterior walls and onto both exterior and interior columns, for a height of **12 inches (300 mm)**, where floors, but not walls, are treated.
 - d. Onto every substrate in areas indicated for treatment, including **[pipe trenches][pipe chases][pits][sumps]<Insert area>[and][similar offsets and features]**.
 3. Number of Coats: **[Number required for specified water permeability][Two][Three]<Insert number>**.
 4. Application Method: Apply to ensure that each coat fills voids and is in full contact with substrate or previous coat.
 5. Dampen surface between coats.
- B. Final Coat Finish: **[Smooth][Brushed][Spray textured]**.
- C. Curing: Moist-cure waterproofing for **[three]<Insert number>** days immediately after final coat has set, followed by air drying, unless otherwise recommended in writing by manufacturer.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed application of waterproofing.
- B. Prepare test and inspection reports.

END OF SECTION 07 16 16 00

SECTION 07 16 19 00 - METAL OXIDE WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal-oxide waterproofing.

B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for forms and waterstops.
2. Section 033000 "Cast-in-Place Concrete" for concrete slabs serving as protective topping for waterproofing and the finishing of concrete walls and slabs to receive waterproofing.
3. Section 042000 "Unit Masonry" for cleaning of unit masonry walls to receive waterproofing.
4. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.2 COORDINATION

- A. Coordinate Work under this Section with adjacent concrete foundation work, including fill[, **other waterproofing systems**] [, **underslab vapor retarders**] [, **underslab insulation**] [**and**] [**subdrainage systems**].

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]** **<Insert location>**.

1. Review waterproofing requirements including, but not limited to, the following:
 - a. Minimum concrete curing period.
 - b. Forecasted weather conditions.
 - c. Repairs.
 - d. Field quality control.
 - e. **<Insert agenda items>**.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include construction details, material descriptions, and installation instructions.

- B. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for moisture control>

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Statements: For Applicator[**and testing agency**].
- B. Manufacturer Certificates: For each type of waterproofing, patching, and plugging material.
- C. Product Test Reports: For tests performed by manufacturer and witnessed by a qualified testing agency.
 - 1. Iron content of metallic waterproofing.
 - 2. Oxidizing agent content of metallic waterproofing.
- D. Field quality control reports.

1.6 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm that employs applicators and supervisors who are trained and **[certified] [approved]** by waterproofing manufacturer.

1.7 MOCKUPS

- A. Build mockups to verify selections made under submittals and to set quality standards for application.
 - 1. Build mockup of typical **[vertical] [and] [horizontal]** surfaces[**as shown on Drawings**].
 - a. Size: **[100 sq. ft. (9.29 sq. m) in size] <Insert size>**.
 - 2. Visually and physically examined for bonding and loose materials by waterproofing material manufacturer.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver packaged waterproofing materials in original undamaged containers, with manufacturer's labels and seals intact.
- B. Store in dry locations, at the temperature recommended in writing by the manufacturer, with adequate ventilation and handle in a manner to prevent damage or contamination.
- C. Remove and replace materials that cannot be applied within their stated shelf life.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit metal-oxide waterproofing to be performed in accordance with manufacturer's written instructions and warranty requirements.

- B. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.
- C. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F (4.4 deg C) or above during work and cure period, and space is well ventilated and kept free of water.

PART 2 - PRODUCTS

2.1 WATERPROOFING MATERIALS

- A. Metal-Oxide Waterproofing: A product specifically formulated for waterproofing concrete and masonry substrates and containing pulverized iron and a chemical oxidizing agent to cause the iron particles to oxidize and grow in size in the presence of water.
 - 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 - 2. **<Insert properties>**.

2.2 ACCESSORY WATERPROOFING SYSTEM MATERIALS

- A. General: Accessory materials as recommended in writing by metal-oxide waterproofing manufacturer for intended use and compatibility with one another and with waterproofing.
- B. Patching Compound: Factory-premixed cementitious repair mortar, crack filler, or sealant recommended in writing by waterproofing manufacturer for filling and patching tie holes, honeycombs, reveals, and other imperfections; and compatible with substrate and other materials indicated.
 - 1. **<Insert manufacturers or products>**.
- C. Plugging Compound: Factory-premixed cementitious compound with hydrophobic properties and recommended in writing by waterproofing manufacturer; resistant to water and moisture but vapor permeable for all standard applications (vertical, overhead, and horizontal surfaces not exposed to vehicular traffic); and compatible with substrate and other materials indicated.
 - 1. **<Insert manufacturers or products>**.
- D. Portland Cement: ASTM C150/C150M, Type I.
- E. Sand: ASTM C144.
- F. Aggregate for Protective Coat: ASTM C33/33M.
- G. Water: Potable.
- H. Sealant: Polyurethane foam.

2.3 MIXES

- A. Metal-Oxide Coats: Add metal-oxide waterproofing compound and other mix components, if any, to water in accordance with manufacturer's written instructions. Blend together with mechanical mixer or by hand to required consistency for each coat.
- B. Measure, batch, and mix portland cement and sand in the proportion of [1:2-1/2] <Insert proportion> and water. Blend together with mechanical mixer to required consistency.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for suitable conditions where waterproofing is to be applied.
- B. Confirm water stops and other primary joint seals have been installed in concrete joints.
- C. Proceed with application only after unsatisfactory conditions have been corrected.
- D. Notify Architect in writing of active leaks or defects that would affect system performance.
- E. Confirm waterproofing thickness to be applied to substrate face locations will not interfere with required operating and service clearances for elevators and other equipment installed within pits.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions.
- B. Protect other work from damage caused by cleaning, preparation, and application of waterproofing. Provide temporary enclosure to ensure adequate ambient temperatures and ventilation conditions for application.
- C. Do not allow waterproofing, patching, and plugging materials to enter reveals or annular spaces intended for resilient sealants or gaskets, such as joint spaces between pipes and pipe sleeves.
- D. Stop active water leaks with plugging compound.
- E. Repair damaged or unsatisfactory substrate with patching compound.
 - 1. At holes and cracks 1/16 inch (1.6 mm) wide or larger in substrate, remove loosened chips and cut reveal with sides perpendicular to surface, not tapered, and minimum 1 inch (25 mm) deep. Fill reveal with patching compound flush with surface.
- F. Surface Preparation: Remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, paint, curing compounds, and form-release agents to ensure that waterproofing bonds to surfaces.
 - 1. Clean concrete surfaces in accordance with ASTM D4258.
 - a. Scratch- and Float-Finished Concrete: Etch with 10 percent muriatic acid solution in accordance with ASTM D4260.

- b. Smooth-Formed and Trowel-Finished Concrete: Prepare by mechanical abrading or abrasive-blast cleaning in accordance with ASTM D4259.
2. Clean concrete unit masonry surfaces in accordance with ASTM D4261.
 - a. Lightweight Concrete Unit Masonry: Etch with 10 percent muriatic acid solution or abrade surface by wire brushing. Remove acid residue until pH readings of water after rinse are not more than 1.0 pH lower or 2.0 pH higher than pH of water before rinse.
 - b. Medium- and Normal-Weight Concrete Unit Masonry: Sandblast or bushhammer to a depth of 1/16 inch (1.6 mm).
3. Clean clay masonry surfaces in accordance with ASTM D5703.
4. Concrete Joints: Clean reveals.

3.3 APPLICATION OF METAL-OXIDE WATERPROOFING

- A. General: Comply with waterproofing manufacturer's written instructions for application and curing.
 1. Saturate surface with water and maintain damp condition in accordance with manufacturer's written instructions until applying waterproofing. Remove standing water.
 2. Apply waterproofing to surfaces, and extend waterproofing onto adjacent surfaces as follows:
 - a. Onto columns integral with treated walls.
 - b. Onto interior nontreated walls intersecting exterior treated walls, for a distance of **[24 inches (600 mm) for cast-in-place concrete] [and] [48 inches (1200 mm) for masonry]**.
 - c. Onto exterior walls and onto both exterior and interior columns, for a height of 12 inches (300 mm), where floors, but not walls, are treated.
 - d. Onto every substrate in areas indicated for treatment, including **[pipe trenches] [, pipe chases] [, pits] [, sumps] <Insert area> [, and similar offsets and features]**.
 3. Number of Metal-Oxide Coats: Applying two or more coats required for specified water permeability.
 4. Application Method: Brush apply the waterproofing, vigorously working first coat onto the substrate and forcing the material into surface voids. Brush each subsequent coat into full contact with previous coat.
 5. Dampen surface between coats.
 6. Allow each coat to set for maximum 24 hours between coats.
- B. Wall and Columns Protection Coat: Immediately after metal-oxide coats have set, apply protection coat on walls and columns to a minimum thickness of **[1/8 inch (3 mm)] <Insert thickness>**.
 1. Finish: **[Smooth] [Brushed] [Textured] <Insert finish>**.
- C. Floors Protective Topping: Immediately after metal-oxide coats have set, apply floor topping to a thickness of **[1 inch (25 mm)] [1-1/2 inches (38 mm)] <Insert thickness>**.
 1. Finish: **[Smooth] [Brushed] <Insert finish>**.
- D. Curing: Moist-cure waterproofing for **[three] <Insert number>** days immediately after installation has set, followed by air drying prior to being placed in service, unless otherwise recommended in writing by manufacturer.



07 - Thermal And Moisture Protection

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed application of waterproofing.
- B. Prepare test and inspection reports.

END OF SECTION 07 16 19 00

SECTION 07 17 00 00 - BENTONITE WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Geotextile/bentonite sheets.
2. Composite bentonite membrane.
3. Protection course.
4. Molded-sheet drainage panels.
5. Insulation drainage panels.

B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for forms and waterstops.
2. Section 072100 "Thermal Insulation" for below-grade foundation insulation.
3. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
4. Section 079513.16 "Exterior Expansion Joint Cover Assemblies" for exterior-wall expansion-joint assemblies that interface with waterproofing.
5. Section 312000 "Earth Moving" for excavating and backfilling.
6. Section 315000 "Excavation Support and Protection" for permanent below-grade support systems that receive blindside waterproofing.

1.2 DEFINITIONS

- A. Compatible: Material that will not adversely affect adjacent materials, is chemically compatible with adjacent materials, and where required for bond, achieves adhesive compatibility with adjacent materials.
- B. Chemical Compatibility: Material that will not break down, deteriorate, degrade, or prematurely fail when in contact with another material. Material that will not cause chemical breakdown, deterioration, degradation, staining, or premature failure of another material.

1.3 COORDINATION

- A. Coordinate the Work of this Section with adjacent concrete foundation work, including fill[, **other waterproofing systems**] [, **under-slab vapor retarders**] [, **under-slab insulation**] [and] [**subdrainage systems**].
- B. Coordinate requirements for concrete formwork to provide suitable substrate for waterproofing and to minimize penetrations through waterproofing.
- C. Coordinate formwork and form bracing requirements for blindside sheet waterproofing. Coordinate restrictions on use of form ties and other components as necessary to eliminate or minimize penetrations through blindside sheet waterproofing.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]** <Insert location>.

1.5 ACTION SUBMITTALS

- A. Product Data:
 - 1. For each type of product.
 - a. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - b. Include manufacturer's written installation instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, expansion joints, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, air barrier, and other termination conditions.
- C. Samples: For each of the following products, in sizes indicated:
 - 1. Waterproofing: 6 inches (150 mm) square.
 - 2. Protection Course: 6 inches (150 mm) square.
 - 3. Molded-Sheet Drainage Panels: 6 inches (150 mm) square.
 - 4. Insulation Drainage Panels: 6 inches (150 mm) square.
- D. Sustainable Design Submittals:
 - 1. <Double click to insert sustainable design text for moisture control>

1.6 INFORMATIONAL SUBMITTALS

- A. Manufacturer Certificates: For each type of waterproofing material.
- B. Preconstruction Test Reports: For water samples taken at Project site along with recommendations resulting from these tests.
- C. Field quality control reports.
- D. Sample warranties.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that employs installers and supervisors who are trained and **[certified]** **[approved]** by waterproofing manufacturer.

1.8 MOCKUPS

- A. Build mockups to verify selections made under samples and set quality standards for application.

1. Build mockup of installation on typical **[vertical]** **[and]** **[horizontal]** surfaces **[as indicated on Drawings]**.
 - a. Size: **[10 sq. ft. (0.9 sq. m) in size]** **<Insert description>**.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in factory-sealed and -labeled packaging. Handle and store following manufacturer's instructions, recommendations, and material safety data sheets. Protect from construction operation-related damage and damage from weather, excessive temperatures, and prolonged sunlight.
- B. Do not double-stack pallets during shipping or storage. Protect waterproofing materials from moisture, excessive temperatures, and sources of ignition. Provide cover, top, and all sides, for materials stored on-site, allowing for adequate ventilation.
- C. Remove damaged material from site and dispose of in accordance with applicable regulations.

1.10 PRECONSTRUCTION TESTING

- A. Preconstruction Testing: Engage a qualified testing agency to perform preconstruction testing on ground water.
 1. Obtain water samples from Project site at approximate locations where waterproofing will be installed and test for acids, alkalis, brine, or other contaminants that may inhibit performance of waterproofing materials.
 2. Comply with waterproofing manufacturer's written instructions for testing.

1.11 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit bentonite waterproofing to be installed in accordance with manufacturer's written instructions and warranty requirements.
 1. Do not apply waterproofing materials to surfaces where ice or frost is visible. Do not apply bentonite waterproofing materials in areas with standing water.
 2. Do not place bentonite clay products in panel or composite form on damp surfaces unless such practice is approved in writing by manufacturer.

1.12 WARRANTY

- A. Special Warranty: Manufacturer **[and Installer]** agree(s) to repair or replace components of bentonite waterproofing system that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: **[Five]** **[10]** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain bentonite waterproofing system from single source from single manufacturer. Obtain accessory products used with bentonite waterproofing, including waterstops specified in Section 033000 "Cast-in-Place Concrete" from sources acceptable to bentonite waterproofing manufacturer.

2.2 GEOTEXTILE/BENTONITE SHEETS

- A. Geotextile/Bentonite Sheet: Minimum of 1.10 lb/sq. ft. (5.37 kg/sq. m) of granular sodium bentonite between two layers of polypropylene geotextile fabric, one woven and one nonwoven, needle punched.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
2. Grab Tensile Strength: **[95 lbf (422 N)]** **<Insert value>** in accordance with ASTM D4632.
3. Puncture Resistance: 100 lbf (445 N) in accordance with ASTM D4833.

- B. Contaminant-Resistant Geotextile/Bentonite Sheet: Minimum of 1.10 lb/sq. ft. (5.37 kg/sq. m) of contaminant-resistant granular sodium bentonite, specially formulated for use in saltwater or contaminated ground water, between two layers of polypropylene geotextile fabric, one woven and one nonwoven, needle punched.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
2. Grab Tensile Strength: **[95 lbf (422 N)]** **<Insert value>** in accordance with ASTM D4632.
3. Puncture Resistance: 100 lbf (445 N) in accordance with ASTM D4833.

- C. Polyethylene-Lined Geotextile/Bentonite Sheet: Minimum of 1.0 lb/sq. ft. (4.8 kg/sq. m) of granular sodium bentonite between two layers of geotextile fabric.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
2. Grab Tensile Strength: 95 lbf (422 N) in accordance with ASTM D4632.
3. Puncture Resistance: 100 lbf (445 N) in accordance with ASTM D4833.
4. Vapor Permeance: 0.03 perm (0.172 ng/Pa x s x sq. m) in accordance with ASTM E96/E96M.

- D. Contaminant-Resistant Polyethylene-Lined Geotextile/Bentonite Sheet: Minimum of 1.0 lb/sq. ft. (4.8 kg/sq. m) of contaminant-resistant granular sodium bentonite clay granules, specially formulated for use in saltwater or contaminated ground water, between two layers of geotextile fabric.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
2. Grab Tensile Strength: 120 lbf (530 N) in accordance with ASTM D4632.
3. Puncture Resistance: 140 lbf (620 N) in accordance with ASTM D4833.
4. Vapor Permeance: 0.03 perm (0.172 ng/Pa x s x sq. m) in accordance with ASTM E96/E96M.

2.3 COMPOSITE BENTONITE MEMBRANE

- A. Composite Bentonite Membrane: Manufacturer's standard membrane consisting of a geomembrane liner bonded to a layer of bentonite.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
2. Puncture Resistance: 155 lbf (689 N) in accordance with ASTM E154.
3. Vapor Permeance: 0.03 perm (0.172 ng/Pa x s x sq. m) in accordance with ASTM E96/E96M.

- B. Composite Bentonite Membrane with Protective Facing: Manufacturer's standard membrane consisting of geomembrane liner bonded to a layer of bentonite clay granules with a spun polypropylene facing.
 - 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
 - 2. Puncture Resistance: 155 lbf (689 N) in accordance with ASTM E154.
 - 3. Vapor Permeance: 0.03 perm (0.172 ng/Pa x s x sq. m) in accordance with ASTM E96/E96M.
- C. Contaminant-Resistant Composite Bentonite Membrane: Manufacturer's standard membrane consisting of polyethylene geomembrane bonded to a layer of bentonite.
 - 1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
 - 2. Puncture Resistance: 112 lbf (498 N) in accordance with ASTM E154.
 - 3. Vapor Permeance: 0.03 perm (0.172 ng/Pa x s x sq. m) in accordance with ASTM E96/E96M.

2.4 ACCESSORY WATERPROOFING SYSTEM MATERIALS

- A. General: Accessory materials as recommended in writing by bentonite waterproofing manufacturer for intended use and compatibility with one another and with waterproofing.
- B. Granular Bentonite: Sodium bentonite clay containing a minimum of 90 percent montmorillonite (hydrated aluminum silicate), with a minimum of 90 percent passing a No. 20 (0.85 mm) sieve.
- C. Bentonite Mastic: Bentonite compound of trowelable consistency, specifically formulated for application at joints and penetrations.
- D. Bentonite Tubes: Manufacturer's standard 2-inch- (50-mm-) diameter, water-soluble tube containing approximately 1.5 lb/ft. (2.2 kg/m) of granular bentonite; hermetically sealed; designed specifically for placing on wall footings at line of joint with exterior base of wall.
- E. Metal Termination Bars: Manufacturer's standard aluminum or stainless steel bars with upper flange to receive sealant.
- F. Plastic Protection Sheet: Polyethylene sheeting in accordance with ASTM D4397; thickness as recommended in writing by waterproofing manufacturer to suit application but at least 6 mils (0.15 mm) thick.
- G. Cement Grout Patching Material: Grout mix compatible with substrate being patched and recommended in writing by waterproofing manufacturer.
- H. Masonry Fasteners: Case-hardened nails or hardened-steel, powder-actuated fasteners. Depending on manufacturer's written requirements, provide 1/2- or 1-inch- (13- or 25-mm-) diameter washers under fastener heads.
- I. Sealants: As recommended in writing by waterproofing manufacturer. Comply with requirements specified in Section 079200 "Joint Sealants."
- J. Tapes: Waterproofing manufacturer's recommended waterproof tape for joints between sheets, membranes, or panels.
- K. Adhesive: Waterproofing manufacturer's water-based adhesive used to secure waterproofing to both vertical and horizontal surfaces.

2.5 PROTECTION COURSE

- A. Protection course material of type and thickness as recommended in writing by waterproofing manufacturer for each Project condition.

2.6 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel acceptable to dampproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to one side of the core, with or without a polymeric film bonded to the other side; and with a vertical flow rate through the core of **[9 to 21 gpm per ft. (112 to 261 L/min. per m)] <Insert value>**.
 - 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.7 INSULATION DRAINAGE PANELS

- A. Insulation Drainage Panels:
 - 1. Comply with Section 072100 "Thermal Insulation" for insulation drainage panels.
 - 2. Unfaced or geotextile-faced, extruded-polystyrene board insulation in accordance with ASTM C578, Type IV, 25 psi (173 kPa), or Type VI, 40 psi (276 kPa), minimum compressive strength; fabricated with shiplap or channel edges and with one side having grooved drainage channels.
 - 3. <Double click here to find, evaluate, and insert list of manufacturers and products.>

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate preparations and other conditions affecting performance of bentonite waterproofing.
- B. Examine bentonite materials before installation. Reject materials that have been prematurely exposed to moisture.
- C. Verify that substrate is complete and that work that will penetrate waterproofing is complete and rigidly installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean, prepare, and treat substrates in accordance with manufacturer's written instructions.
- B. Formed Concrete Surfaces: Remove fins and projections. Fill voids, rock pockets, form-tie holes, and other defects with bentonite mastic or cement grout patching material in accordance with manufacturer's written instructions.

- C. Horizontal Concrete Surfaces: Remove debris, standing water, oily substances, mud, and similar substances that could impair the bonding ability of concrete or the effectiveness of waterproofing. Fill voids, cracks greater than 1/8 inch (3 mm), honeycomb areas, and other defects with bentonite mastic or cement grout patching material in accordance with manufacturer's written instructions.
- D. Excavation Support and Protection System: If water is seeping, use plastic protection sheets or other suitable means to prevent wetting the bentonite waterproofing. Fill minor gaps and spaces 1/8 inch (3 mm) wide or wider with wood, metal, concrete, or other appropriate filling material. Cover or fill large voids and crevices with cement mortar in accordance with manufacturer's written instructions.

3.3 INSTALLATION, GENERAL

- A. Prepare substrates, voids, cracks, and cavities; and install waterproofing and accessories in accordance with manufacturer's written instructions.
 - 1. Before installing, verify the correct side of waterproofing that faces substrate surface.
 - 2. Apply granular bentonite around penetrations in horizontal surfaces and changes in plane in accordance with manufacturer's details in preparation for bentonite tubes and mastic.
 - 3. Apply bentonite tubes, bentonite mastic, or both at changes of plane, construction joints in substrate, projections, and penetrations.
 - 4. Prime concrete substrates. Primer may be omitted on concrete surfaces that comply with manufacturer's written requirements for dryness, surface texture, and freedom from imperfections.
- B. Apply bentonite tubes continuously on footing against base of wall to be waterproofed.
- C. Protect waterproofing from damage and wetting before and during subsequent construction operations. Repair punctures, tears, and cuts.
- D. Install protection course before backfilling or placing overburden when recommended in writing by waterproofing manufacturer.

3.4 INSTALLATION OF GEOTEXTILE/BENTONITE SHEETS

- A. Install a continuous layer of waterproofing sheets directly against surface to be waterproofed. Lap ends and edges a minimum of 4 inches (100 mm) on horizontal and vertical substrates unless otherwise indicated. Stagger end joints between sheets a minimum of 24 inches (600 mm). Fasten seams by stapling to adjacent sheet or nailing to substrate.
- B. Below Structural Slabs-on-Grade: Place waterproofing sheets on compacted substrate with ends and edges lapped and stapled.
 - 1. Install a layer of waterproofing sheets under footings, grade beams, and pile caps; or continue waterproofing through key joints between footings and foundation walls and extend a minimum of 8 inches (200 mm) up or beyond perimeter slab forms.
- C. Concrete Walls: Starting at bottom of wall, apply waterproofing sheets horizontally against wall. Secure with masonry fasteners spaced in accordance with manufacturer's written instructions. Extend to bottom of footing, grade beam, or wall, and secure.
- D. Termination at Grade:

1. Extend waterproofing sheets to within **[12 inches (300 mm)]** <Insert dimension> of finish grade unless otherwise indicated. Secure top edge with termination bar. Apply sealant to top edge of termination bar.
 2. Fasten top edge of waterproofing sheets to wall and protect top edge with sheet metal counterflashing. Cover waterproofing with a lapped course of plastic protection sheets if backfilling does not proceed immediately.
- E. Excavation Support and Protection (Permanent Shoring): Encase tieback heads, rods, nuts, and plates in accordance with waterproofing manufacturer's written instructions for each configuration.
1. Install a layer of waterproofing sheets, with ends and edges lapped and nailed to shoring. Cover waterproofing with plastic protection sheets if needed for protection from precipitation; remove plastic sheets before placing concrete.
 2. Inspect and repair waterproofing after reinforcing steel has been placed. Coordinate and control concrete placement to avoid damage to waterproofing.

3.5 INSTALLATION OF COMPOSITE BENTONITE MEMBRANE

- A. Install a continuous layer of waterproofing membrane, with ends and edges lapped a minimum of 4 inches (100 mm) unless otherwise indicated. Stagger end joints between membranes a minimum of 24 inches (600 mm). Seal joints with permanent seam tape or heat-welded for gas barrier.
- B. Below Structural Slabs-on-Grade: Apply waterproofing membrane with polyethylene side down, and staple ends and edges.
1. Install under footings, grade beams, and pile caps; or continue waterproofing through key joints between footings and foundation walls and extend a minimum of 8 inches (200 mm) up or beyond perimeter slab forms.
 2. Protect waterproofing from damage caused by reinforcing bar supports with sharp edges.
- C. Slabs: Starting at lowest point, install a continuous layer of waterproofing membrane, with ends and edges lapped a minimum of 4 inches (100 mm).
- D. Concrete Walls: Apply mastic to form continuous 3/4-inch (19-mm) cant or fillet at intersection of footings and walls.
1. Starting at lowest point, install a layer of waterproofing membrane horizontally, extending a minimum of 6 inches (150 mm) onto the footing. Lap membrane ends and edges a minimum of 2 inches (50 mm).
 2. Secure membrane to wall.
 3. Apply mastic to form continuous 3/4-inch (19-mm) layer around penetrations.
 4. Termination at Grade: Extend waterproofing membrane to within **[12 inches (300 mm)]** <Insert dimension> of finish grade unless otherwise indicated. Secure top edge with termination bar. Apply sealant to top edge of termination bar.
- E. Excavation Support and Protection (Permanent Shoring): Cut, clean, and treat tiebacks and similar projections. Encase tieback heads, rods, nuts, and plates in accordance with waterproofing manufacturer's written instructions for each configuration. If water is present, cover shoring and lagging with plastic protection sheets; remove plastic sheets before placing concrete.
1. Starting at lowest point, install a layer of waterproofing membrane, with ends and edges lapped minimum of 4 inches (100 mm) and nailed to shoring.
 2. Inspect and repair waterproofing membrane after reinforcing steel has been placed. Coordinate and control concrete placement to avoid damage to waterproofing.

- F. Horizontal Roofs, Plazas, and between Slabs: Starting at lowest point, install a layer of waterproofing membrane, with ends and edges lapped a minimum of 3 inches (75 mm).
 - 1. Apply mastic to form continuous 3/4-inch (19-mm) cant or fillet at intersection of horizontal and vertical substrates. Extend waterproofing membrane to top of curb or to a minimum of 6 inches (150 mm) above plane of waterproofing; secure with manufacturer's recommended tape.
 - 2. Clean overlap area and apply waterproof tape, rolling the exposed edge to seal to membrane below.
 - 3. Turn edges up and seal to vertical surfaces.

3.6 INSTALLATION OF MOLDED-SHEET DRAINAGE PANELS

- A. Place and secure molded-sheet drainage panels in accordance with manufacturer's written instructions. Use adhesives or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - 1. For vertical applications, install protection course before installing drainage panels.

3.7 INSTALLATION OF INSULATION DRAINAGE PANELS

- A. Install over waterproofed surfaces. Cut and fit to within 3/4 inch (19 mm) of projections and penetrations.
- B. Ensure that drainage channels are aligned and free of obstructions.
- C. On vertical surfaces, set insulation units in adhesive or tape applied in accordance with manufacturer's written instructions.
- D. On horizontal surfaces, loosely lay insulation drainage panels in accordance with manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.8 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service:
 - 1. Engage a factory-authorized service representative to test and inspect completed waterproofing installation before covering with other construction and provide written report stating that installation complies with manufacturer's written instructions.
 - a. Remove and replace applications of bentonite waterproofing where inspection indicates that it does not comply with specified requirements.
 - 2. Engage a **[full-time]** site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components and to furnish daily reports to Architect.
- B. Waterproofing will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.



3.9 PROTECTION, REPAIR, AND CLEANING

- A. Do not permit traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Correct deficiencies in waterproofing or remove waterproofing that does not comply with requirements; repair substrates and reapply waterproofing.

END OF SECTION 07 17 00 00



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 17 13 00	07 17 00 00	Bentonite Waterproofing



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SECTION 07 18 00 00 - TRAFFIC COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Traffic coatings and pavement markings for the following applications:
 - 1. Pedestrian traffic.
 - 2. Vehicular traffic.
 - 3. Equipment-room floor.
- B. Related Requirements:
 - 1. Section 071900 "Water Repellents" for penetrating and film-forming water repellents applied on traffic-bearing surfaces.
 - 2. Section 096723 "Resinous Flooring" for fluid-applied, [**decorative**][**general-use commercial**][**general-use industrial**][**high-performance**] resinous flooring that does not serve as a waterproofing membrane with integral wearing surface.
 - 3. Section 096766 "Fluid-Applied Athletic Flooring" for fluid-applied, resinous flooring for athletic activity areas.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at [**Project site**]<Insert location>.

1.3 ACTION SUBMITTALS

- A. Product Data: Traffic coatings and pavement markings for the following applications:
 - 1. Pedestrian traffic.
 - 2. Vehicular traffic.
 - 3. Equipment-room floor.
- B. Product Data Submittals: For each product.
 - 1. Include installation instructions and details, material descriptions, dry- or wet-film thickness requirements, and finish.
- C. Sustainable Design Submittals:
 - 1. Product Data: For coatings, indicating VOC content.
 - 2. Laboratory Test Reports: For coatings, indicating compliance with requirements for low-emitting materials.
 - 3. Product Test Reports: For traffic coatings, documentation indicating the Solar Reflectance properties.
- D. Shop Drawings: For traffic coatings.
 - 1. Include details for treating substrate joints and cracks, flashings, deck penetrations, and other

- termination conditions that are not included in manufacturer's product data.
2. Include plans showing layout of pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

- E. Samples for Initial Selection: For each type of exposed finish.
- F. Samples for Verification: For each type of exposed finish, prepared on rigid backing.
 1. Provide stepped Samples on backing to illustrate buildup of traffic coatings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of traffic coating.
- C. Field quality-control reports.
- D. Sample Warranty: For manufacturer's warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For traffic coatings to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockups to set quality standards for materials and execution.
 1. Build mockup for each traffic coating and substrate to receive traffic coatings.
 2. Size: [200 sq. ft. (18.5 sq. m)]<Insert dimension> of each substrate to demonstrate surface preparation, joint and crack treatment, thickness, texture, color, and standard of workmanship.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Apply traffic coatings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply traffic coatings to damp or wet substrates, when temperatures are below **40 deg F (5 deg C)**, when relative humidity exceeds 85 percent, or when temperatures are less than **5 deg F (3 deg C)** above dew point.
 1. Do not apply traffic coatings in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period. Apply only when frost-free conditions occur throughout the depth of substrate.

- B. Do not install traffic coating until items that penetrate membrane have been installed.
- C. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of **[40 deg F (4.4 deg C) for oil-based materials][50 deg F (10 deg C) for water-based materials]**, and not exceeding **95 deg F (35 deg C)**.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace traffic coating that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Adhesive or cohesive failures.
 - b. Abrasion or tearing failures.
 - c. Surface crazing or spalling.
 - d. Intrusion of water, oils, gasoline, grease, salt, deicer chemicals, or acids into deck substrate.
 - 2. Warranty Period: **[Five]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain traffic coatings from single source from single manufacturer.
- B. Obtain primary traffic-coating materials, including primers, from traffic-coating manufacturer. Obtain accessory materials including aggregates, sheet flashings, joint sealants, and substrate repair materials of types and from sources recommended in writing by primary material manufacturer.
- C. Obtain pavement-marking paint from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Material Compatibility: Provide primers; base coat, intermediate coat, and topcoat; and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.3 TRAFFIC COATINGS

- A. Traffic Coating : Manufacturer's standard, traffic-bearing, seamless, high-solids-content, cold liquid-applied, elastomeric, water-resistant membrane system with integral wearing surface for **[pedestrian traffic][vehicular traffic][and][equipment-room floor]<Insert requirement>** service condition; according to ASTM C957/C957M.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. [Advanced Polymer Technology Corp.]
 - b. [Crossfield Products Corp]
 - c. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - d. [Gaco; Holcim Building Envelope]
 - e. [GCP Applied Technologies Inc.]
 - f. [H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.]
 - g. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
 - h. [Insl-X Products; Benjamin Moore & Co.]
 - i. [Key Resin Company]
 - j. [LymTal International, Inc.]
 - k. [Master Builders Solutions]
 - l. [Neogard; Hempel Group]
 - m. [Pacific Polymers; a Holcim brand]
 - n. [Pecora Corporation]
 - o. [POLY-CARB; Olin Corporation]
 - p. [Polycoat Products]
 - q. [PPG Paints; PPG Industries, Inc.]
 - r. [Sherwin-Williams Company (The)]
 - s. [Soprema, Inc.]
 - t. [Tremco Incorporated]
 - u. [Urethane Polymers International, Inc. (UPI)]
 - v. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Advanced Polymer Technology Corp.]
 - b. [Crossfield Products Corp]
 - c. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - d. [Gaco; Holcim Building Envelope]
 - e. [GCP Applied Technologies Inc.]
 - f. [H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.]
 - g. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
 - h. [Insl-X Products; Benjamin Moore & Co.]
 - i. [Key Resin Company]
 - j. [LymTal International, Inc.]
 - k. [Master Builders Solutions]
 - l. [Neogard; Hempel Group]
 - m. [Pacific Polymers; a Holcim brand]
 - n. [Pecora Corporation]
 - o. [POLY-CARB; Olin Corporation]
 - p. [Polycoat Products]
 - q. [PPG Paints; PPG Industries, Inc.]
 - r. [Sherwin-Williams Company (The)]
 - s. [Soprema, Inc.]
 - t. [Tremco Incorporated]
 - u. [Urethane Polymers International, Inc. (UPI)]
 - v. <Insert manufacturer's name>
- B. Primer: Liquid primer as recommended in writing for substrate and conditions by traffic-coating manufacturer.

1. Material: **[Epoxy][Polyurethane]**.
- C. Preparatory and Base Coats: **[Polyurethane][Aromatic urethane][Aliphatic urethane][or][epoxy]**.
1. Thicknesses: Minimum **[dry-][or][wet-]**film thickness **[as recommended in writing by manufacturer for substrate and service conditions indicated]<Insert thickness>**.
- D. Intermediate Coat: **[Polyurethane][Aromatic urethane][Aliphatic urethane][or][epoxy]**.
1. Thicknesses: Minimum **[dry-][or][wet-]**film thickness **[as recommended in writing by manufacturer for substrate and service conditions indicated]<Insert thickness>**, measured excluding aggregate.
 2. Aggregate Content: **[As recommended in writing by traffic-coating manufacturer for substrate and service conditions indicated][Not less than 8 to 10 lb/100 sq. ft. (3.9 to 4.9 kg/10 sq. m)][To refusal]<Insert requirement>**.
- E. Topcoat: **[Polyurethane][Aromatic urethane][Aliphatic urethane][Aromatic urethane with UV inhibitors][or][epoxy]**.
1. Thicknesses: Minimum **[dry-][or][wet-]**film thickness **[as recommended in writing by manufacturer for substrate and service conditions indicated]<Insert thickness>**, measured excluding aggregate.
 2. Aggregate Content: **[As recommended in writing by traffic-coating manufacturer for substrate and service conditions indicated][As required to achieve slip-resistant finish][8 to 10 lb/100 sq. ft. (3.9 to 4.9 kg/10 sq. m)][To refusal]<Insert requirement>**.
 3. Color: **[As selected by Architect from manufacturer's full range][Match Architect's sample]<Insert color>**.
- F. Aggregate: **[Manufacturer's standard aggregate for each use indicated][Uniformly graded, washed silicon carbide sand][Uniformly graded, washed silica sand][Uniformly graded, washed flint shot silica][Walnut shell granules][or][Aluminum-oxide grit]<Insert aggregate>** of particle sizes, shape, and minimum hardness recommended in writing by traffic-coating manufacturer.
- G. Fire-Test-Response Characteristics: Provide traffic-coating materials with the fire-test-response characteristics as determined by testing identical products according to test method below for deck type and slopes indicated by an independent testing and inspecting agency that is acceptable to authorities having jurisdiction.
1. **[Class A][Class B][Class C]** roof covering according to ASTM E108.
 2. **<Insert test requirement>**.
- H. Energy Star Listing: Provide traffic coating that is listed on the DOE's Energy Star "Roof Products Qualified Product List" for low-slope roof products.
- I. Energy Performance: Provide traffic coating with an initial Solar Reflectance Index of **[not less than 0.70]<Insert value>** and emissivity of **[not less than 0.75]<Insert value>** when tested according to CRRC-1.
- J. VOC Content, LEED 2009: **[250]<Insert value>** g/L or less.
- K. Low-Emitting Materials, LEED 2009: Interior coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- L. VOC Content, LEED v4: **[100]<Insert value>** g/L or less.

- M. Low-Emitting Materials, LEED v4: Interior coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- N. VOC Content: **[100]<Insert value>** g/L or less.
- O. Low-Emitting Materials: VOC emissions of interior coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
- P. VOC Content: **[100]<Insert value>** g/L or less.
- Q. Low-Emitting Materials: Interior coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- R. VOC Emissions: Interior coatings shall contain no more than half of the chronic REL of VOCs when tested according to the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

2.4 ACCESSORY MATERIALS

- A. Joint Sealants: **[As specified in Section 079200 "Joint Sealants."][ASTM C920.]<Insert requirement.>**
- B. Sheet Flashing: Nonstaining **[sheet material recommended in writing by traffic-coating manufacturer][, uncured neoprene sheet][, cured neoprene sheet]<Insert material>**.
 - 1. Thickness: Minimum **[60 mils (1.5 mm)][50 mils (1.3 mm)]<Insert value>**.
- C. Adhesive: Contact adhesive recommended in writing by traffic-coating manufacturer.
- D. Reinforcing Strip: Fiberglass mesh recommended in writing by traffic-coating manufacturer.

2.5 PAVEMENT MARKINGS

- A. Pavement-Marking Paint Specified Elsewhere: Comply with Section 321723 "Pavement Markings."
- B. Pavement-Marking Paint:
 - 1. Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, **[Type N][Type F][Type S]**; colors complying with FS TT-P-1952.
 - 2. MPI #32 Alkyd Traffic Marking Paint.
 - 3. Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than **[three][45]** minutes.
 - 4. MPI #97 Latex Traffic Marking Paint.
 - 5. Color: **[White][Yellow][Blue][As indicated]<Insert color>**.

- C. Glass Beads: [AASHTO M 247, Type 1][FS TT-B-1325, Type 1A].
- D. VOC Content: [150]<Insert value> g/L or less.
- E. Low-Emitting Materials: Interior paints shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- F. VOC Content: [100]<Insert value> g/L or less.
- G. Low-Emitting Materials: Interior paints shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- H. VOC Content: [100]<Insert value> g/L or less.
- I. Low-Emitting Materials: VOC emissions of interior paints shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
- J. VOC Content: [100]<Insert value> g/L or less.
- K. Low-Emitting Materials: Interior paints shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- L. VOC Emissions: Interior paints shall contain no more than half of the chronic REL of VOCs when tested according to the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, surface smoothness, and other conditions affecting performance of traffic-coating work.
- B. Verify that substrates are visibly dry and free of moisture.
 - 1. Test for moisture according to ASTM D4263.
 - 2. Test for moisture content by [measuring with an electronic moisture meter][method recommended in writing by traffic-coating manufacturer]<Insert test method>.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of traffic-coating work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Begin coating application only after substrate construction and penetrating work have been

- completed.
2. Begin coating application only after minimum concrete-curing and -drying period recommended in writing by traffic-coating manufacturer has passed and after substrates are dry.
3. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Clean and prepare substrates according to ASTM C1127 and manufacturer's written instructions to produce clean, dust-free, dry substrate for traffic-coating application. Remove projections, fill voids, and seal joints if any, as recommended in writing by traffic-coating manufacturer.
- B. Priming: Unless manufacturer recommends in writing against priming, prime substrates according to manufacturer's written instructions.
 1. Limit priming to areas that will be covered by traffic-coating material on same day. Reprime areas exposed for more time than recommended by manufacturer.
- C. Schedule preparation work so dust and other contaminants from process do not fall on wet, newly coated surfaces.
- D. Mask adjoining surfaces not receiving traffic coatings to prevent overspray, spillage, leaking, and migration of coatings. Prevent traffic-coating materials from entering deck substrate penetrations and clogging weep holes and drains.
- E. Concrete Substrates: **[Mechanically abrade surface to a uniform profile acceptable to manufacturer, according to ASTM D4259.]**Do not acid etch.
 1. Remove grease, oil, paints, and other penetrating contaminants from concrete.
 2. Remove concrete fins, ridges, and other projections.
 3. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion.
 4. Remove remaining loose material to provide a sound surface, and clean surfaces according to ASTM D4258.

3.3 TERMINATIONS AND PENETRATIONS

- A. Prepare vertical and horizontal surfaces at terminations and penetrations through traffic coatings and at expansion joints, drains, and sleeves according to ASTM C1127 and manufacturer's written instructions.
- B. Provide sealant cants at penetrations and at reinforced and nonreinforced, deck-to-wall butt joints.
- C. Terminate edges of deck-to-deck expansion joints with preparatory base-coat strip.
- D. Install sheet flashings at deck-to-wall expansion and dynamic joints, and bond to deck and wall substrates according to manufacturer's written recommendations.

3.4 JOINT AND CRACK TREATMENT

- A. Prepare, treat, rout, and fill joints and cracks in substrates according to ASTM C1127 and manufacturer's written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D4258.

1. Comply with recommendations in ASTM C1193 for joint-sealant installation.
- B. Apply reinforcing strip in traffic-coating system where recommended in writing by traffic-coating manufacturer.

3.5 INSTALLATION OF TRAFFIC COATINGS

- A. Apply traffic coating according to ASTM C1127 and manufacturer's written instructions.
- B. Apply coats of specified compositions for each type of traffic coating at locations as indicated on Drawings.
- C. Start traffic-coating application in presence of manufacturer's technical representative.
- D. Verify that wet-film thickness of each coat complies with requirements every [100 sq. ft. (9 sq. m)]<Insert dimension>.
- E. Uniformly broadcast and embed aggregate in each coat indicated to receive aggregate according to manufacturer's written instructions. After coat dries, sweep away excess aggregate.
- F. Apply traffic coatings to prepared wall terminations and vertical surfaces to height indicated; omit aggregate on vertical surfaces.
- G. Cure traffic coatings. Prevent contamination and damage during coating application and curing.

3.6 INSTALLATION OF PAVEMENT MARKINGS

- A. Do not apply pavement-marking paint for striping and other markings until layout, colors, and placement have been verified with Architect and traffic coating has cured.
- B. Sweep and clean surface to eliminate loose material and dust.
- C. Apply pavement-marking paint with mechanical equipment to produce markings of dimensions indicated with uniform straight edges. Apply at manufacturer's recommended rates for a minimum wet-film thickness of 15-mils (0.4-mm).
 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
 2. Broadcast glass beads uniformly into wet pavement-marking paint at a rate of 6 lb/gal. (0.72 kg/L).

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: [Owner will engage][Engage] a qualified testing agency to perform the following field tests and inspections:
 1. Materials Testing:
 - a. Samples of material delivered to Project site are to be taken, identified, sealed, and certified in presence of [Owner and]Contractor.
 - b. Testing agency must perform tests for characteristics specified, using applicable

referenced testing procedures.

- c. Testing agency must verify thickness of coatings during traffic-coating application for each [600 sq. ft. (56 sq. m)]<Insert dimension> of installed traffic coating or part thereof.

2. Electronic Leak-Detection Testing:

- a. Testing agency must test [each deck area][each deck area indicated for testing on Drawings]<Insert area to be tested> for leaks using an electronic leak-detection method that locates discontinuities in the traffic-coating membrane.
- b. Testing agency must perform tests on abutting or overlapping smaller areas as necessary to cover entire test area.
- c. Testing agency must create a conductive electronic field over the area of traffic coating to be tested and electronically determine locations of discontinuities or leaks, if any, in the traffic coating.
- d. Testing agency must provide survey report indicating locations of discontinuities, if any.

- B. Final Traffic-Coating Inspection: Arrange for traffic-coating manufacturer's technical personnel to inspect membrane installation on completion.

1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

- C. Waterproofing will be considered defective if it does not pass tests and inspections.

- D. Prepare test and inspection reports.

3.8 PROTECTING AND CLEANING

- A. Protect traffic coatings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 18 00 00



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 18 13 00	07 18 00 00	Traffic Coatings
07 18 16 00	07 18 00 00	Traffic Coatings



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SECTION 07 19 00 00 - WATER REPELLENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetrating water repellents.
2. Film-forming water repellents.
3. MPI-approved water repellents.

B. Related Requirements:

1. Section 030130 "Maintenance of Cast-in-Place Concrete" for high-build penetrating polymer sealers for exterior traffic surfaces.
2. Section 042000 "Unit Masonry" for integral water-repellent admixture for unit masonry assemblies.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's printed statement of VOC content.
2. Include manufacturer's standard colors.
3. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.
4. Include printout of current "MPI Approved Products List" for each product category specified in Part 2 that specifies water repellents approved by MPI, with the proposed product highlighted.

- B. Samples: For each type[**and color**] of water repellent and substrate indicated, **12 by 12 inches (300 by 300 mm)** in size, with specified water-repellent treatment applied to half of each Sample.

C. Sustainable Design Submittals:

1. Product Data: For paints and coatings, indicating VOC content.
2. Environmental Product Declaration (EPD): For each product.
3. Health Product Declaration (HPD): For each product.
4. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
5. Manufacturer Inventory: For each product, provide manufacturer's manifest of ingredients.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[Applicator][testing agency]**.

- B. Product Certificates: For each type of water repellent.
- C. Preconstruction Test Reports: For water-repellent-treated substrates.
- D. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.
- B. MPI Standards: Comply with MPI standards indicated and provide water repellents listed in its "MPI Approved Products List."

1.6 MOCKUPS

- A. Prepare mockups of each required water repellent on each type of substrate required to demonstrate aesthetic effects[, **for preconstruction testing**,] and to set quality standards for materials and execution.
 - 1. Locate mockups [**where indicated on Drawings**][**on masonry sample panels**][**on existing surfaces where directed by Architect**][**in locations that enable viewing under same conditions as the completed Work**]**<Insert requirement>**.
 - a. Size: [**10 sq. ft. (0.93 sq. m)**][**25 sq. ft. (2.3 sq. m)**]**<Insert size>** each.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing: Engage a qualified testing agency to perform preconstruction testing of water repellents on [**field mockups**][**manufacturer's standard substrate assemblies**][**on existing substrate assemblies**].
 - 1. In addition to verifying performance requirements, use mockups to verify manufacturer's written instructions for application procedure and optimum rates of product application to substrates.
 - 2. Propose changes to materials and methods to suit Project.
 - 3. Notify Architect [**seven**]**<Insert number>** days in advance of the dates and times when mockups will be tested.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than **35 deg F (2 deg C)** and not more than **110 deg F (44 deg C)**, in accordance with manufacturer's written instructions.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

3. Protect materials from direct sunlight.
4. **<Insert requirements>**.

1.9 FIELD CONDITIONS

- A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied in accordance with manufacturers' written instructions and warranty requirements:
 1. Concrete surfaces and mortar have cured for not less than 28 days.
 2. Building has been closed in for not less than 30 days before treating wall assemblies.
 3. Ambient temperature is above **40 deg F (4.4 deg C)** and below **100 deg F (37.8 deg C)** and will remain so for 24 hours.
 4. Substrate is not frozen and substrate-surface temperature is above **40 deg F (4.4 deg C)** and below **100 deg F (37.8 deg C)**.
 5. Rain or snow is not predicted within 24 hours.
 6. Not less than **[24 hours][seven days]** have passed since surfaces were last wet.
 7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.
 8. **<Insert restriction>**.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which **[manufacturer][and][Applicator]** agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.
 1. Warranty Period: **[Two][Five]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Water repellents must meet the following performance requirements as determined by **[preconstruction]** testing on **[manufacturer's standard]** substrates representing those indicated for this Project.
- B. Water Absorption: Minimum **[80][90]<Insert number>** percent reduction of water absorption after 24 hours for treated compared to untreated specimens when tested in accordance with the following:
 1. Cast-in-Place Concrete: ASTM C642.
 2. Precast Concrete: ASTM C642.
 3. Cast Stone: ASTM C1195.
 4. Concrete Masonry Units: ASTM C140/C140M.
 5. Clay Brick: ASTM C67/C67M.
 6. Natural Stone: ASTM C97/C97M.
 7. Portland Cement Plaster (Stucco): ASTM D6532.
- C. Water-Vapor Transmission: Comply with one or both of the following:
 1. Maximum **[10]<Insert number>** percent reduction in water-vapor transmission of treated

- compared to untreated specimens, in accordance with ASTM E96/E96M.
2. Minimum **[80]<Insert number>** percent water-vapor transmission of treated compared to untreated specimens, in accordance with ASTM D1653.
 - D. Water Penetration and Leakage through Masonry: Minimum **[90]<Insert number>** percent reduction in leakage rate of treated compared to untreated specimens, in accordance with ASTM E514/E514M.
 - E. Durability: Maximum **[5]<Insert number>** percent loss of water-repellent performance after 2500 hours of weathering in accordance with ASTM G154 compared to water-repellent-treated specimens before weathering.

2.2 PENETRATING WATER REPELLENTS

- A. Penetrating Low-VOC Silane Water Repellent: Clear, containing **[20][40][100]<Insert number>** percent or more active content of **[modified]**silane; with alcohol, mineral spirits, water, or other proprietary solvent carrier; and with 400 g/L or less of VOCs.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. **[Advanced Chemical Technologies, Inc]**
- b. **[Chemical Products Industries, Inc]**
- c. **[ChemMasters, Inc]**
- d. **[Concrete Sealers USA]**
- e. **[Dayton Superior Corporation]**
- f. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
- g. **[Evonik Corporation]**
- h. **[Foxfire Enterprises, Inc.]**
- i. **[Ghostshield]**
- j. **[LymTal International, Inc.]**
- k. **[Master Builders Solutions]**
- l. **[Nox-Crete Products Group]**
- m. **[Pecora Corporation]**
- n. **[PPG Paints; PPG Industries, Inc.]**
- o. **[Price Research, Ltd. dba Charles Paint Research]**
- p. **[PROSOCO, Inc]**
- q. **[Specco Industries, Inc]**
- r. **[Textured Coatings of America, Inc]**
- s. **[Tnemec Company, Inc.]**
- t. **[W. R. Meadows, Inc]**
- u. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Advanced Chemical Technologies, Inc]**
- b. **[Chemical Products Industries, Inc]**
- c. **[ChemMasters, Inc]**
- d. **[Concrete Sealers USA]**
- e. **[Dayton Superior Corporation]**
- f. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**

- g. [Evonik Corporation]
 - h. [Foxfire Enterprises, Inc.]
 - i. [Ghostshield]
 - j. [LymTal International, Inc.]
 - k. [Master Builders Solutions]
 - l. [Nox-Crete Products Group]
 - m. [Pecora Corporation]
 - n. [PPG Paints; PPG Industries, Inc.]
 - o. [Price Research, Ltd. dba Charles Paint Research]
 - p. [PROSOCO, Inc.]
 - q. [Specco Industries, Inc]
 - r. [Textured Coatings of America, Inc]
 - s. [Tnemec Company, Inc.]
 - t. [W. R. Meadows, Inc]
 - u. <Insert manufacturer's name>
- B. Penetrating Silane Water Repellent: Clear, containing [20][40][100]<Insert number> percent or more active content of [modified]silane; with alcohol, mineral spirits, water, or other proprietary solvent carrier; and with 600 g/L or less of VOCs.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- a. [Advanced Chemical Technologies, Inc]
 - b. [Chemical Products Industries, Inc]
 - c. [ChemMasters, Inc]
 - d. [Dayton Superior Corporation]
 - e. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - f. [Evonik Corporation]
 - g. [Fox Industries, Inc.]
 - h. [H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.]
 - i. [LymTal International, Inc.]
 - j. [Master Builders Solutions]
 - k. [Nox-Crete Products Group]
 - l. [Pecora Corporation]
 - m. [PPG Paints; PPG Industries, Inc.]
 - n. [Price Research, Ltd. dba Charles Paint Research]
 - o. [PROSOCO, Inc]
 - p. [Specco Industries, Inc]
 - q. [Textured Coatings of America, Inc]
 - r. [TK Products Construction Coatings, a Fenix Group SPC Company]
 - s. [Tnemec Company, Inc.]
 - t. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Advanced Chemical Technologies, Inc]
 - b. [Chemical Products Industries, Inc]
 - c. [ChemMasters, Inc]
 - d. [Dayton Superior Corporation]
 - e. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - f. [Evonik Corporation]

- g. [Fox Industries, Inc.]
- h. [H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.]
- i. [LymTal International, Inc.]
- j. [Master Builders Solutions]
- k. [Nox-Crete Products Group]
- l. [Pecora Corporation]
- m. [PPG Paints; PPG Industries, Inc.]
- n. [Price Research, Ltd. dba Charles Paint Research]
- o. [PROSOCO, Inc]
- p. [Specco Industries, Inc]
- q. [Textured Coatings of America, Inc]
- r. [TK Products Construction Coatings, a Fenix Group SPC Company]
- s. [Tnemec Company, Inc.]
- t. <Insert manufacturer's name>

C. Penetrating Low-VOC Siloxane Water Repellent: Clear, containing [10][12]<Insert number> percent or more active content of [modified]siloxane; with alcohol, ethanol, mineral spirits, water, or other proprietary solvent carrier; and with 400 g/L or less of VOCs.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Cathedral Stone Products, Inc.]
- b. [Concrete Sealers USA]
- c. [Conproco Corporation]
- d. [Dayton Superior Corporation]
- e. [Evonik Corporation]
- f. [Fabrikem Manufacturing Ltd.]
- g. [H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.]
- h. [PPG Paints; PPG Industries, Inc.]
- i. [Price Research, Ltd. dba Charles Paint Research]
- j. [RainGuard Professional]
- k. [SaverSystems]
- l. [Specco Industries, Inc]
- m. [Textured Coatings of America, Inc]
- n. [TK Products Construction Coatings, a Fenix Group SPC Company]
- o. [United Gilsonite Laboratories (UGL)]
- p. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Cathedral Stone Products, Inc.]
- b. [Concrete Sealers USA]
- c. [Conproco Corporation]
- d. [Dayton Superior Corporation]
- e. [Evonik Corporation]
- f. [Fabrikem Manufacturing Ltd.]
- g. [H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.]
- h. [PPG Paints; PPG Industries, Inc.]
- i. [Price Research, Ltd. dba Charles Paint Research]
- j. [RainGuard Professional]

- k. [SaverSystems]
 - l. [Specco Industries, Inc]
 - m. [Textured Coatings of America, Inc]
 - n. [TK Products Construction Coatings, a Fenix Group SPC Company]
 - o. [United Gilsonite Laboratories (UGL)]
 - p. <Insert manufacturer's name>
- D. Penetrating Siloxane Water Repellent: Clear, containing [10][12]<Insert number> percent or more active content of [modified]siloxane; with alcohol, ethanol, mineral spirits, water, or other proprietary solvent carrier; and with 600 g/L or less of VOCs.
- 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Conproco Corporation]
 - b. [Dayton Superior Corporation]
 - c. [Diedrich Technologies, Inc.; a Hohmann & Barnard company]
 - d. [Evonik Corporation]
 - e. [Fabrikem Manufacturing Ltd.]
 - f. [H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.]
 - g. [PPG Paints; PPG Industries, Inc.]
 - h. [Price Research, Ltd. dba Charles Paint Research]
 - i. [PROSOCO, Inc]
 - j. [SaverSystems]
 - k. [Specco Industries, Inc]
 - l. [Textured Coatings of America, Inc]
 - m. [TK Products Construction Coatings, a Fenix Group SPC Company]
 - n. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Conproco Corporation]
 - b. [Dayton Superior Corporation]
 - c. [Diedrich Technologies, Inc.; a Hohmann & Barnard company]
 - d. [Evonik Corporation]
 - e. [Fabrikem Manufacturing Ltd.]
 - f. [H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.]
 - g. [PPG Paints; PPG Industries, Inc.]
 - h. [Price Research, Ltd. dba Charles Paint Research]
 - i. [PROSOCO, Inc]
 - j. [SaverSystems]
 - k. [Specco Industries, Inc]
 - l. [Textured Coatings of America, Inc]
 - m. [TK Products Construction Coatings, a Fenix Group SPC Company]
 - n. <Insert manufacturer's name>
- E. Penetrating Low-VOC Silane/Siloxane-Blend Water Repellent: Clear, containing [10][12]<Insert number> percent or more active content of silane and siloxane blend with 400 g/L or less of VOCs.
- 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the

following]:

- a. [Advanced Chemical Technologies, Inc]
 - b. [AWRC Corporation]
 - c. [Cathedral Stone Products, Inc.]
 - d. [Chemical Products Industries, Inc]
 - e. [Conproco Corporation]
 - f. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - g. [Evonik Corporation]
 - h. [Fabrikem Manufacturing Ltd.]
 - i. [Fox Industries, Inc.]
 - j. [Foxfire Enterprises, Inc.]
 - k. [Ghostshield]
 - l. [Karnak Corporation]
 - m. [Kryton International, Inc.]
 - n. [Laticrete International, Inc.]
 - o. [LymTal International, Inc.]
 - p. [Master Builders Solutions]
 - q. [OKON; a Rust-Oleum brand; a subsidiary of RPM International, Inc.]
 - r. [Pecora Corporation]
 - s. [PPG Paints; PPG Industries, Inc.]
 - t. [Price Research, Ltd. dba Charles Paint Research]
 - u. [PROSOCO, Inc]
 - v. [RainGuard Professional]
 - w. [SaverSystems]
 - x. [Sika Corporation]
 - y. [Symons; a Brand of Dayton Superior Corporation]
 - z. [TK Products Construction Coatings, a Fenix Group SPC Company]
 - aa. [Tnemec Company, Inc.]
 - bb. [United Gilsonite Laboratories (UGL)]
 - cc. [V-Seal Concrete Sealers & Specialty Coatings]
 - dd. [Wacker Chemical Corporation]
 - ee. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Advanced Chemical Technologies, Inc]
 - b. [AWRC Corporation]
 - c. [Cathedral Stone Products, Inc.]
 - d. [Chemical Products Industries, Inc]
 - e. [Conproco Corporation]
 - f. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - g. [Evonik Corporation]
 - h. [Fabrikem Manufacturing Ltd.]
 - i. [Fox Industries, Inc.]
 - j. [Foxfire Enterprises, Inc.]
 - k. [Ghostshield]
 - l. [Karnak Corporation]
 - m. [Kryton International, Inc.]
 - n. [Laticrete International, Inc.]
 - o. [LymTal International, Inc.]
 - p. [Master Builders Solutions]
 - q. [OKON; a Rust-Oleum brand; a subsidiary of RPM International, Inc.]

- r. [Pecora Corporation]
- s. [PPG Paints; PPG Industries, Inc.]
- t. [Price Research, Ltd. dba Charles Paint Research]
- u. [PROSOCO, Inc]
- v. [RainGuard Professional]
- w. [SaverSystems]
- x. [Sika Corporation]
- y. [Symons; a Brand of Dayton Superior Corporation]
- z. [TK Products Construction Coatings, a Fenix Group SPC Company]
- aa. [Tnemec Company, Inc.]
- bb. [United Gilsonite Laboratories (UGL)]
- cc. [V-Seal Concrete Sealers & Specialty Coatings]
- dd. [Wacker Chemical Corporation]
- ee. <Insert manufacturer's name>

F. Penetrating Silane/Siloxane-Blend Water Repellent: Clear, containing [10][12]<Insert number> percent or more active content of silane and siloxane blend with 600 g/L or less of VOCs.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Advanced Chemical Technologies, Inc]
 - b. [Chemical Products Industries, Inc]
 - c. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - d. [Fabrikem Manufacturing Ltd.]
 - e. [Fox Industries, Inc.]
 - f. [Karnak Corporation]
 - g. [Kryton International, Inc.]
 - h. [Laticrete International, Inc.]
 - i. [LymTal International, Inc.]
 - j. [Master Builders Solutions]
 - k. [OKON; a Rust-Oleum brand; a subsidiary of RPM International, Inc.]
 - l. [Pecora Corporation]
 - m. [PPG Paints; PPG Industries, Inc.]
 - n. [Price Research, Ltd. dba Charles Paint Research]
 - o. [PROSOCO, Inc]
 - p. [RainGuard Professional]
 - q. [SaverSystems]
 - r. [Sika Corporation]
 - s. [TK Products Construction Coatings, a Fenix Group SPC Company]
 - t. [Tnemec Company, Inc.]
 - u. [Wacker Chemical Corporation]
 - v. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Advanced Chemical Technologies, Inc]
 - b. [Chemical Products Industries, Inc]
 - c. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - d. [Fabrikem Manufacturing Ltd.]
 - e. [Fox Industries, Inc.]
 - f. [Karnak Corporation]

- g. [Kryton International, Inc.]
- h. [Laticrete International, Inc.]
- i. [LymTal International, Inc.]
- j. [Master Builders Solutions]
- k. [OKON; a Rust-Oleum brand; a subsidiary of RPM International, Inc.]
- l. [Pecora Corporation]
- m. [PPG Paints; PPG Industries, Inc.]
- n. [Price Research, Ltd. dba Charles Paint Research]
- o. [PROSOCO, Inc]
- p. [RainGuard Professional]
- q. [SaverSystems]
- r. [Sika Corporation]
- s. [TK Products Construction Coatings, a Fenix Group SPC Company]
- t. [Tnemec Company, Inc.]
- u. [Wacker Chemical Corporation]
- v. <Insert manufacturer's name>

G. Penetrating Low-VOC Siliconate Water Repellent: Clear, methyl siliconate water repellent with 400 g/L or less of VOCs.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. [Concrete Sealers USA]
- b. [Ghostshield]
- c. [Moxie International]
- d. [PROSOCO, Inc]
- e. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Concrete Sealers USA]
- b. [Ghostshield]
- c. [Moxie International]
- d. [PROSOCO, Inc]
- e. <Insert manufacturer's name>

H. Penetrating Water and Oil Repellent: Clear, oleophobic water repellent; with 400 g/L or less of VOCs.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. [Advanced Chemical Technologies, Inc]
- b. [Chemical Products Industries, Inc]
- c. [ChemMasters, Inc]
- d. [Concrete Sealers USA]
- e. [Evonik Corporation]
- f. [Ghostshield]
- g. [Laticrete International, Inc.]

- h. **[Master Builders Solutions]**
 - i. **[PROSOCO, Inc]**
 - j. **[TK Products Construction Coatings, a Fenix Group SPC Company]**
 - k. **<Insert manufacturer's name>**
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Advanced Chemical Technologies, Inc]**
 - b. **[Chemical Products Industries, Inc]**
 - c. **[ChemMasters, Inc]**
 - d. **[Concrete Sealers USA]**
 - e. **[Evonik Corporation]**
 - f. **[Ghostshield]**
 - g. **[Laticrete International, Inc.]**
 - h. **[Master Builders Solutions]**
 - i. **[PROSOCO, Inc]**
 - j. **[TK Products Construction Coatings, a Fenix Group SPC Company]**
 - k. **<Insert manufacturer's name>**
- I. Penetrating Water Repellent and Corrosion Inhibitor: Clear, containing **[100]<Insert number>** percent or more active content of modified **[silane][siloxane]** water repellent and corrosion inhibitor, with 400 g/L or less of VOCs.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Advanced Chemical Technologies, Inc]**
 - b. **[ChemMasters, Inc]**
 - c. **[Ghostshield]**
 - d. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Advanced Chemical Technologies, Inc]**
 - b. **[ChemMasters, Inc]**
 - c. **[Ghostshield]**
 - d. **<Insert manufacturer's name>**
- J. Penetrating Water Repellent for Calcareous Stone: Clear, modified silane with ethyl silicate, specially formulated for limestone and marble.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Advanced Chemical Technologies, Inc]**
 - b. **[Evonik Corporation]**
 - c. **[PROSOCO, Inc]**
 - d. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Advanced Chemical Technologies, Inc]**
- b. **[Evonik Corporation]**
- c. **[PROSOCO, Inc]**
- d. **<Insert manufacturer's name>**

- K. Penetrating Water Repellent Concentrate: Concentrated **[siloxane][silane]**, for field dilution.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. **[Chemical Products Industries, Inc]**
- b. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
- c. **[Evonik Corporation]**
- d. **[LymTal International, Inc.]**
- e. **[PPG Paints; PPG Industries, Inc.]**
- f. **[PROSOCO, Inc]**
- g. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Chemical Products Industries, Inc]**
- b. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
- c. **[Evonik Corporation]**
- d. **[LymTal International, Inc.]**
- e. **[PPG Paints; PPG Industries, Inc.]**
- f. **[PROSOCO, Inc]**
- g. **<Insert manufacturer's name>**

2.3 FILM-FORMING WATER REPELLENTS

- A. Film-Forming Low-VOC Silicone Water Repellent: Clear, polymerized, silicone-resin water repellent for dense substrates; in a solvent- or waterborne solution containing not less than 3 and up to 7 percent solids by weight; and with 400 g/L or less of VOCs.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. **[Professional Products of Kansas, Inc.]**
- b. **[Specco Industries, Inc]**
- c. **[United Gilsonite Laboratories (UGL)]**
- d. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the

following:

- a. **[Professional Products of Kansas, Inc.]**
 - b. **[Specco Industries, Inc]**
 - c. **[United Gilsonite Laboratories (UGL)]**
 - d. **<Insert manufacturer's name>**
- B. Film-Forming Silicone Water Repellent: Clear, polymerized, silicone-resin water repellent for dense substrates; in a solvent- or waterborne solution containing not less than 3 and up to 7 percent solids by weight; and with 600 g/L or less of VOCs.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Professional Products of Kansas, Inc.]**
 - b. **[Specco Industries, Inc]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Professional Products of Kansas, Inc.]**
 - b. **[Specco Industries, Inc]**
 - c. **<Insert manufacturer's name>**
- C. Film-Forming Water Repellent for Masonry: **[Clear][Pigmented]**, consisting of resins, acrylics, polymers, with 600 g/L or less of VOCs; for masonry block or brick.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[OKON; a Rust-Oleum brand; a subsidiary of RPM International, Inc.]**
 - b. **[PPG Paints; PPG Industries, Inc.]**
 - c. **[SaverSystems]**
 - d. **[Textured Coatings of America, Inc]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[OKON; a Rust-Oleum brand; a subsidiary of RPM International, Inc.]**
 - b. **[PPG Paints; PPG Industries, Inc.]**
 - c. **[SaverSystems]**
 - d. **[Textured Coatings of America, Inc]**
 - e. **<Insert manufacturer's name>**
 3. Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>**.
- D. Film-Forming Low-VOC Modified Acrylic Water Repellent: **[Clear][Pigmented]**, breathing coating of

acrylic resin, which may be enhanced with silane and siloxane resins; in a waterborne, solvent-borne, or acrylic emulsion solution containing less than 15 percent solids by volume; and with 400 g/L or less of VOCs.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Ghostshield]**
 - b. **[H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.]**
 - c. **[Nox-Crete Products Group]**
 - d. **[OKON; a Rust-Oleum brand; a subsidiary of RPM International, Inc.]**
 - e. **[PPG Paints; PPG Industries, Inc.]**
 - f. **[Rust-Oleum Corporation; a subsidiary of RPM International, Inc.]**
 - g. **[Specco Industries, Inc]**
 - h. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Ghostshield]**
 - b. **[H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.]**
 - c. **[Nox-Crete Products Group]**
 - d. **[OKON; a Rust-Oleum brand; a subsidiary of RPM International, Inc.]**
 - e. **[PPG Paints; PPG Industries, Inc.]**
 - f. **[Rust-Oleum Corporation; a subsidiary of RPM International, Inc.]**
 - g. **[Specco Industries, Inc]**
 - h. **<Insert manufacturer's name>**
3. Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>**.

E. Film-Forming Modified Acrylic Water Repellent: **[Clear][Pigmented]**, breathing coating of acrylic resins, which may be enhanced silane and siloxane resins; in a waterborne, solvent-borne, or acrylic emulsion solution containing less than 15 percent solids by volume; and with 600 g/L or less of VOCs.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.]**
 - b. **[Nox-Crete Products Group]**
 - c. **[OKON; a Rust-Oleum brand; a subsidiary of RPM International, Inc.]**
 - d. **[PPG Paints; PPG Industries, Inc.]**
 - e. **[Rust-Oleum Corporation; a subsidiary of RPM International, Inc.]**
 - f. **[Specco Industries, Inc]**
 - g. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. [H&C Decorative Concrete Products; a brand of Sherwin-Williams Co.]
 - b. [Nox-Crete Products Group]
 - c. [OKON; a Rust-Oleum brand; a subsidiary of RPM International, Inc.]
 - d. [PPG Paints; PPG Industries, Inc.]
 - e. [Rust-Oleum Corporation; a subsidiary of RPM International, Inc.]
 - f. [Specco Industries, Inc]
 - g. <Insert manufacturer's name>
3. Color: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.

2.4 MPI-APPROVED WATER REPELLENTS

- A. Water Repellent, Clear (Paintable); MPI #34: Penetrating, clear water-repellent coating, for use on interior or exterior masonry, brick, and concrete surfaces, and that can be recoated with conventional paints.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Cloverdale Paint]
 - b. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - c. [PPG Paints; PPG Industries, Inc.]
 - d. [Rust-Oleum Corporation; a subsidiary of RPM International, Inc.]
 - e. [United Gilsonite Laboratories (UGL)]
 - f. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Cloverdale Paint]
 - b. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]
 - c. [PPG Paints; PPG Industries, Inc.]
 - d. [Rust-Oleum Corporation; a subsidiary of RPM International, Inc.]
 - e. [United Gilsonite Laboratories (UGL)]
 - f. <Insert manufacturer's name>
 3. VOC Content: [600 g/L or less][400 g/L or less][150 g/L or less][Less than 51 g/L]<Insert limit>.
 4. MPI Green Performance Standard: [GPS-1][GPS-2].
- B. Water Repellent, Clear (Not Paintable); MPI #117: Penetrating, silicone-oil type, clear water-repellent for interior or exterior masonry block or brick, not intended for recoating.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Behr Paint Company (Behr Process LLC)]
 - b. [Benjamin Moore & Co.]
 - c. [Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]

- d. **[Sherwin-Williams Company (The)]**
 - e. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[Behr Paint Company (Behr Process LLC)]**
 - b. **[Benjamin Moore & Co.]**
 - c. **[Euclid Chemical Company (The); a subsidiary of RPM International, Inc.]**
 - d. **[Sherwin-Williams Company (The)]**
 - e. **<Insert manufacturer's name>**
3. VOC Content: **[600 g/L or less][350 g/L or less][200 g/L or less][Less than 51 g/L]<Insert limit>**.
4. MPI Green Performance Standard: **[GPS-1][GPS-2]**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.
 - 1. Verify that surfaces are clean and dry in accordance with water-repellent manufacturer's requirements. Check moisture content in **[three]<Insert number>** representative locations by method recommended by manufacturer.
 - 2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
 - 3. Verify that required repairs are complete, cured, and dry before applying water repellent.
- B. Test pH level in accordance with water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. New Construction and Repairs: Allow concrete and other cementitious materials to age before application of water repellent, in accordance with repellent manufacturer's written instructions.
- B. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product in accordance with water-repellent manufacturer's written instructions **[and as follows:]**[.].
 - 1. Concrete-Based Substrates: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents on **[cast-in-place concrete][precast concrete][cast stone][and][concrete masonry unit]** substrate **[in accordance with ASTM E1857]<Insert requirement>**.
 - 2. Clay Brick Masonry Substrate: **[ASTM D5703.]****[Section 040110 "Masonry Cleaning."]**
 - 3. Natural Stone Substrate: **[ASTM C1515.]****[ASTM D5107.]****[Section 040110 "Masonry Cleaning."]**

4. Portland Cement Plaster (Stucco) Substrate: **[ASTM E1857]<Insert requirement>**.
- C. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.
- D. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.
- E. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION OF WATER REPELLENTS

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.
- B. Apply coating of water repellent on surfaces to be treated using **[15 psi (103 kPa) pressure spray with a fan-type spray nozzle][roller][or][brush]<Insert requirement>** to the point of saturation. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.
 1. At Contractor's option, first application of water repellent may be completed before installing **[precast concrete][and][cast stone]** units. Mask mortar and sealant bond surfaces to prevent water repellent from migrating onto adjacent joint surfaces. Remove masking after repellent has cured.
- C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 FIELD QUALITY CONTROL

- A. Testing of Water-Repellent Material: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when water repellent is being applied:
 1. Owner may engage the services of a qualified testing agency to sample water-repellent material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
 2. Testing agency will perform tests for compliance of water-repellent material with product requirements.
 3. Owner may direct Contractor to stop applying water repellents if test results show material being used does not comply with product requirements. Contractor to remove noncomplying material from Project site, pay for testing, and correct deficiency of surfaces treated with rejected materials, as approved by Architect. **<Insert additional requirements to suit Project>**.
- B. Coverage Test: In the presence of Architect, hose down a dry, repellent-treated surface to verify

complete and uniform product application. A change in surface color will indicate incomplete application.

1. Notify Architect [**seven**]**<Insert number>** days in advance of the dates and times when surfaces will be tested.
2. Reapply water repellent until coverage test indicates complete coverage.

3.5 CLEANING

- A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application, in accordance with manufacturer's written cleaning instructions, as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.

END OF SECTION 07 19 00 00



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 19 13 00	07 19 00 00	Water Repellents
07 19 16 00	07 19 00 00	Water Repellents



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SECTION 07 21 00 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Molded (expanded) polystyrene foam-plastic board insulation.
3. Graphite-polystyrene foam-plastic board insulation.
4. Polyisocyanurate foam-plastic board insulation.
5. Glass-fiber blanket insulation.
6. Glass-fiber board insulation.
7. Mineral-wool blanket insulation.
8. Mineral-wool board insulation.
9. Loose-fill insulation.
10. Spray-applied cellulosic insulation.
11. Cellular-glass insulation.
12. Reflective insulation and radiant barriers.
13. Rigid vacuum insulation.
14. Glass-wool vacuum insulation.

B. Related Requirements:

1. Section 042000 "Unit Masonry" for insulation installed in masonry cells.
2. Section 061600 "Sheathing" for foam-plastic board sheathing installed directly over wood or steel framing.
3. **[Section 071326 "Self-Adhering Sheet Waterproofing"] [Section 071353 "Elastomeric Sheet Waterproofing"] [Section 071354 "Thermoplastic Sheet Waterproofing"] [Section 071413 "Hot Fluid-Applied Rubberized Asphalt Waterproofing"] [Section 071416 "Cold Fluid-Applied Waterproofing"]** for insulated drainage panels installed with plaza deck insulation.
4. Section 072119 "Foamed-in-Place Insulation" for spray-applied polyurethane foam insulation.
5. **[Section 070150.19 "Preparation for Reroofing"] [Section 075113 "Built-up Asphalt Roofing"] [Section 075116 "Built-up Coal Tar Roofing"] [Section 075213 "Atactic-Polypropylene (APP) Modified Bituminous Membrane Roofing"] [Section 075216 "Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing"] [Section 075316 "Chlorosulfonate-Polyethylene (CSPE) Roofing"] [Section 075323 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing"] [Section 075416 "Ketone Ethylene Ester (KEE) Roofing"] [Section 075419 "Polyvinyl-Chloride (PVC) Roofing"] [Section 075423 "Thermoplastic-Polyolefin (TPO) Roofing"] [Section 075552.13 "Atactic-Polypropylene (APP) Modified Bituminous Protected Membrane Roofing"] [Section 075552.16 "Styrene-Butadiene-Styrene (SBS) Modified Bituminous Protected Membrane Roofing"] [Section 075556 "Fluid-Applied Protected Membrane Roofing"] [and] [Section 075700 "Coated Foamed Roofing"]** for insulation specified as part of roofing construction.
6. **[Section 092300 "Gypsum Plastering"] [Section 092400 "Portland Cement Plastering"] [Section 092613 "Gypsum Veneer Plastering"] [Section 092900 "Gypsum Board"]** for sound attenuation blanket used as acoustic insulation.

1.2 ACTION SUBMITTALS

- ##### A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.
2. Environmental Product Declaration: For each product.
3. Health Product Declaration: For each product.
4. Environmental Product Declaration: For each product.
5. Environmental Product Declaration: For each product.
6. Environmental Product Declaration: For each product.
7. Third-Party Certifications: For each product.
8. Third-Party Certified Life Cycle Assessment: For each product.
9. Health Product Declaration (HPD): Provide documentation indicating that manufacturer has screened and publicly provided ingredient disclosure to 1000 ppm, and has developed an action plan to mitigate known hazards.
10. Product Data: For adhesives, indicating VOC content.
11. Laboratory Test Reports: For insulation, indicating compliance with the VOC emissions evaluation.
12. Laboratory Test Reports: For insulation, indicating compliance with requirements for low-emitting materials.

1.3 INFORMATIONAL SUBMITTALS

- A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.
1. For blown-in or sprayed fiberglass and cellulosic-fiber loose-fill insulation, indicate initial installed thickness, settled thickness, settled R-value, installed density, coverage area, and number of bags installed.
 2. Sign, date, and post the certification in a conspicuous location on Project site.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Research Reports: For foam-plastic insulation, from ICC-ES.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than **[Class A, 25 and 450][Class B, 75 and 450][Class C, 200 and 450]** when tested in accordance with ASTM E84.
- B. Fire-Resistance Ratings: Comply with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.
- C. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- D. Labeling: Provide identification of mark indicating R-value of each piece of insulation **12 inches (305 mm)** and wider in width.
- E. Thermal-Resistance Value (R-Value): **[R-value as indicated on Drawings][R-value as indicated below]<Insert R-value>** in accordance with ASTM C518.
 - 1. R-Value at **<Insert location>**: **<Insert R-value>**.
- F. Verify insulation complies with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- G. Verify insulation complies with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less, except for insulation manufactured without formaldehyde.
- H. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
 - 1. Verify adhesives have a VOC content of **[70]<Insert number>** g/L or less.
 - 2. Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 3. Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 - 4. Verify adhesive complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.

2.2 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION (XPS)

- A. Extruded Polystyrene Board Insulation, Type X : ASTM C578, Type X, **15 psi (104 kPa)** minimum compressive strength; unfaced.

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1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[DiversiFoam Products]**
 - b. **[DuPont de Nemours, Inc.]**
 - c. **[MBCI; Cornerstone Building Brands]**
 - d. **[Owens Corning]**
 - e. **[The Dow Chemical Company]**
 - f. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[DiversiFoam Products]**
 - b. **[DuPont de Nemours, Inc.]**
 - c. **[MBCI; Cornerstone Building Brands]**
 - d. **[Owens Corning]**
 - e. **[The Dow Chemical Company]**
 - f. **<Insert manufacturer's name>**
- B. Extruded Polystyrene Board Insulation, Type IV : ASTM C578, Type IV, **25 psi (173 kPa)** minimum compressive strength; unfaced.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[DiversiFoam Products]**
 - b. **[DuPont de Nemours, Inc.]**
 - c. **[Kingspan Insulation LLC]**
 - d. **[Owens Corning]**
 - e. **[The Dow Chemical Company]**
 - f. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[DiversiFoam Products]**
 - b. **[DuPont de Nemours, Inc.]**
 - c. **[Kingspan Insulation LLC]**
 - d. **[Owens Corning]**
 - e. **[The Dow Chemical Company]**
 - f. **<Insert manufacturer's name>**
- C. Extruded Polystyrene Board Insulation, Type IV, Drainage Panels : ASTM C578, Type IV, **25 psi (173 kPa)** minimum compressive strength; unfaced.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the**

following]:

- a. [DiversiFoam Products]
 - b. [DuPont de Nemours, Inc.]
 - c. [Owens Corning]
 - d. [The Dow Chemical Company]
 - e. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [DiversiFoam Products]
 - b. [DuPont de Nemours, Inc.]
 - c. [Owens Corning]
 - d. [The Dow Chemical Company]
 - e. <Insert manufacturer's name>
- D. Extruded Polystyrene Board Insulation, Type VI : ASTM C578, Type VI, **40 psi (276 kPa)** minimum compressive strength.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [DiversiFoam Products]
 - b. [DuPont de Nemours, Inc.]
 - c. [Kingspan Insulation LLC]
 - d. [Owens Corning]
 - e. [The Dow Chemical Company]
 - f. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [DiversiFoam Products]
 - b. [DuPont de Nemours, Inc.]
 - c. [Kingspan Insulation LLC]
 - d. [Owens Corning]
 - e. [The Dow Chemical Company]
 - f. <Insert manufacturer's name>
- E. Extruded Polystyrene Board Insulation, Type VI, Drainage Panels : ASTM C578, Type VI, **40 psi (276 kPa)** minimum compressive strength; unfaced.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [DiversiFoam Products]
 - b. [DuPont de Nemours, Inc.]
 - c. [Owens Corning]
 - d. [The Dow Chemical Company]

- e. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [DiversiFoam Products]
 - b. [DuPont de Nemours, Inc.]
 - c. [Owens Corning]
 - d. [The Dow Chemical Company]
 - e. <Insert manufacturer's name>
- F. Extruded Polystyrene Board Insulation, Type VII : ASTM C578, Type VII, **60 psi (414 kPa)** minimum compressive strength.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [DiversiFoam Products]
 - b. [DuPont de Nemours, Inc.]
 - c. [Kingspan Insulation LLC]
 - d. [Owens Corning]
 - e. [The Dow Chemical Company]
 - f. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [DiversiFoam Products]
 - b. [DuPont de Nemours, Inc.]
 - c. [Kingspan Insulation LLC]
 - d. [Owens Corning]
 - e. [The Dow Chemical Company]
 - f. <Insert manufacturer's name>
- G. Extruded Polystyrene Board Insulation, Type VII, Drainage Panels : ASTM C578, Type VII, **60 psi (414 kPa)** minimum compressive strength.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [DiversiFoam Products]
 - b. [DuPont de Nemours, Inc.]
 - c. [Owens Corning]
 - d. [The Dow Chemical Company]
 - e. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. **[DiversiFoam Products]**
 - b. **[DuPont de Nemours, Inc.]**
 - c. **[Owens Corning]**
 - d. **[The Dow Chemical Company]**
 - e. **<Insert manufacturer's name>**
- H. Extruded Polystyrene Board Insulation, Type V : ASTM C578, Type V, **100 psi (690 kPa)** minimum compressive strength.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[DuPont de Nemours, Inc.]**
 - b. **[Owens Corning]**
 - c. **[The Dow Chemical Company]**
 - d. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[DuPont de Nemours, Inc.]**
 - b. **[Owens Corning]**
 - c. **[The Dow Chemical Company]**
 - d. **<Insert manufacturer's name>**
- 2.3 MOLDED (EXPANDED) POLYSTYRENE FOAM-PLASTIC BOARD INSULATION (EPS)
- A. Molded (Expanded) Polystyrene Board Insulation, Type I : ASTM C578, Type I, **10 psi (69 kPa)** minimum compressive strength.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Alleguard (formerly Amvic Building System)]**
 - b. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - c. **[DiversiFoam Products]**
 - d. **[Insulfoam; a Carlisle Company]**
 - e. **[Plymouth Foam, an Altor Solutions Company]**
 - f. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Alleguard (formerly Amvic Building System)]**
 - b. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - c. **[DiversiFoam Products]**
 - d. **[Insulfoam; a Carlisle Company]**
 - e. **[Plymouth Foam, an Altor Solutions Company]**
 - f. **<Insert manufacturer's name>**

- B. Molded (Expanded) Polystyrene Board Insulation, Type IV, Faced : ASTM C578, Type IV, **25 psi (173 kPa)** minimum compressive strength.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Insulfoam; a Carlisle Company]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Insulfoam; a Carlisle Company]**
 - b. **<Insert manufacturer's name>**
- C. Molded (Expanded) Polystyrene Board Insulation, Type VI, Faced : ASTM C578, Type VI, **40 psi (276 kPa)** minimum compressive strength.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Insulfoam; a Carlisle Company]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Insulfoam; a Carlisle Company]**
 - b. **<Insert manufacturer's name>**
- D. Molded (Expanded) Polystyrene Board Insulation, Type VII, Faced : ASTM C578, Type VII, **60 psi (414 kPa)** minimum compressive strength.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Insulfoam; a Carlisle Company]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Insulfoam; a Carlisle Company]**
 - b. **<Insert manufacturer's name>**
- E. Molded (Expanded) Polystyrene Board Insulation, Type VIII : ASTM C578, Type VIII, **13 psi (90 kPa)**

minimum compressive strength.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[DiversiFoam Products]**
 - c. **[Insulfoam; a Carlisle Company]**
 - d. **[Plymouth Foam, an Altor Solutions Company]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[DiversiFoam Products]**
 - c. **[Insulfoam; a Carlisle Company]**
 - d. **[Plymouth Foam, an Altor Solutions Company]**
 - e. **<Insert manufacturer's name>**
- F. Molded (Expanded) Polystyrene Board Insulation, Type II : ASTM C578, Type II, **15 psi (104 kPa)** minimum compressive strength.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Alleguard (formerly Amvic Building System)]**
 - b. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - c. **[DiversiFoam Products]**
 - d. **[Insulfoam; a Carlisle Company]**
 - e. **[Plymouth Foam, an Altor Solutions Company]**
 - f. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Alleguard (formerly Amvic Building System)]**
 - b. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - c. **[DiversiFoam Products]**
 - d. **[Insulfoam; a Carlisle Company]**
 - e. **[Plymouth Foam, an Altor Solutions Company]**
 - f. **<Insert manufacturer's name>**
- G. Molded (Expanded) Polystyrene Board Insulation, Type IX : ASTM C578, Type IX, **25 psi (173 kPa)** minimum compressive strength.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

-
- a. **[Alleguard (formerly Amvic Building System)]**
 - b. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - c. **[DiversiFoam Products]**
 - d. **[Insulfoam; a Carlisle Company]**
 - e. **[Plymouth Foam, an Altor Solutions Company]**
 - f. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Alleguard (formerly Amvic Building System)]**
 - b. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - c. **[DiversiFoam Products]**
 - d. **[Insulfoam; a Carlisle Company]**
 - e. **[Plymouth Foam, an Altor Solutions Company]**
 - f. **<Insert manufacturer's name>**
- H. Molded (Expanded) Polystyrene Board Insulation, Type X, Faced : ASTM C578, Type X, **15 psi (104 kPa)** minimum compressive strength.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Insulfoam; a Carlisle Company]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Insulfoam; a Carlisle Company]**
 - b. **<Insert manufacturer's name>**
- I. Molded (Expanded) Polystyrene Board Insulation, Type XIV : ASTM C578, Type XIV, **40 psi (276 kPa)** minimum compressive strength.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Alleguard (formerly Amvic Building System)]**
 - b. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - c. **[Insulfoam; a Carlisle Company]**
 - d. **[Plymouth Foam, an Altor Solutions Company]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Alleguard (formerly Amvic Building System)]**

- b. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - c. **[Insulfoam; a Carlisle Company]**
 - d. **[Plymouth Foam, an Altor Solutions Company]**
 - e. **<Insert manufacturer's name>**
- J. Molded (Expanded) Polystyrene Board Insulation, Type XV : ASTM C578, Type XV, **60 psi (414 kPa)** minimum compressive strength.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Alleguard (formerly Amvic Building System)]**
 - b. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - c. **[Insulfoam; a Carlisle Company]**
 - d. **[Plymouth Foam, an Altor Solutions Company]**
 - e. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Alleguard (formerly Amvic Building System)]**
 - b. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - c. **[Insulfoam; a Carlisle Company]**
 - d. **[Plymouth Foam, an Altor Solutions Company]**
 - e. **<Insert manufacturer's name>**
- 2.4 GRAPHITE-POLYSTYRENE FOAM-PLASTIC BOARD INSULATION (GPS)
- A. Graphite-Polystyrene Foam-Plastic Board Insulation, Type I : ASTM C578, Type I, **10 psi (69 kPa)** minimum compressive strength; **4-perm (230-ng/Pa x s x sq. m)** maximum vapor permeance at **1-inch (25.4-mm)** thickness per ASTM E96/E96M.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Alleguard (formerly Amvic Building System)]**
 - b. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - c. **[BASF]**
 - d. **[LOGIX Brands Ltd.]**
 - e. **[Opco, Inc.]**
 - f. **[Perma R Products, Inc.]**
 - g. **[Polar Industries, Inc.]**
 - h. **[Progressive Foam Technologies, Inc.]**
 - i. **[StarRFoam]**
 - j. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Alleguard (formerly Amvic Building System)]**
- b. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
- c. **[BASF]**
- d. **[LOGIX Brands Ltd.]**
- e. **[Opco, Inc.]**
- f. **[Perma R Products, Inc.]**
- g. **[Polar Industries, Inc.]**
- h. **[Progressive Foam Technologies, Inc.]**
- i. **[StarRFoam]**
- j. **<Insert manufacturer's name>**

B. Graphite-Polystyrene Foam-Plastic Board Insulation, Type I, Faced : ASTM C578, Type I, **10 psi (69 kPa)** minimum compressive strength; **4-perm (230-ng/Pa x s x sq. m)** maximum vapor permeance at **1-inch (25.4-mm)** thickness per ASTM E96/E96M.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[Insulfoam; a Carlisle Company]**
 - c. **[LOGIX Brands Ltd.]**
 - d. **[Progressive Foam Technologies, Inc.]**
 - e. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[Insulfoam; a Carlisle Company]**
 - c. **[LOGIX Brands Ltd.]**
 - d. **[Progressive Foam Technologies, Inc.]**
 - e. **<Insert manufacturer's name>**

C. Graphite-Polystyrene Foam-Plastic Board Insulation, Type VIII : ASTM C578, Type VIII, **13 psi (90 kPa)** minimum compressive strength; **3.1-perm (178-ng/Pa x s x sq. m)** maximum vapor permeance at **1-inch (25.4-mm)** thickness per ASTM E96/E96M.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[BASF]**
 - b. **[Opco, Inc.]**
 - c. **[Perma R Products, Inc.]**
 - d. **[Polar Industries, Inc.]**
 - e. **[StarRFoam]**
 - f. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. [BASF]
 - b. [Opco, Inc.]
 - c. [Perma R Products, Inc.]
 - d. [Polar Industries, Inc.]
 - e. [StarRFoam]
 - f. <Insert manufacturer's name>
- D. Graphite-Polystyrene Foam-Plastic Board Insulation, Type VIII, Faced : ASTM C578, Type VIII, **13 psi (90 kPa)** minimum compressive strength; **3.1-perm (178-ng/Pa x s x sq. m)** maximum vapor permeance at **1-inch (25.4-mm)** thickness per ASTM E96/E96M.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [Perma R Products, Inc.]
 - c. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [Perma R Products, Inc.]
 - c. <Insert manufacturer's name>
- E. Graphite-Polystyrene Foam-Plastic Board Insulation, Type II : ASTM C578, Type II, **15 psi (104 kPa)** minimum compressive strength; **3.1-perm (178-ng/Pa x s x sq. m)** maximum vapor permeance at **1-inch (25.4-mm)** thickness per ASTM E96/E96M.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [BASF]
 - c. [Opco, Inc.]
 - d. [Polar Industries, Inc.]
 - e. [StarRFoam]
 - f. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [BASF]
 - c. [Opco, Inc.]
 - d. [Polar Industries, Inc.]
 - e. [StarRFoam]
 - f. <Insert manufacturer's name>
- F. Graphite-Polystyrene Foam-Plastic Board Insulation, Type IX : ASTM C578, Type IX, **25 psi (173 kPa)**

minimum compressive strength; **2.5-perm (144-ng/Pa x s x sq. m)** maximum vapor permeance at **1-inch (25.4-mm)** thickness per ASTM E96/E96M.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[BASF]**
 - c. **[Perma R Products, Inc.]**
 - d. **[Polar Industries, Inc.]**
 - e. **[StarRFoam]**
 - f. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[BASF]**
 - c. **[Perma R Products, Inc.]**
 - d. **[Polar Industries, Inc.]**
 - e. **[StarRFoam]**
 - f. **<Insert manufacturer's name>**

G. Graphite-Polystyrene Foam-Plastic Board Insulation, Type IX, Faced : ASTM C578, Type IX, **25 psi (173 kPa)** minimum compressive strength; **2.5-perm (144-ng/Pa x s x sq. m)** maximum vapor permeance at **1-inch (25.4-mm)** thickness per ASTM E96/E96M.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[LOGIX Brands Ltd.]**
 - c. **[Perma R Products, Inc.]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[LOGIX Brands Ltd.]**
 - c. **[Perma R Products, Inc.]**
 - d. **<Insert manufacturer's name>**

H. Graphite-Polystyrene Foam-Plastic Board Insulation, Type XI : **5 psi (35 kPa)** minimum compressive strength; maximum vapor permeance at **1-inch (25.4-mm)** thickness per ASTM E96/E96M; R4.5 minimum stable R-value at **1-inch (25.4-mm)** thickness per ASTM C518.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering**

products that may be incorporated into the Work include, but are not limited to, the following]:

- a. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. <Insert manufacturer's name>
- I. Graphite-Polystyrene Foam-Plastic Board Insulation, Type XIV : ASTM C578, Type XIV, **40 psi (276 kPa)** minimum compressive strength; **2.5-perm (144-ng/Pa x s x sq. m)** maximum vapor permeance at **1-inch (25.4-mm)** thickness per ASTM E96/E96M.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [BASF]
 - b. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [BASF]
 - b. <Insert manufacturer's name>
- J. Graphite-Polystyrene Foam-Plastic Board Insulation, Type XV : ASTM C578, Type XV, **60 psi (414 kPa)** minimum compressive strength; **2.5-perm (144-ng/Pa x s x sq. m)** maximum vapor permeance at **1-inch (25.4-mm)** thickness per ASTM E96/E96M.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [BASF]
 - b. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [BASF]
 - b. <Insert manufacturer's name>
- K. Graphite-Polystyrene Foam-Plastic Board Insulation, Type X, Faced : ASTM C578, Type X, **15 psi (104 kPa)** minimum compressive strength; **1.1-perm (63-ng/Pa x s x sq. m)** maximum vapor permeance at **1-inch (25.4-mm)** thickness per ASTM E96/E96M.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the

following]:

a. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

a. <Insert manufacturer's name>

- L. Graphite-Polystyrene Foam-Plastic Board Insulation, Type IV, Faced : ASTM C578, Type IV, **25 psi (173 kPa)** minimum compressive strength; **1.1-perm (63-ng/Pa x s x sq. m)** maximum vapor permeance at **1-inch (25.4-mm)** thickness per ASTM E96/E96M.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. [Insulfoam; a Carlisle Company]

b. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

a. [Insulfoam; a Carlisle Company]

b. <Insert manufacturer's name>

2.5 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

- A. Polyisocyanurate Board Insulation, Foil Faced : ASTM C1289, foil faced, Type I, Class 1 or 2.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

a. [Atlas Molded Products, a division of Atlas Roofing Corporation]

b. [Atlas Polyiso Roof and Wall Insulation]

c. [Carlisle Coatings & Waterproofing Inc]

d. [DuPont de Nemours, Inc.]

e. [Elevate; Holcim Building Envelope]

f. [Hunter Panels; a Carlisle company]

g. [Johns Manville; a Berkshire Hathaway company]

h. [Rmax, A Business Unit of Sika Corporation]

i. [The Dow Chemical Company]

j. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

a. [Atlas Molded Products, a division of Atlas Roofing Corporation]

- b. [Atlas Polyiso Roof and Wall Insulation]
 - c. [Carlisle Coatings & Waterproofing Inc]
 - d. [DuPont de Nemours, Inc.]
 - e. [Elevate; Holcim Building Envelope]
 - f. [Hunter Panels; a Carlisle company]
 - g. [Johns Manville; a Berkshire Hathaway company]
 - h. [Rmax, A Business Unit of Sika Corporation]
 - i. [The Dow Chemical Company]
 - j. <Insert manufacturer's name>
- B. Polyisocyanurate Board Insulation, Glass-Fiber-Mat Faced : ASTM C1289, glass-fiber-mat faced, Type II, Class 2.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [Carlisle Coatings & Waterproofing Inc]
 - c. [Elevate; Holcim Building Envelope]
 - d. [Hunter Panels; a Carlisle company]
 - e. [Johns Manville; a Berkshire Hathaway company]
 - f. [Rmax, A Business Unit of Sika Corporation]
 - g. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [Carlisle Coatings & Waterproofing Inc]
 - c. [Elevate; Holcim Building Envelope]
 - d. [Hunter Panels; a Carlisle company]
 - e. [Johns Manville; a Berkshire Hathaway company]
 - f. [Rmax, A Business Unit of Sika Corporation]
 - g. <Insert manufacturer's name>
- 2.6 GLASS-FIBER BLANKET INSULATION
- A. Glass-Fiber Blanket Insulation, Unfaced : ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. [CertainTeed; SAINT-GOBAIN]
 - b. [Johns Manville; a Berkshire Hathaway company]
 - c. [Knauf Insulation]
 - d. [Owens Corning]
 - e. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert

manufacturer's name; product name or designation> or comparable product by one of the following:

- a. **[CertainTeed; SAINT-GOBAIN]**
- b. **[Johns Manville; a Berkshire Hathaway company]**
- c. **[Knauf Insulation]**
- d. **[Owens Corning]**
- e. **<Insert manufacturer's name>**

B. Glass-Fiber Blanket Insulation, Polypropylene-Scrim-Kraft Faced : ASTM C665, Type II (nonreflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. **[CertainTeed; SAINT-GOBAIN]**
- b. **[Johns Manville; a Berkshire Hathaway company]**
- c. **[Knauf Insulation]**
- d. **[Owens Corning]**
- e. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[CertainTeed; SAINT-GOBAIN]**
- b. **[Johns Manville; a Berkshire Hathaway company]**
- c. **[Knauf Insulation]**
- d. **[Owens Corning]**
- e. **<Insert manufacturer's name>**

C. Glass-Fiber Blanket Insulation, Kraft Faced : ASTM C665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. **[CertainTeed; SAINT-GOBAIN]**
- b. **[Johns Manville; a Berkshire Hathaway company]**
- c. **[Knauf Insulation]**
- d. **[Owens Corning]**
- e. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[CertainTeed; SAINT-GOBAIN]**
- b. **[Johns Manville; a Berkshire Hathaway company]**
- c. **[Knauf Insulation]**

- d. **[Owens Corning]**
 - e. **<Insert manufacturer's name>**
- D. Glass-Fiber Blanket Insulation, Reinforced-Foil Faced : ASTM C665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Johns Manville; a Berkshire Hathaway company]**
 - c. **[Knauf Insulation]**
 - d. **[Owens Corning]**
 - e. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Johns Manville; a Berkshire Hathaway company]**
 - c. **[Knauf Insulation]**
 - d. **[Owens Corning]**
 - e. **<Insert manufacturer's name>**
- E. Glass-Fiber Blanket Insulation, Foil Faced : ASTM C665, Type III (reflective faced), Class B (faced surface with a flame-propagation resistance of 0.12 W/sq. cm); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Johns Manville; a Berkshire Hathaway company]**
 - c. **[Knauf Insulation]**
 - d. **[Owens Corning]**
 - e. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Johns Manville; a Berkshire Hathaway company]**
 - c. **[Knauf Insulation]**
 - d. **[Owens Corning]**
 - e. **<Insert manufacturer's name>**

2.7 GLASS-FIBER BOARD INSULATION

- A. Glass-Fiber Board Insulation, Unfaced : ASTM C612, Type IA; unfaced[, **passing ASTM E136 for combustion characteristics**].
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Johns Manville; a Berkshire Hathaway company]**
 - c. **[Knauf Insulation]**
 - d. **[Owens Corning]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Johns Manville; a Berkshire Hathaway company]**
 - c. **[Knauf Insulation]**
 - d. **[Owens Corning]**
 - e. **<Insert manufacturer's name>**
 3. Nominal Density: **[2.25 lb/cu. ft. (36 kg/cu. m)][3 lb/cu. ft. (48 kg/cu. m)][4.25 lb/cu. ft. (68 kg/cu. m)][6 lb/cu. ft. (96 kg/cu. m)]<Insert value>**.
- B. Glass-Fiber Board Insulation, Faced : ASTM C612, Type IA; faced on one side with foil-scrim-kraft or foil-scrim-polyethylene vapor retarder.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Johns Manville; a Berkshire Hathaway company]**
 - c. **[Knauf Insulation]**
 - d. **[Owens Corning]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Johns Manville; a Berkshire Hathaway company]**
 - c. **[Knauf Insulation]**
 - d. **[Owens Corning]**
 - e. **<Insert manufacturer's name>**
 3. Nominal Density: **[2.25 lb/cu. ft. (36 kg/cu. m)][3 lb/cu. ft. (48 kg/cu. m)][4.25 lb/cu. ft. (68 kg/cu. m)][6 lb/cu. ft. (96 kg/cu. m)]<Insert value>**.

2.8 MINERAL-WOOL BLANKET INSULATION

- A. Mineral-Wool Blanket Insulation, Unfaced : ASTM C665, Type I (blankets without membrane facing); consisting of fibers; complying with ASTM E136 for combustion characteristics.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **[Owens Corning]**
 - c. **[ROCKWOOL]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **[Owens Corning]**
 - c. **[ROCKWOOL]**
 - d. **<Insert manufacturer's name>**
- B. Mineral-Wool Blanket Insulation, Reinforced-Foil Faced : ASTM C665, Type III (reflective faced); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **[Owens Corning]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **[Owens Corning]**
 - c. **<Insert manufacturer's name>**

2.9 MINERAL-WOOL BOARD INSULATION

- A. Mineral-Wool Board Insulation, Types IA and IB, Unfaced : ASTM C612, Types IA and IB; passing ASTM E136 for combustion characteristics.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. [Johns Manville; a Berkshire Hathaway company]
 - b. [Owens Corning]
 - c. [ROCKWOOL]
 - d. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Johns Manville; a Berkshire Hathaway company]
 - b. [Owens Corning]
 - c. [ROCKWOOL]
 - d. <Insert manufacturer's name>
 3. Nominal Density: [1.6 lb/cu. ft. (26 kg/cu. m)][2.25 lb/cu. ft. (36 kg/cu. m)][3 lb/cu. ft. (48 kg/cu. m)][4 lb/cu. ft. (64 kg/cu. m)][4.3 lb/cu. ft. (69 kg/cu. m)][6 lb/cu. ft. (96 kg/cu. m)][8 lb/cu. ft. (128 kg/cu. m)]<Insert value>.
- B. Mineral-Wool Board Insulation, Types IA and IB, Faced : ASTM C612, Types IA and IB; faced on one side with foil-scrim or foil-scrim-polyethylene vapor retarder.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Johns Manville; a Berkshire Hathaway company]
 - b. [Owens Corning]
 - c. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Johns Manville; a Berkshire Hathaway company]
 - b. [Owens Corning]
 - c. <Insert manufacturer's name>
 3. Nominal Density: [1.6 lb/cu. ft. (26 kg/cu. m)][2.25 lb/cu. ft. (36 kg/cu. m)][3 lb/cu. ft. (48 kg/cu. m)][4 lb/cu. ft. (64 kg/cu. m)][4.3 lb/cu. ft. (69 kg/cu. m)][6 lb/cu. ft. (96 kg/cu. m)][8 lb/cu. ft. (128 kg/cu. m)]<Insert value>.
- C. Mineral-Wool Board Insulation, Type II, Unfaced : ASTM C612, Type II; passing ASTM E136 for combustion characteristics.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Johns Manville; a Berkshire Hathaway company]
 - b. [Owens Corning]
 - c. [ROCKWOOL]
 - d. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **[Owens Corning]**
 - c. **[ROCKWOOL]**
 - d. **<Insert manufacturer's name>**
 3. Nominal Density: **[4 lb/cu. ft. (64 kg/cu. m)][6 lb/cu. ft. (96 kg/cu. m)][8 lb/cu. ft. (128 kg/cu. m)]<Insert value>**.
- D. Mineral-Wool Board Insulation, Type II, Faced : ASTM C612, Type II; faced on one side with foil-scrim or foil-scrim-polyethylene vapor retarder.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **[Owens Corning]**
 - c. **[Specialty Products & Insulation (SPI)]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **[Owens Corning]**
 - c. **[Specialty Products & Insulation (SPI)]**
 - d. **<Insert manufacturer's name>**
 3. Nominal Density: **[4 lb/cu. ft. (64 kg/cu. m)][6 lb/cu. ft. (96 kg/cu. m)][8 lb/cu. ft. (128 kg/cu. m)]<Insert value>**.
- E. Mineral-Wool Board Insulation, Type III, Unfaced : ASTM C612, Type III; passing ASTM E136 for combustion characteristics.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **[Owens Corning]**
 - c. **[ROCKWOOL]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **[Owens Corning]**

- c. **[ROCKWOOL]**
- d. **<Insert manufacturer's name>**

- 3. Nominal Density: **[4 lb/cu. ft. (64 kg/cu. m)][6 lb/cu. ft. (96 kg/cu. m)][8 lb/cu. ft. (128 kg/cu. m)][10 lb/cu. ft. (160 kg/cu. m)]<Insert value>**.

F. Mineral-Wool Board Insulation, Type III, Faced : ASTM C612, Type III; faced on one side with foil-scrim or foil-scrim-polyethylene vapor retarder.

- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **[Owens Corning]**
 - c. **[ROCKWOOL]**
 - d. **[Specialty Products & Insulation (SPI)]**
 - e. **<Insert manufacturer's name>**
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **[Owens Corning]**
 - c. **[ROCKWOOL]**
 - d. **[Specialty Products & Insulation (SPI)]**
 - e. **<Insert manufacturer's name>**
- 3. Nominal Density: **[4 lb/cu. ft. (64 kg/cu. m)][6 lb/cu. ft. (96 kg/cu. m)][8 lb/cu. ft. (128 kg/cu. m)][10 lb/cu. ft. (160 kg/cu. m)]<Insert value>**.

G. Mineral-Wool Board Insulation, Type IVA : ASTM C612, Type IVA; **[unfaced][with black mat facer]<Insert facer material>**.

- 1. Nominal Density: **[4 lb/cu. ft. (64 kg/cu. m)][6 lb/cu. ft. (96 kg/cu. m)][8 lb/cu. ft. (128 kg/cu. m)][10 lb/cu. ft. (160 kg/cu. m)][11 lb/cu. ft. (176 kg/cu. m)][12 lb/cu. ft. (192 kg/cu. m)]<Insert value>**.

H. Mineral-Wool Board Insulation, Type IVB : ASTM C612, Type IVB; **[unfaced][with black mat facer]<Insert facer material>**.

- 1. Nominal Density: **[4.3 lb/cu. ft. (69 kg/cu. m)][6 lb/cu. ft. (96 kg/cu. m)][8 lb/cu. ft. (128 kg/cu. m)][10 lb/cu. ft. (160 kg/cu. m)][11 lb/cu. ft. (176 kg/cu. m)][12 lb/cu. ft. (192 kg/cu. m)][6.2 lb/cu. ft. (99 kg/cu. m) outer layer and 3.8 lb/cu. ft. (61 kg/cu. m) inner layer]<Insert value>**.

2.10 LOOSE-FILL INSULATION

A. Cellulosic-Fiber Loose-Fill Insulation : ASTM C739, chemically treated for flame-resistance, processing, and handling characteristics. **[Type I for pneumatic application][or][Type II for poured application]**.

- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the**

following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Greenfiber, LLC]
- b. [Hamilton Manufacturing, Inc. (HMI)]
- c. [Nu-Wool Co., Inc.]
- d. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Greenfiber, LLC]
- b. [Hamilton Manufacturing, Inc. (HMI)]
- c. [Nu-Wool Co., Inc.]
- d. <Insert manufacturer's name>

- B. Glass-Fiber Loose-Fill Insulation : ASTM C764, [Type I for pneumatic application][or][Type II for poured application].

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [CertainTeed; SAINT-GOBAIN]
- b. [Johns Manville; a Berkshire Hathaway company]
- c. [Knauf Insulation]
- d. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [CertainTeed; SAINT-GOBAIN]
- b. [Johns Manville; a Berkshire Hathaway company]
- c. [Knauf Insulation]
- d. <Insert manufacturer's name>

- C. Mineral-Fiber Loose-Fill Insulation : ASTM C764, [Type I for pneumatic application][or][Type II for poured application].

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Knauf Insulation]
- b. [Owens Corning]
- c. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Knauf Insulation]
- b. [Owens Corning]
- c. <Insert manufacturer's name>

2.11 SPRAY-APPLIED CELLULOSIC INSULATION

- A. Self-Supported, Spray-Applied Cellulosic Insulation : ASTM C1149, [Type I (materials applied with liquid adhesive; suitable for either exposed or enclosed applications),][Type II (materials containing a dry adhesive activated by water during installation; intended only for enclosed or covered applications),][Type III (materials containing an adhesive mixed with water during application; intended for application on attic floors),] chemically treated for flame-resistance, processing, and handling characteristics.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Greenfiber, LLC]
 - b. [Hamilton Manufacturing, Inc. (HMI)]
 - c. [International Cellulose Corp.]
 - d. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Greenfiber, LLC]
 - b. [Hamilton Manufacturing, Inc. (HMI)]
 - c. [International Cellulose Corp.]
 - d. <Insert manufacturer's name>

2.12 CELLULAR-GLASS INSULATION

- A. Cellular-Glass Insulation : Type V, ASTM C1902, structural insulating block with compressive strength of minimum **304 psi (2096 kPa)**, per ASTM D1621.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Owens Corning]
 - b. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Owens Corning]
 - b. <Insert manufacturer's name>

2.13 REFLECTIVE INSULATION AND RADIANT BARRIERS

- A. Reflective Insulation : ASTM C1224, with one or more low-emittance surfaces with emittance value of 0.1 or less as measured per ASTM C1371.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Covertex Flexible Packaging; division of Balcan Plastics]**
 - b. **[Fi-Foil Company, Inc.]**
 - c. **[Innovative Energy, Inc]**
 - d. **[Innovative Insulation, Inc.]**
 - e. **[ISI Building Products]**
 - f. **[Reflectix Inc.]**
 - g. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Covertex Flexible Packaging; division of Balcan Plastics]**
 - b. **[Fi-Foil Company, Inc.]**
 - c. **[Innovative Energy, Inc]**
 - d. **[Innovative Insulation, Inc.]**
 - e. **[ISI Building Products]**
 - f. **[Reflectix Inc.]**
 - g. **<Insert manufacturer's name>**
 3. Construction: **[Surfaces separated with internal expanders][Surfaces separated by single-layer polyethylene bubble film][Surfaces separated by double-layer polyethylene bubble film]<Insert construction>**.
 4. Water-Vapor Transmission: **[1 perm, maximum][5 perms or greater]**.
- B. Sheet Radiant Barriers : ASTM C1313/C1313M with at least one surface with emittance value of 0.1 or less as measured per ASTM C1371.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Covertex Flexible Packaging; division of Balcan Plastics]**
 - b. **[Fi-Foil Company, Inc.]**
 - c. **[Innovative Energy, Inc]**
 - d. **[Innovative Insulation, Inc.]**
 - e. **[ISI Building Products]**
 - f. **[Reflectix Inc.]**
 - g. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Covertex Flexible Packaging; division of Balcan Plastics]**

- b. [Fi-Foil Company, Inc.]
 - c. [Innovative Energy, Inc]
 - d. [Innovative Insulation, Inc.]
 - e. [ISI Building Products]
 - f. [Reflectix Inc.]
 - g. <Insert manufacturer's name>
- 3. Construction: [Foil on one side of substrate][Foil on both sides of substrate][Vacuum metallizing on substrate].
 - 4. Tear Resistance: <Insert value>.
 - 5. Water-Vapor Transmission: [1 perm, maximum][5 perms or greater].
 - 6. Sheet Width: <Insert width>.

C. Interior Radiation Control Coating System : Silver-colored, low-emissivity, [solvent][water]-based coating; with a surface emittance value of 0.25 or less as measured per ASTM C1371.

- 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [SOLEC Solar Energy Corporation]
 - b. [STS Coatings, Inc.]
 - c. <Insert manufacturer's name>
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [SOLEC Solar Energy Corporation]
 - b. [STS Coatings, Inc.]
 - c. <Insert manufacturer's name>

2.14 RIGID VACUUM INSULATION (VIP)

A. Rigid Vacuum Insulation Panel, Foil Faced : A microporous, insulated core heat-sealed under vacuum and encased in metal film.

- 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Kingspan Insulation LLC]
 - b. [Panasonic Industrial]
 - c. <Insert manufacturer's name>
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Kingspan Insulation LLC]
 - b. [Panasonic Industrial]
 - c. <Insert manufacturer's name>

2.15 GLASS-WOOL VACUUM INSULATION (VIP)

- A. Glass-Wool Vacuum Insulation Panel, Foil Faced : ASTM C1484, foil faced; Class A fire-rated in accordance with ASTM E84.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Panasonic Industrial Devices Sales Company of America; division of Panasonic Corporation of America]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Panasonic Industrial Devices Sales Company of America; division of Panasonic Corporation of America]**
 - b. **<Insert manufacturer's name>**

2.16 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[AGM Industries, Inc]**
 - b. **[Gemco]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[AGM Industries, Inc]**
 - b. **[Gemco]**
 - c. **<Insert manufacturer's name>**
 3. Plate: Perforated, galvanized carbon-steel sheet, **0.030 inch (0.762 mm)** thick by **2 inches (50 mm)** square.
 4. Spindle: Copper-coated, low-carbon steel; fully annealed; **0.105 inch (2.67 mm)** in diameter; length to suit depth of insulation.
- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**

following]:

- a. **[Gemco]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Gemco]**
 - b. **<Insert manufacturer's name>**
 3. Angle: Formed from **0.030-inch- (0.762-mm-)** thick, perforated, galvanized carbon-steel sheet with each leg **2 inches (50 mm)** square.
 4. Spindle: Copper-coated, low-carbon steel; fully annealed; **0.105 inch (2.67 mm)** in diameter; length to suit depth of insulation.
- C. Insulation-Retaining Washers: Self-locking washers formed from **0.016-inch- (0.41-mm-)** thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than **1-1/2 inches (38 mm)** square or in diameter.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[AGM Industries, Inc]**
 - b. **[Gemco]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[AGM Industries, Inc]**
 - b. **[Gemco]**
 - c. **<Insert manufacturer's name>**
 3. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Crawl spaces.
 - b. Ceiling plenums.
 - c. Attic spaces.
 - d. **<Insert location>**.
- D. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain airspace of **[1 inch (25 mm)][2 inches (50 mm)][3 inches (76 mm)]** between face of insulation and substrate to which anchor is attached.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. **[Gemco]**
 - b. **<Insert manufacturer's name>**
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Gemco]**
 - b. **<Insert manufacturer's name>**
- E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[AGM Industries, Inc]**
 - b. **[Gemco]**
 - c. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[AGM Industries, Inc]**
 - b. **[Gemco]**
 - c. **<Insert manufacturer's name>**
- F. Insulation Fastener Accessories: Provide double-pointed weld pins, lagging pins, quilting pins, duct liner pins, insulation hangers, specialty washers, special caps, j-hooks, capacitor discharge annular weld pins, capacitor discharge acoustical lagging pins, and other accessory materials that are recommended in writing by insulation fastener manufacturer to produce complete insulation supports.

2.17 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 - 1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
 - 2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
 - 3. Polyurethane Pour-In-Place Insulation: Closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84, specifically formulated for pour-in-place applications.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1) **[Huntsman Building Solutions]**
 - 2) **<Insert manufacturer's name>**

- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- 1) **[Huntsman Building Solutions]**
- 2) **<Insert manufacturer's name>**

B. Miscellaneous Application Accessories:

1. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
2. Crack Sealer: Closed-cell insulating foam in aerosol dispenser recommended in writing by insulation manufacturer for filling gaps in board insulation.
3. Curtain-Wall Insulation Clips: Z-shaped galvanized steel as recommended in writing by insulation manufacturer.
4. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.
5. Detailing Foam Insulation for Voids: Urethane foam complying with AAMA 812, low expansion pressure suitable for filling insulation gaps and voids adjacent to openings to protect against water, air, and sound intrusion.
6. Tapes for Reflective Insulation and Barriers:
 - a. Aluminum-foil tape for repairs or splicing material.
 - b. Double-sided tape for adhering to metal framing or overlapping material.
 - c. Reinforced-foil tape for sealing tears or cuts in sheet vapor barrier.
7. Clip-and-Pin Components:
 - a. Beam/Bar Joist Clips: For beams, bar joists, and Z-type purlins.
 - b. C-Purlin Clips: For C-type purlins.
 - c. Angle Clips: For sidewalks and floors.
 - d. Tube Clips: For wood beams and metal tubular framing.
 - e. Locking Washers: Aluminum; white to match reflective bubble insulation facing colors.
8. Wire Mesh Lath Support for Insulation: ASTM C1032.
 - a. Material: Woven wire lath **1-1/2-inch (38-mm)** hexagonal-shaped mesh with minimum **0.0510-inch- (1.3-mm-)** diameter, galvanized-steel wire.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or those that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products, applications and

applicable codes.

- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive in accordance with manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of **[24 inches (610 mm)][36 inches (915 mm)]<Insert dimension>** below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units in accordance with manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of **[24 inches (610 mm)][36 inches (915 mm)]<Insert dimension>** in from exterior walls.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive in accordance with anchor manufacturer's written instructions.
 - 2. Space anchors in accordance with insulation manufacturer's written instructions for insulation type, thickness, and application.
 - 3. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.
 - 4. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
 - 5. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.
- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing in accordance with manufacturer's written instructions.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately **24 inches (610 mm)** o.c. both ways on inside face and as recommended in writing by manufacturer.
1. Fit courses of insulation between[**wall ties and other**] obstructions, with edges butted tightly in both directions, and with faces flush.
 2. Press units firmly against inside substrates.
 3. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."
- B. Cellular-Glass Structural Insulating Blocks:
1. Verify manufacturer-recommended cure time for air and water barrier system and waterproofing before installing structural insulating block.
 2. Install a single layer of cellular-glass structural insulating block with facers on top and bottom surfaces fully embedded into mortar set on brick ledge in accordance with manufacturer's written instructions.
 3. Install cellular-glass structural insulating block maximum sizes to minimize joints.
 4. Locate joints square to framing members. Do not cantilever cellular-glass structural insulating block.
 5. Butt joints of cellular-glass structural insulating block with no gaps or mortar between joints.
 6. Insulation board edges are to be butted together tightly and fit around openings and penetrations. Install square edges to fit square and tight.
 7. Extend insulation in single course to cover entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Do not drill.
- C. Mineral-Wool Board Insulation: Install insulation fasteners **4 inches (100 mm)** from each corner of board insulation, at center of board, and as recommended by manufacturer.
1. Fit courses of insulation between[**masonry wall ties and other**] obstructions, with edges butted tightly in both directions, and with faces flush.
 2. Press units firmly against inside substrates.

3.6 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members in accordance with the following requirements:
1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 3. Maintain **3-inch (76-mm)** clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 5. For metal-framed wall cavities where cavity heights exceed **96 inches (2438 mm)**, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 6. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install unfaced blanket insulation over ceiling area in thickness indicated. Where partitions occur, extend insulation up either side of partition.
 7. For wood-framed construction, install blankets in accordance with ASTM C1320 and as follows:

- a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
 - 8. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
 - a. Exterior Walls: Set units with facing placed toward **[exterior of construction][interior of construction][as indicated on Drawings]**.
 - b. Interior Walls: Set units with facing placed **[as indicated on Drawings][toward areas of high humidity]<Insert location>**.
 - B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately **2.5 lb/cu. ft. (40 kg/cu. m)**.
 - 2. Detailing Foam Insulation for Voids: Apply in accordance with manufacturer's written instructions.
 - C. Loose-Fill Insulation: Apply in accordance with ASTM C1015 and manufacturer's written instructions.
 - 1. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.
 - 2. For cellulosic-fiber loose-fill insulation, comply with CIMA's Technical Bulletin #2, "Standard Practice for Installing Cellulose Building Insulation."
 - D. Spray-Applied Cellulosic Insulation: Apply spray-applied insulation in accordance with manufacturer's written instructions.
 - 1. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked.
 - 2. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.
- 3.7 INSTALLATION OF BOARD INSULATION
- A. Install board insulation in accordance with manufacturer's written instructions per project applications and conditions.
- 3.8 INSTALLATION OF REFLECTIVE AND RADIANT BARRIERS INSULATION
- A. Install sheet reflective insulation in accordance with ASTM C727.
 - B. Install sheet radiant barriers in accordance with ASTM C1744.
 - C. Install interior radiation control coating system in accordance with ASTM C1321.
- 3.9 INSTALLATION OF VACUUM INSULATION
- A. Install vacuum insulation panels in accordance with manufacturer's written instructions.



07 - Thermal And Moisture Protection

3.10 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00 00



Task	Specification	Specification Description
07 21 13 13	07 51 13 00	Built-Up Asphalt Roofing
07 21 13 13	07 01 50 81	Built-Up Coal Tar Roofing
07 21 13 13	07 52 13 00	Atactic-Polypropylene (APP) Modified Bituminous Membrane Roofing
07 21 13 13	07 52 16 00	Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing
07 21 13 13	07 53 16 00	Chlorosulfonate-Polyethylene (CSPE) Roofing
07 21 13 13	07 53 23 00	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing
07 21 13 16	07 51 13 00	Built-Up Asphalt Roofing
07 21 13 16	07 01 50 81	Built-Up Coal Tar Roofing
07 21 13 16	07 52 13 00	Atactic-Polypropylene (APP) Modified Bituminous Membrane Roofing
07 21 13 16	07 52 16 00	Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing
07 21 13 16	07 53 16 00	Chlorosulfonate-Polyethylene (CSPE) Roofing
07 21 13 16	07 53 23 00	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing
07 21 13 19	07 51 13 00	Built-Up Asphalt Roofing
07 21 13 19	07 01 50 81	Built-Up Coal Tar Roofing
07 21 13 19	07 52 13 00	Atactic-Polypropylene (APP) Modified Bituminous Membrane Roofing
07 21 13 19	07 52 16 00	Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing
07 21 13 19	07 53 16 00	Chlorosulfonate-Polyethylene (CSPE) Roofing
07 21 13 19	07 53 23 00	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing
07 21 16 00	07 21 00 00	Thermal Insulation



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SECTION 07 21 19 00 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Closed-cell spray polyurethane foam insulation.
2. Open-cell spray polyurethane foam insulation.

B. Related Requirements:

1. Section 072100 "Thermal Insulation" for foam-plastic board insulation.
2. Section 075700 "Coated Foamed Roofing" for spray polyurethane foam insulation used for roofing applications.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Manufacturer Inventory: For each product, provide manufacturer's manifest of ingredients.
2. Manufacturer Inventory: Provide manufacturer's ingredient inventory.
3. Health Product Declaration (HPD): Provide documentation confirming product compliance with one of the following:
 - a. Inventory or HPD to at least 0.01 percent by weight, with at least 95 percent assessed using GreenScreen Benchmark assessment.
 - b. Cradle to Cradle v3 certification with minimum Silver level of Material Health.
 - c. Living Product Challenge certification indicating achievement of Imperative 09, "Transparent Material Health."
4. Product Data: For insulation, indicating that R-values comply with tables in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air Conditioning.
5. Laboratory Test Reports: For insulation, indicating compliance with the VOC emissions evaluation.
6. Laboratory Test Reports: For insulation, indicating compliance with requirements for low-emitting materials.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality control reports.

B. Qualification Statements: For Installer.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM INSULATION

- A. Closed-Cell Spray Polyurethane Foam: ASTM C1029.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[AMBIT Polyurethane]**
 - b. **[Carlisle Spray Foam Insulation]**
 - c. **[ENVERGE]**
 - d. **[Gaco; Holcim Building Envelope]**
 - e. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - f. **[Huntsman Building Solutions]**
 - g. **[Johns Manville; a Berkshire Hathaway company]**
 - h. **[NCFI Polyurethanes; a division of Barnhardt Manufacturing Company]**
 - i. **[Quadrant Performance Materials]**
 - j. **[SWD Urethane Company]**
 - k. **[Thermoseal USA]**
 - l. **[Volatile Free, Inc.]**
 - m. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[AMBIT Polyurethane]**
 - b. **[Carlisle Spray Foam Insulation]**
 - c. **[ENVERGE]**
 - d. **[Gaco; Holcim Building Envelope]**
 - e. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - f. **[Huntsman Building Solutions]**
 - g. **[Johns Manville; a Berkshire Hathaway company]**
 - h. **[NCFI Polyurethanes; a division of Barnhardt Manufacturing Company]**
 - i. **[Quadrant Performance Materials]**
 - j. **[SWD Urethane Company]**
 - k. **[Thermoseal USA]**
 - l. **[Volatile Free, Inc.]**
 - m. **<Insert manufacturer's name>**
3. Type and Minimum Compressive Strength:
 - a. Type II, minimum density of **[1.5 lb/cu. ft. (24 kg/cu. m)]<Insert density>** and minimum aged R-value at 1-inch (25.4-mm) thickness of **6.2 deg F x h x sq. ft./Btu at 75 deg F**

(43 K x sq. m/W at 24 deg C).

4. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: **[25][75]<Insert value>** or less.
 - b. Smoke-Developed Index: **[450]<Insert value>** or less.
 - c. Fire-Propagation Characteristics: Passes **[NFPA 285][and][NFPA 276]** testing as part of an approved assembly.
5. Fire-Safety Barriers: Approved assembly as **[thermal barrier][and][ignition barrier]** with accessory components.

2.2 OPEN-CELL SPRAY POLYURETHANE FOAM INSULATION

- A. Open-Cell Spray Polyurethane Foam: Spray-applied polyurethane foam using water as a blowing agent.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[AMBIT Polyurethane]**
 - b. **[Carlisle Spray Foam Insulation]**
 - c. **[ENVERGE]**
 - d. **[Gaco; Holcim Building Envelope]**
 - e. **[General Coatings Manufacturing Corp.]**
 - f. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - g. **[Huntsman Building Solutions]**
 - h. **[Johns Manville; a Berkshire Hathaway company]**
 - i. **[NCFI Polyurethanes; a division of Barnhardt Manufacturing Company]**
 - j. **[Quadrant Performance Materials]**
 - k. **[SWD Urethane Company]**
 - l. **[Thermoseal USA]**
 - m. **[UPC; a General Coatings Manufacturing Corp. brand]**
 - n. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[AMBIT Polyurethane]**
 - b. **[Carlisle Spray Foam Insulation]**
 - c. **[ENVERGE]**
 - d. **[Gaco; Holcim Building Envelope]**
 - e. **[General Coatings Manufacturing Corp.]**
 - f. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - g. **[Huntsman Building Solutions]**
 - h. **[Johns Manville; a Berkshire Hathaway company]**
 - i. **[NCFI Polyurethanes; a division of Barnhardt Manufacturing Company]**
 - j. **[Quadrant Performance Materials]**
 - k. **[SWD Urethane Company]**
 - l. **[Thermoseal USA]**

- m. **[UPC; a General Coatings Manufacturing Corp. brand]**
 - n. **<Insert manufacturer's name>**
3. Type and Minimum Compressive Strength:
- a. Minimum density of **[0.4 lb/cu. ft. (6.4 kg/cu. m)]<Insert density>** and minimum aged R-value at **1-inch (25.4-mm)** thickness of **3.4 deg F x h x sq. ft./Btu at 75 deg F (24 K x sq. m/W at 24 deg C)**.
4. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- a. Flame-Spread Index: **[25][75]<Insert value>** or less.
 - b. Smoke-Developed Index: **[450]<Insert value>** or less.
5. Fire-Propagation Characteristics: Passes **[NFPA 285][and][NFPA 276]** testing as part of an approved assembly.
6. Fire-Safety Barriers: Approved assembly as **[thermal barrier][and][ignition barrier]** with accessory components.

2.3 ACCESSORIES

- A. Prescriptive Thermal Barriers: Building-code-approved materials.
- 1. Gypsum Board: **1/2-inch (12.7-mm)** minimum thickness.
 - 2. Wood Structural Panels: **23/32-inch (18.2-mm)** thickness.
 - 3. Plywood: Nominal **1/2-inch (12.7-mm)** minimum thickness.
 - 4. Heavy timber in accordance with the IBC.
- B. Alternate Thermal Barriers: Assembly consisting of foam insulation with applied fire-protective intumescent coating.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Flame Control Coatings, a brand of Seal for Life Industries]**
 - b. **[Flame Control Coatings, LLC]**
 - c. **[International Fireproof Technology Inc]**
 - d. **[No-Burn, Inc.]**
 - e. **[TPR2 Corporation]**
 - f. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Flame Control Coatings, a brand of Seal for Life Industries]**
 - b. **[Flame Control Coatings, LLC]**
 - c. **[International Fireproof Technology Inc]**
 - d. **[No-Burn, Inc.]**
 - e. **[TPR2 Corporation]**
 - f. **<Insert manufacturer's name>**

3. Fire-Performance Requirements: Materials as an equivalent assembly must pass the following fire test:
 - a. NFPA 286 Fire Integrity Test: Ensures material remains in place for 15 minutes during specified large-scale fire tests. This could include UL 1715, UL 1040 or FM 4880.
 4. Components:
 - a. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.
 - b. Fire-Protective Intumescent Coatings: Coating formulated for application over polyurethane foam plastics in thicknesses listed in compliance with the ICC-ES report.
 - c. **<Insert component>**.
- C. Equivalent Thermal Barriers: Assembly consisting of foam insulation with applied fire-protective intumescent coating.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Firestable Insulation Company]**
 - b. **[International Cellulose Corp.]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Firestable Insulation Company]**
 - b. **[International Cellulose Corp.]**
 - c. **<Insert manufacturer's name>**
 3. Fire-Performance Requirements: Material or equivalent assembly is in compliance with the following two fire tests:
 - a. ASTM E119 Temperature Transmission Fire Test: Average temperature rise of the unexposed surface less than **250 deg F (120 deg C)** after 15 minutes of fire exposure in accordance with ASTM E119 or UL 263.
 - b. NFPA 286 Fire Integrity Test: Ensures material remain in place for 15 minutes during specified large-scale fire tests such as NFPA 286.
 - c. NFPA 275: Combination of both ASTM E119 and NFPA 275 fire tests.
 4. Components:
 - a. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.
 - b. Fire-Protective Intumescent Coatings: Coating formulated for application over polyurethane foam plastics in thicknesses listed in compliance with the ICC-ES report.
 - c. **<Insert component>**.
- D. Prescriptive Ignition Barriers: Building-code-approved materials.
1. Mineral-Fiber Insulation: **1-1/2-inch (38-mm)** minimum thickness.
 2. Wood Structural Panel or Hardboard: **1/4-inch (6-mm)** minimum thickness.

3. Particleboard: **0.325-inch (9.5-mm)** minimum thickness.
 4. Gypsum Wallboard: **0.325-inch (9.5-mm)** minimum thickness.
 5. Corrosion-Resistant Steel: **0.016-inch (0.4-mm)** base metal thickness.
 6. Cellulose Insulation: **1-1/2-inch (38-mm)** minimum thickness, self-supported spray-applied; for attic spaces only.
- E. Alternative Ignition Barriers: Assembly consisting of foam insulation with applied fire-protective intumescent coating.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[ENVERGE]**
 - b. **[Flame Seal Products, Inc.]**
 - c. **[No-Burn, Inc.]**
 - d. **[TPR2 Corporation]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ENVERGE]**
 - b. **[Flame Seal Products, Inc.]**
 - c. **[No-Burn, Inc.]**
 - d. **[TPR2 Corporation]**
 - e. **<Insert manufacturer's name>**
 3. Fire-Performance Requirements:
 - a. Fire-protective coating formulated for application over polyurethane foam plastics, compatible with insulation, and in compliance with ICC-ES AC377, Appendix X.
 - b. ASTM E970 radiant heat flux test.
 4. Components:
 - a. Fire-Protective Intumescent Coatings: Coating formulated for application over polyurethane foam plastics in thicknesses listed in compliance with the ICC-ES report.
 - b. **<Insert component>**.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.
- B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION OF FOAMED-IN-PLACE INSULATION

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Spray insulation to envelop entire area to be insulated and fill voids.
- C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
- D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.
- E. Cavity Walls: Install into cavities to **[thickness indicated on Drawings][fully fill void]**.
- F. Miscellaneous Voids: Apply according to manufacturer's written instructions.
- G. Install **[thermal][ignition]** barrier material.
 - 1. Do not cover insulation prior to any required spray foam insulation inspections.
- H. Apply barrier coatings in accordance with manufacturer's written instructions and to comply with requirements for listing and labeling for fire-propagation characteristics and surface-burning characteristics specified.
 - 1. Use equipment and techniques best suited for substrate and type of material applied as recommended by coating manufacturer.
 - 2. Apply coatings to prepared surfaces as soon as practical after preparation and before subsequent surface soiling or deterioration.
 - 3. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Produce sharp lines and color breaks.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect spray foam insulation installation, including accessories. Report results in writing.

3.4 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION 07 21 19 00

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07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 21 23 00	07 21 00 00	Thermal Insulation
07 21 26 00	07 21 00 00	Thermal Insulation
07 21 29 00	07 21 00 00	Thermal Insulation
07 22 16 00	07 51 13 00	Built-Up Asphalt Roofing
07 22 16 00	07 01 50 81	Built-Up Coal Tar Roofing
07 22 16 00	07 52 13 00	Atactic-Polypropylene (APP) Modified Bituminous Membrane Roofing
07 22 16 00	07 52 16 00	Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing
07 22 16 00	07 53 16 00	Chlorosulfonate-Polyethylene (CSPE) Roofing
07 22 16 00	07 53 23 00	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing



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SECTION 07 24 13 00 - POLYMER-BASED EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Polymer-based exterior insulation and finish system (EIFS).
 - 1. EIFS-clad barrier-wall assemblies that are field applied over substrate.
 - 2. Prefabricated panels consisting of EIFS-clad barrier-wall assemblies that are shop applied over sheathing on metal framing.
- B. Related Requirements:
 - 1. Section 072419 "Water-Drainage Exterior Insulation and Finish System (EIFS)" for EIFS-clad drainage-wall assemblies.
 - 2. Section 072600 "Vapor Retarders" for wall sheet vapor retarders.
 - 3. Section 072713 "Modified Bituminous Sheet Air Barriers" for self-adhering sheet air barriers composed of bituminous materials applied over sheathing behind mechanically fastened EIFS.
 - 4. Section 072715 "Nonbituminous Self-Adhering Sheet Air Barriers" for self-adhering sheet air barriers composed of nonbituminous polymers applied over sheathing behind mechanically fastened EIFS.
 - 5. Section 072726 "Fluid-Applied Membrane Air Barriers" for fluid-applied, synthetic polymer air barriers applied over sheathing behind EIFS-clad wall assemblies.
- C. Products furnished, but not installed, under this Section include connections and other attachment devices for prefabricated panels to be **[cast in concrete][embedded in masonry assemblies]**.

1.2 DEFINITIONS

- A. Definitions in ASTM E2110 apply to Work of this Section.
- B. EIFS: Exterior insulation and finish system(s).
- C. IBC: International Building Code.
- D. Polymer-Based Exterior Insulation and Finish System: Class PB EIFS, as defined in ASTM E2568.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.4 ACTION SUBMITTALS

- A. Product Data: For each EIFS component, trim, and accessory.
- B. Sustainable Design Submittals:



1. Manufacturer Inventory: For each product, provide manufacturer's manifest of ingredients.
 2. Manufacturer Inventory: Provide manufacturer's ingredient inventory.
 3. Health Product Declaration (HPD): Provide documentation confirming product compliance with one of the following:
 - a. Inventory or HPD to at least 0.01 percent by weight, with at least 95 percent assessed using GreenScreen Benchmark assessment.
 - b. Cradle to Cradle v3 certification with minimum Silver level of Material Health.
 - c. Living Product Challenge certification indicating achievement of Imperative 09, "Transparent Material Health."
 4. Product Data: For insulation, indicating that R-values comply with tables in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air Conditioning."
 5. Laboratory Test Reports: For Insulation, indicating compliance with requirements for low-emitting materials.
 6. Laboratory Test Reports: For insulation, indicating compliance with requirements for low-emitting materials.
 7. Laboratory Test Reports: For insulation, indicating compliance with requirements for low-emitting materials.
 8. Laboratory Test Reports: For insulation, indicating compliance with requirements for low-emitting materials.
- C. Health Product Declaration (HPD): Provide documentation indicating that manufacturer has screened and publicly provided ingredient disclosure to 1000 ppm, and has developed an action plan to mitigate known hazards.
- D. Shop Drawings: For prefabricated EIFS panels.
1. Include plans, elevations, sections, details of components including build-outs, details of penetrations and terminations, flashing details, joint locations and configurations, lifting points, fastening and anchorage details including mechanical fasteners, and connections and attachments to other work.
- E. Panel Schedule: For prefabricated panel fabrication.
- F. Samples: For each exposed product and for each color and texture specified, **[8 inches (200 mm) square]<Insert dimension and shape>** in size.
- G. Samples for Initial Selection: For each type of finish-coat color and texture indicated.
1. Include similar Samples of exposed accessories involving color selection.
- H. Samples for Verification: **24-inch- (600-mm-)** square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work, including **[custom trim, each profile],[and][an aesthetic reveal]**.
1. Include **[exposed trim and accessory]<Insert item>** Samples to verify color selected.
 2. Include a typical control joint filled with sealant of color selected, as specified in Section 079200 "Joint Sealants."
- I. Delegated Design Submittal: For prefabricated EIFS panels.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[Installer][fabricator/erector]**.
- B. Manufacturer Certificates: Signed by EIFS manufacturer, certifying the following:
 - 1. EIFS substrate is acceptable to EIFS manufacturer.
 - 2. Accessory products installed with EIFS, including **[joint sealants,][flashing,][water-resistant barriers,][trim,]<Insert accessory>** whether or not furnished by EIFS manufacturer and whether or not specified in this Section, are acceptable to EIFS manufacturer.
- C. Product Certificates: For **[cementitious materials and aggregates and for]** insulation, from manufacturer.
- D. Product Test Reports: For each EIFS assembly and component, for tests performed by a qualified testing agency.
- E. Field quality-control reports.
- F. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For EIFS to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: **[An installer who is certified in writing by AWCI International as qualified to install Class PB EIFS using trained workers]<Insert requirements>**.
- B. Fabricator/Erector Qualifications: Certified in writing by EIFS manufacturer as qualified to fabricate and erect manufacturer's prefabricated panel system using skilled and trained workers.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, to set quality standards for materials and execution, and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.
- B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.

1. Stack insulation board flat and off the ground.
2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1. Proceed with installation of adhesives or coatings only when ambient temperatures have remained, or are forecast to remain, above **40 deg F (4.4 deg C)** for a minimum of 24 hours before, during, and after application. Do not apply EIFS adhesives or coatings during rainfall.

1.10 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of EIFS that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Bond integrity and weathertightness.
 - b. Deterioration of EIFS finishes and other EIFS materials beyond normal weathering.
2. Warranty coverage includes the following EIFS components:
 - a. EIFS finish, including base coats, finish coats, and reinforcing mesh.
 - b. Insulation installed as part of EIFS[, **including buildouts**].
 - c. Insulation adhesive[**and mechanical fasteners**].
 - d. EIFS accessories, including trim components and flashing.
3. Warranty Period: [**Five**][**10**]**<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 POLYMER-BASED EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

- A. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

1. [**Corev America, Inc**]
2. [**Dryvit Systems, Inc.**]
3. [**Dryvit, part of Tremco CPG**]
4. [**Finestone, a Sika brand**]
5. [**Master Wall Inc.**]
6. [**Omega Products International, Inc.**]

7. [Parex, a Sika brand]
8. [Senergy; a SIKA brand]
9. [Sto Corp.]
10. [Stuc-O-Flex International, Inc.]
11. [Total Wall, Inc.]
12. <Insert manufacturer's name>

- B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [Corev America, Inc]
2. [Dryvit Systems, Inc.]
3. [Dryvit, part of Tremco CPG]
4. [Finestone, a Sika brand]
5. [Master Wall Inc.]
6. [Omega Products International, Inc.]
7. [Parex, a Sika brand]
8. [Senergy; a SIKA brand]
9. [Sto Corp.]
10. [Stuc-O-Flex International, Inc.]
11. [Total Wall, Inc.]
12. <Insert manufacturer's name>

- C. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as tested and compatible with EIFS components.

2.2 PERFORMANCE REQUIREMENTS

- A. EIFS Performance: Comply with ASTM E2568 and with the following:

1. Weathertightness: Resistant to water penetration from exterior.
2. System Fire Performance: [**Fire-resistance rating of wall assembly**][**Full-scale multistory fire test**].
3. Structural Performance of Assembly and Components:
 - a. Wind Loads:
 - 1) Uniform pressure of <Insert lbf/sq. ft. (Pa)>, acting inward or outward.
 - 2) Uniform pressure as indicated on Drawings.
4. Impact Performance: ASTM E2568, [**Standard**][**Medium**][**High**][**Ultra High**] impact resistance[**unless otherwise indicated**].
5. Abrasion Resistance of Finish Coat: Sample consisting of **1-inch- (25.4-mm-)** thick EIFS mounted on **1/2-inch- (12.7-mm-)** thick gypsum board; cured for a minimum of 28 days and shows no cracking, checking, or loss of film integrity after exposure to **528 quarts (500 L)** of sand when tested in accordance with ASTM D968, Method A.
6. Mildew Resistance of Finish Coat: Sample applied to **2-by-2-inch (50.8-by-50.8-mm)** clean glass substrate; cured for 28 days and shows no growth when tested in accordance with ASTM D3273 and evaluated in accordance with ASTM D3274.

- B. Performance of Prefabricated Panels: EIFS to be designed as follows and withstand the structural performance indicated for Class PB EIFS and thermal movement limits indicated below without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design prefabricated panels, including comprehensive engineering analysis, using performance requirements and design criteria indicated.
2. Structural Performance: EIFS must withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated in accordance with [ASCE/SEI 7]<Insert requirement>:
 - a. Wind Loads:
 - 1) Uniform pressure of <Insert lbf/sq. ft. (Pa)>, acting inward or outward.
 - 2) Uniform pressure as indicated on Drawings.
3. Deflection Limits: Design prefabricated panels to withstand design loads without deflections greater than [1/240]<Insert deflection limits>.
4. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change: [100 deg F (55 deg C)]<Insert temperature change>.

2.3 EIFS MATERIALS

- A. Prefabricated Panels: Comply with requirements in Section 054000 "Cold-Formed Metal Framing" for metal framing supporting sheathing beneath EIFS and Section 061600 "Sheathing" for sheathing and sheathing joint treatment.
- B. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.
- C. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; compatible with substrate and complying with [one of] the following:
 1. Job-mixed formulation of portland cement, complying with ASTM C150/C150M, Type I, and polymer-based adhesive specified for base coat.
 2. Factory-blended dry formulation of portland cement, dry polymer admixture, and fillers specified for base coat.
 3. Factory-mixed noncementitious formulation designed for adhesive attachment of insulation to substrates of type indicated, as recommended by EIFS manufacturer.
 4. Adhesives shall have a VOC content of [50]<Insert value> g/L or less.
 5. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 6. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 7. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 8. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

9. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- D. Molded, (Expanded) Rigid Cellular Polystyrene Board Insulation: Comply with ASTM E2430/E2430M, unless otherwise noted, and the following:
1. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, in accordance with ASTM E84.
 2. Dimensions: Provide insulation boards of not more than **24 by 48 inches (610 by 1219 mm)**, with thickness indicated on Drawings.
 3. Foam Buildouts: Provide with profiles and dimensions indicated on Drawings.
- E. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multi-end strands with retained mesh tensile strength of not less than **120 lbf/in. (21 dN/cm)** in accordance with ASTM E2098/E2098M and the following:
1. Reinforcing Mesh for EIFS, General: Not less than weight required to comply with impact-performance level specified in "Performance Requirements" Article.
 2. Strip-Reinforcing Mesh: Not less than **[3.75 oz./sq. yd. (127 g/sq. m)]****[As recommended by EIFS manufacturer]<Insert weight>**.
 3. Detail-Reinforcing Mesh: Not less than **[4.0 oz./sq. yd. (136 g/sq. m)]****[As recommended by EIFS manufacturer]<Insert weight>**.
 4. Corner-Reinforcing Mesh: Not less than **[7.2 oz./sq. yd. (244 g/sq. m)]****[As recommended by EIFS manufacturer]<Insert weight>**.
- F. Base Coat: EIFS manufacturer's standard mixture complying with **[one of]** the following:
1. Job-mixed formulation of portland cement complying with ASTM C150/C150M, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
 2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
 3. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.
 4. Factory-mixed noncementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.
 5. Adhesives shall have a VOC content of **[50]<Insert value> g/L** or less.
 6. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 7. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 8. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 9. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 10. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical

Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

- G. Water-Resistant Base Coat: EIFS manufacturer's standard waterproof formulation complying with[**one of**] the following:
1. Job-mixed formulation of portland cement complying with ASTM C150/C150M, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
 2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
 3. Adhesives shall have a VOC content of [50]<Insert value> g/L or less.
 4. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 5. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 6. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 7. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 8. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- H. Mechanical Fasteners: EIFS manufacturer's standard corrosion-resistant fasteners, consisting of thermal cap, standard washer and shaft attachments, and fastener indicated below; designed to resist Project's design loads; capable of pulling fastener head below surface of insulation board; and complying with the following:
1. For attachment to steel studs from **0.033 to 0.112 inch (0.84 to 2.84 mm)** in thickness, provide steel drill screws complying with ASTM C954.
 2. For attachment to light-gage steel framing members not less than **0.0179 inch (0.45 mm)** in thickness, provide steel drill screws complying with ASTM C1002.
 3. For attachment to wood framing members and plywood sheathing, provide steel drill screws complying with ASTM C1002, Type W.
 4. For attachment to masonry and concrete substrates, provide sheathing dowel in form of a plastic wing-tipped fastener with thermal cap, sized to fit insulation thickness indicated and to penetrate substrate to depth required to secure anchorage.
 5. For attachment to <Insert substrate>, provide manufacturer's standard fasteners suitable for substrate.
- I. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
1. VOC Content: [250]<Insert value> g/L or less.
 2. Low-Emitting Materials: Coatings shall comply with the testing and product requirements of the

- California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 3. VOC Content: **[100]<Insert value>** g/L or less.
 4. Low-Emitting Materials: Coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 5. VOC Content: **[100]<Insert value>** g/L or less.
 6. Low-Emitting Materials: VOC emissions of coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 7. VOC Content: **[100]<Insert value>** g/L or less.
 8. Low-Emitting Materials: Coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 9. VOC Emissions: Coatings shall contain no more than half of the chronic REL of VOCs when tested according to the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- J. Finish Coat: EIFS manufacturer's **[standard acrylic-based coating][standard acrylic-based coating with enhanced mildew resistance][siliconized acrylic-based coating][elastomeric coating]<Insert coating>** complying with the following:
1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
 2. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, and fillers used with stone particles for embedding in finish coat to produce an applied-aggregate finish.
 - a. Aggregate: Marble chips of size and color **[as indicated by manufacturer's designations][to match Architect's sample][as selected by Architect from manufacturer's full range of industry colors and color densities]**.
 3. Colors: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]**.
 4. Textures: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]**.
- K. Sealer: Manufacturer's waterproof, clear acrylic-based sealer for protecting finish coat.
- L. Water: Potable.
- M. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D1784 and ASTM C1063.
1. Casing Bead: Prefabricated, one-piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
 2. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation, with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
 3. Expansion Joint: Closed-cell polyethylene backer rod and elastomeric sealant, **3/4-inch (19-mm)**

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minimum.

4. Windowsill Flashing: Prefabricated type for both flashing and sloping sill over framing beneath windows; with end and back dams; designed to direct water to exterior.
5. Parapet Cap Flashing: Type for both flashing and covering parapet top, with design complying with ASTM C1397[**and ANSI/SPRI/FM 4435/ES-1**].

2.4 MIXING

- A. Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials, except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

2.5 PANEL FABRICATION

- A. Panel Framing: Fabricate panel framing to comply with requirements in Section 054000 "Cold-Formed Metal Framing."
 1. Connect panel framing by welding unless otherwise indicated.
 2. Connections: Provide connections capable of adjustment, complying with erection tolerance requirements, to anchor panels to structure.
- B. Sheathing: Install on metal framing to comply with requirements in Section 061600 "Sheathing."
- C. EIFS Application: Apply EIFS to sheathed metal-framed panels to comply with requirements in "Substrate Protection Application," "Trim Installation," "Insulation Installation," "Base-Coat Application," and "Finish-Coat Application" articles and as follows:
 1. Wrap base coat and reinforcing mesh at edges of panels, and extend coverage not less than **[4 inches (100 mm) over backs of panels][full thickness to cover edges of metal framing]** unless otherwise indicated.
 2. Continue finish coat around corners at edges of panels unless otherwise indicated, and extend to location indicated for sealant application. Do not extend finish coat over surfaces where sealant is applied.
 3. Continue finish coat around corners at edges of panels, and extend over edges to cover base coat unless otherwise indicated.
- D. Panel Fabrication Tolerances: Comply with the following:
 1. Overall Height and Width: Plus or minus **[1/8 inch (3 mm)]<Insert dimension>**.
 2. Cumulative Height and Width over Length of Building: Not more than **[3/8 inch (10 mm)]<Insert dimension>**.
 3. Openings within One Unit: Plus or minus **[1/8 inch (3 mm)]<Insert dimension>** for window and door frames.
 4. Out of Square: Plus or minus **[1/8 inch (3 mm)]<Insert dimension>**.
 5. Locations of Reveals and Architectural Features: Plus or minus **[1/8 inch (3 mm)]<Insert dimension>**.
 6. Thickness: Plus or minus **[1/16 inch (1.5 mm)]<Insert dimension>**.
 7. Flatness: Not more than **[1/8 inch in 8 feet (3 mm in 2.5 m)]<Insert dimensions>** across face of panel.

2.6 SOURCE QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform shop tests and inspections indicated below and to prepare test reports:
1. Shop welds are subject to testing and inspection.
 2. Testing and inspecting agency will interpret tests and report whether tested Work complies with or deviates from requirements.
 3. Correct deficiencies in or replace EIFS prefabricated panels that test reports and inspections indicate do not comply with requirements.
 4. Additional testing and inspection, at Contractor's expense, will be performed to determine compliance of corrected Work with requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Begin coating application only after surfaces are dry.
 2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.
- B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind EIFS and deterioration of substrates.
- C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.
1. Concrete Substrates: Provide clean, dry, neutral-pH substrate for insulation installation. Verify suitability of substrate by performing bond and moisture tests recommended by EIFS manufacturer.

3.3 INSTALLATION OF EIFS, GENERAL

- A. Comply with ASTM C1397, ASTM E2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate.

3.4 APPLICATION OF SUBSTRATE PROTECTION

- A. Flexible-Membrane Flashing: Apply and lap to shed water; seal at openings, penetrations, and terminations. Prime substrates with flashing primer if required and install flashing.

3.5 INSTALLATION OF TRIM

- A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, **[at windowsills,]** and elsewhere as indicated. Coordinate with installation of insulation.
 - 1. Drip Screed/Track: Use at bottom edges of EIFS unless otherwise indicated.
 - 2. Windowsill Flashing: Use at windows unless otherwise indicated.
 - 3. Expansion Joint: Use where indicated on Drawings.
 - 4. Casing Bead: Use at other locations.
 - 5. Parapet Cap Flashing: Use where indicated on Drawings.
 - 6. **<Insert trim and requirements>.**

3.6 INSTALLATION OF INSULATION

- A. Board Insulation: **[Adhesively][Mechanically][Adhesively and mechanically]** attach insulation to substrate in compliance with ASTM C1397 and the following:
 - 1. Sheathing: Apply adhesive to insulation by notched-trowel method in a manner that results in coating the entire surface of sheathing with adhesive once insulation is adhered to substrate. Apply adhesive to a thickness of not less than **1/4 inch (6.4 mm)** for factory mixed and not less than **3/8 inch (10 mm)** for field mixed, measured from surface of insulation before placement.
 - 2. Concrete or Masonry: Apply adhesive by ribbon-and-dab method.
 - 3. Press and slide insulation into place. Apply pressure over entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.
 - 4. Allow adhered insulation to remain undisturbed for not less than 24 hours, before **[installing mechanical fasteners,]** beginning rasping and sanding insulation or before applying base coat and reinforcing mesh.
 - 5. Mechanically attach insulation to substrate. Install top surface of fastener heads flush with plane of insulation. Install fasteners into or through substrates with the following minimum penetration:
 - a. Steel Framing: **5/16 inch (8 mm).**
 - b. Wood Framing: **1 inch (25 mm).**
 - c. Concrete and Masonry: **1 inch (25 mm).**
 - 6. Apply insulation over dry substrates in courses, with long edges of boards oriented horizontally.
 - 7. Begin first course of insulation from a level base line and work upward.
 - 8. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
 - 9. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints, so no piece of insulation is less than **12 inches (300 mm)** wide or **6 inches (150 mm)** high. Offset joints not less than **6 inches (150 mm)** from corners of window and door openings **[and not less than 4 inches (100 mm) from aesthetic reveals].**
 - a. Adhesive Attachment: Offset joints of insulation not less than **6 inches (150 mm)** from horizontal and **4 inches (100 mm)** from vertical joints in sheathing.
 - b. Mechanical Attachment: Offset joints of insulation from horizontal joints in sheathing.

10. Interlock ends at internal and external corners.
11. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than **1/16 inch (1.6 mm)** occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
12. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
13. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than **1/32 inch (0.8 mm)** **1/16 inch (1.6 mm)** from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than **1/16 inch (1.6 mm)**. Prevent airborne dispersal and immediately collect insulation raspings or sandings.
14. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than **3/4 inch (19 mm)**.
15. Install foam buildouts and attach to structural substrate by **[adhesive][mechanical fastening][adhesive and mechanical fastening]**.
16. Interrupt insulation for expansion joints where indicated.
17. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
18. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.
19. Before installing insulation and before applying field-applied reinforcing mesh, fully wrap board edges. Cover edges of board and extend encapsulating mesh not less than **2-1/2 inches (64 mm)** over front and back face unless otherwise indicated on Drawings.
20. Treat exposed edges of insulation as follows:
 - a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
 - b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
 - c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.
21. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and EIFS lamina.

B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:

1. At expansion joints in substrates behind EIFS.
2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
3. At floor lines in multilevel wood-framed construction.
4. Where wall height or building shape changes.
5. Where EIFS manufacturer requires joints in long continuous elevations.
6. Where panels abut one another.

3.7 APPLICATION OF BASE COAT

- A. Water-Resistant Base Coat: Apply full-thickness coverage **[to exposed insulation and]** to exposed surfaces of **[sloped shapes][window sills][parapets][foam buildouts]<Insert location>** and to other surfaces indicated on Drawings.
- B. Base Coat: Apply full coverage to exposed insulation **[and foam buildouts]** with not less than **1/16-inch**

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(1.6-mm)]<Insert dimension> dry-coat thickness.

- C. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than **2-1/2 inches (64 mm)** or otherwise treated at joints to comply with ASTM C1397. Do not lap reinforcing mesh within **8 inches (200 mm)** of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.
- D. Double-Layer Reinforcing-Mesh Application: Where indicated or required, apply second base coat and second layer of reinforcing mesh, overlapped not less than **2-1/2 inches (64 mm)** or otherwise treated at joints to comply with ASTM C1397 in same manner as first application. Do not apply until first base coat has cured.
- E. Additional Reinforcing Mesh: Apply strip-reinforcing mesh around openings, extending **4 inches (100 mm)** beyond perimeter. Apply additional **9-by-12-inch (230-by-300-mm)** strip-reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply **8-inch- (200-mm-)** wide, strip-reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than **4 inches (100 mm)** on each side of corners.
 - 1. At aesthetic reveals, apply strip-reinforcing mesh not less than **8 inches (200 mm)** wide.
 - 2. Embed strip-reinforcing mesh in base coat before applying first layer of reinforcing mesh.
- F. Foam Buildouts: Fully embed reinforcing mesh in base coat.
- G. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application, except without reinforcing mesh. Do not apply until first base coat has cured.

3.8 APPLICATION OF FINISH COAT

- A. Primer: Apply over dry base coat.
- B. Finish Coat: Apply full-thickness coverage over dry **[primed]** base coat, maintaining a wet edge at all times for uniform appearance, to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.
 - 1. Embed aggregate in finish coat to produce a uniform applied-aggregate finish of color and texture matching approved sample.
- C. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.

3.9 INSTALLATION OF PREFABRICATED PANELS

- A. General: Install panels according to Shop Drawings. Install **[by welding metal framing to structural-steel frame][by welding to steel-weld plates anchored in concrete]<Insert requirements>** to comply with requirements in Section 054000 "Cold-Formed Metal Framing" unless otherwise indicated.
 - 1. Lift panels only as indicated on Shop Drawings.
 - 2. Do not warp or stress panels by forcing alignment.
 - 3. Adjust connections to align panels and maintain correct and uniform joint widths.
 - 4. Install bracing as panels are erected. Weld securely to panel framing and to structure.



- B. Erection Tolerances: Install panels level, plumb, and true to line with no variation in plane or alignment exceeding **1/16 inch (1.6 mm)** and no variation in position exceeding **1/8 inch (3 mm)**.
 - 1. Maintain clearance between panels required for installing joint sealants.

3.10 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. As stipulated in Ch. 17 of the IBC.
 - 2. **<Insert special inspections>**.
- B. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
- C. EIFS Tests and Inspections: In accordance with ASTM E2568 **<Insert tests and inspections>**.
- D. Prefabricated Panels: Test and inspect field welds.
- E. EIFS will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.11 CLEANING AND PROTECTION

- A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION 07 24 13 00



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SECTION 07 24 13 00A - WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Water-drainage exterior insulation and finish system (EIFS).
 - 1. EIFS-clad drainage-wall assemblies that are field applied over substrate.
 - 2. Water-resistive barrier coatings.
- B. Related Requirements:
 - 1. Section 072413 "Polymer-Based Exterior Insulation and Finish System (EIFS)" for EIFS-clad barrier-wall assemblies.
 - 2. Section 072500 "Weather Barriers" for water-resistant building paper or building wrap and flexible flashings installed over sheathing behind mechanically fastened EIFS.
 - 3. Section 072600 "Vapor Retarders" for wall sheet vapor retarders.
 - 4. Section 072713 "Modified Bituminous Sheet Air Barriers" for self-adhering sheet air barriers composed of bituminous materials applied over sheathing behind mechanically fastened EIFS.
 - 5. Section 072715 "Nonbituminous Self-Adhering Sheet Air Barriers" for self-adhering sheet air barriers composed of nonbituminous polymers applied over sheathing behind mechanically fastened EIFS.
 - 6. Section 072726 "Fluid-Applied Membrane Air Barriers" for fluid-applied, synthetic polymer air barriers applied over sheathing behind EIFS-clad wall assemblies.

1.2 DEFINITIONS

- A. Definitions in ASTM E2110 apply to Work of this Section.
- B. EIFS: Exterior insulation and finish system(s).
- C. IBC: International Building Code.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.4 ACTION SUBMITTALS

- A. Product Data: For each EIFS component, trim, and accessory[, **including water-resistive barrier coatings**].
- B. Sustainable Design Submittals:
 - 1. Manufacturer Inventory: For each product, provide manufacturer's manifest of ingredients.
 - 2. Manufacturer Inventory: Provide manufacturer's ingredient inventory.
 - 3. Product Data: For insulation, indicating that R-values comply with tables in ASHRAE/IES 90.1,

Section 6 - "Heating, Ventilating, and Air Conditioning."

4. Laboratory Test Reports: For Insulation, indicating compliance with requirements for low-emitting materials.
5. Laboratory Test Reports: For insulation, indicating compliance with requirements for low-emitting materials.
6. Laboratory Test Reports: For insulation, indicating compliance with requirements for low-emitting materials.
7. Laboratory Test Reports: For insulation, indicating compliance with requirements for low-emitting materials.
8. Health Product Declaration (HPD): Provide documentation confirming product compliance with one of the following:

- a. Inventory or HPD to at least 0.01 percent by weight, with at least 95 percent assessed using GreenScreen Benchmark assessment.
- b. Cradle to Cradle v3 certification with minimum Silver level of Material Health.
- c. Living Product Challenge certification indicating achievement of Imperative 09, "Transparent Material Health."

- C. Health Product Declaration (HPD): Provide documentation indicating that manufacturer has screened and publicly provided ingredient disclosure to 1000 ppm, and has developed an action plan to mitigate known hazards.

- D. Shop Drawings:

1. Include details for EIFS buildouts.
2. Include details for parapet cap flashing.

- E. Samples: For each exposed product and for each color and texture specified, **[8 inches (200 mm) square]<Insert dimension and shape>** in size.

- F. Samples for Initial Selection: For each type of finish-coat color and texture indicated.

1. Include similar Samples of exposed accessories involving color selection.

- G. Samples for Verification: **24-inch- (600-mm-)** square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work, including **[custom trim, each profile,][and][an aesthetic reveal]**.

1. Include **[exposed trim and accessory]<Insert item>** Samples to verify color selected.
2. Include a typical control joint filled with sealant of color selected, as specified in Section 079200 "Joint Sealants."

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Manufacturer Certificates: Signed by EIFS manufacturer, certifying the following:

1. EIFS complies with requirements.
2. Substrates to which EIFS is indicated to be attached are acceptable to EIFS manufacturer.
3. Accessory products installed with EIFS, including **[joint sealants,][flashing,][water-resistive barrier coatings,][trim,]<Insert accessory>** whether or not furnished by EIFS manufacturer and

whether or not specified in this Section, are acceptable to EIFS manufacturer.

- C. Product Certificates: For[**cementitious materials and aggregates and for**] insulation and joint sealant, from manufacturer.
- D. Product Test Reports: For each EIFS assembly and component, [**and for water-resistive barrier coatings,**]for tests performed by a qualified testing agency.
- E. Field quality-control reports.
- F. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For EIFS to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: [**An installer who is certified in writing by AWCI International as qualified to install Class PB EIFS using trained workers**]<Insert requirements>.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, to set quality standards for materials and execution, and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.
- B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.
 - 1. Stack insulation board flat and off the ground.
 - 2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1. Proceed with installation of adhesives or coatings only when ambient temperatures have remained, or are forecast to remain, above **40 deg F (4.4 deg C)** for a minimum of 24 hours before, during, and after application. Do not apply EIFS adhesives or coatings during rainfall.

1.10 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of EIFS-clad drainage-wall assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Bond integrity and weathertightness.
 - b. Deterioration of EIFS finishes and other EIFS materials beyond normal weathering.
2. Warranty coverage includes the following components of EIFS-clad drainage-wall assemblies:
 - a. EIFS finish, including base coats, finish coats, and reinforcing mesh.
 - b. Insulation installed as part of EIFS[**including foam buildouts**].
 - c. Insulation adhesive[**and mechanical fasteners**].
 - d. EIFS accessories, including trim components and flashing.
 - e. Water-resistive barrier coatings.
 - f. EIFS drainage components.
3. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 1. **[Corev America, Inc]**
 2. **[Decoplast; Greenmaker Industries]**
 3. **[Dryvit Systems, Inc.]**
 4. **[Finestone, a Sika brand]**
 5. **[H.B. Fuller Construction Products Inc. / TEC]**
 6. **[Master Builders Solutions]**
 7. **[Master Wall Inc.]**
 8. **[Omega Products International, Inc.]**
 9. **[Parex, a Sika brand]**
 10. **[Pleko Systems International]**
 11. **[Senergy; a SIKA brand]**
 12. **[Sika Corporation]**
 13. **[Sto Corp.]**
 14. **[Stuc-O-Flex International, Inc.]**
 15. **[Total Wall, Inc.]**
 16. **<Insert manufacturer's name>**

- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. [Corev America, Inc]
 2. [Decoplast; Greenmaker Industries]
 3. [Dryvit Systems, Inc.]
 4. [Finestone, a Sika brand]
 5. [H.B. Fuller Construction Products Inc. / TEC]
 6. [Master Builders Solutions]
 7. [Master Wall Inc.]
 8. [Omega Products International, Inc.]
 9. [Parex, a Sika brand]
 10. [Pleko Systems International]
 11. [Senergy; a SIKA brand]
 12. [Sika Corporation]
 13. [Sto Corp.]
 14. [Stuc-O-Flex International, Inc.]
 15. [Total Wall, Inc.]
 16. **<Insert manufacturer's name>**
- C. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with EIFS components.

2.2 PERFORMANCE REQUIREMENTS

- A. EIFS Performance: Comply with ASTM E2568 and with the following:
1. Weathertightness: Resistant to uncontrolled water penetration from exterior, with a means to drain water entering EIFS to the exterior.
 2. System Fire Performance: **[Fire-resistance rating of wall assembly][Full-scale multistory fire test]**.
 3. Structural Performance of Assembly and Components:
 - a. Wind Loads:
 - 1) Uniform pressure of **<Insert lbf/sq. ft. (Pa)>**, acting inward or outward.
 - 2) Uniform pressure as indicated on Drawings.
 4. Impact Performance: ASTM E2568, **[Standard][Medium][High][Ultra High]** impact resistance**[unless otherwise indicated]**.
 5. Abrasion Resistance of Finish Coat: Sample consisting of **1-inch- (25.4-mm-)** thick EIFS mounted on **1/2-inch- (12.7-mm-)** thick gypsum board; cured for a minimum of 28 days and shows no cracking, checking, or loss of film integrity after exposure to **528 quarts (500 L)** of sand when tested in accordance with ASTM D968, Method A.
 6. Mildew Resistance of Finish Coat: Sample applied to **2-by-2-inch (50.8-by-50.8-mm)** clean glass substrate; cured for 28 days and shows no growth when tested in accordance with ASTM D3273 and evaluated in accordance with ASTM D3274.
 7. Drainage Efficiency: 90 percent average minimum when tested in accordance with ASTM E2273.

2.3 EIFS MATERIALS

- A. Water-Resistive Barrier Coating: EIFS manufacturer's standard formulation and accessories for use as water-resistive barrier coating; compatible with substrate.

1. Water-Resistance: Comply with physical and performance criteria of ASTM E2570/E2570M.
 2. VOC Content: **[250]<Insert value>** g/L or less.
 3. Low-Emitting Materials: Coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. VOC Content: **[100]<Insert value>** g/L or less.
 5. Low-Emitting Materials: Coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 6. VOC Content: **[100]<Insert value>** g/L or less.
 7. Low-Emitting Materials: VOC emissions of coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 8. VOC Content: **[100]<Insert value>** g/L or less.
 9. Low-Emitting Materials: Coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 10. VOC Emissions: Coatings shall contain no more than half of the chronic REL of VOCs when tested according to the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- B. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt, and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.
- C. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; **[specifically formulated to be applied to back side of insulation in a manner that creates open vertical channels designed to serve as an integral part of the water-drainage system of the EIFS-clad drainage-wall assembly];** compatible with substrate; and complying with **[one of]** the following:
1. Job-mixed formulation of portland cement complying with ASTM C150/C150M, Type I, and polymer-based adhesive specified for base coat.
 2. Factory-blended dry formulation of portland cement, dry polymer admixture, and fillers specified for base coat.
 3. Factory-mixed noncementitious formulation designed for adhesive attachment of insulation to substrates of type indicated, as recommended by EIFS manufacturer.
 4. Adhesives shall have a VOC content of **[50]<Insert value>** g/L or less.
 5. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 6. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 7. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 8. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

9. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- D. Drainage Mat: **[Three-dimensional, nonwoven, entangled filament, nylon or plastic][Woven or fused, self-furring, PVC mesh lath]<Insert type>** mat designed to drain incidental moisture by gravity; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer, with manufacturer's standard corrosion-resistant mechanical fasteners suitable for intended substrate.
- E. Molded, (Expanded) Rigid Cellular Polystyrene Board Insulation: Comply with ASTM E2430/E2430M, unless otherwise noted, and the following:
 1. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, in accordance with ASTM E84.
 2. Dimensions: Provide insulation boards of not more than **24 by 48 inches (610 by 1219 mm)**, with thickness indicated on Drawings.
 3. Channeled Board Insulation: EIFS manufacturer's standard factory-fabricated profile with linear, vertical-drainage channels, slots, or waves on the back side of board.
 4. Foam Buildouts: Provide with profiles and dimensions indicated on Drawings.
- F. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than **120 lbf/in. (21 dN/cm)** in accordance with ASTM E2098/E2098M and the following:
 1. Reinforcing Mesh for EIFS, General: Not less than weight required to comply with impact-performance level specified in "Performance Requirements" Article.
 2. Strip-Reinforcing Mesh: Not less than **[3.75 oz./sq. yd. (127 g/sq. m)][As recommended by EIFS manufacturer]<Insert weight>**.
 3. Detail-Reinforcing Mesh: Not less than **[4.0 oz./sq. yd. (136 g/sq. m)][As recommended by EIFS manufacturer]<Insert weight>**.
 4. Corner-Reinforcing Mesh: Not less than **[7.2 oz./sq. yd. (244 g/sq. m)][As recommended by EIFS manufacturer]<Insert weight>**.
- G. Base Coat: EIFS manufacturer's standard mixture complying with **[one of]** the following:
 1. Job-mixed formulation of portland cement complying with ASTM C150/C150M, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
 2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
 3. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.
 4. Factory-mixed noncementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.
 5. Adhesives shall have a VOC content of **[50]<Insert value> g/L** or less.
 6. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 7. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 8. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical

Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

9. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
10. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

H. Water-Resistant Base Coat: EIFS manufacturer's standard water-resistant formulation complying with[**one of**] the following:

1. Job-mixed formulation of portland cement complying with ASTM C150/C150M, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
3. Adhesives shall have a VOC content of **[50]<Insert value>** g/L or less.
4. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
5. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
6. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
7. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
8. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

I. Mechanical Fasteners: EIFS manufacturer's standard corrosion-resistant fasteners, consisting of thermal cap, standard washer and shaft attachments, and fastener indicated below; designed to resist Project's design loads; capable of pulling fastener head below surface of insulation board; and complying with the following:

1. For attachment to steel studs from **0.033 to 0.112 inch (0.84 to 2.84 mm)** in thickness, provide steel drill screws complying with ASTM C954.
2. For attachment to light-gage steel framing members not less than **0.0179 inch (0.45 mm)** in thickness, provide steel drill screws complying with ASTM C1002.
3. For attachment to wood framing members and plywood sheathing, provide steel drill screws complying with ASTM C1002, Type W.
4. For attachment to masonry and concrete substrates, provide sheathing dowel in form of a plastic wing-tipped fastener with thermal cap, sized to fit insulation thickness indicated and to penetrate substrate to depth required to secure anchorage.
5. For attachment to **<Insert substrate>**, provide manufacturer's standard fasteners suitable for

substrate.

- J. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
1. VOC Content: **[250]<Insert value>** g/L or less.
 2. Low-Emitting Materials: Coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 3. VOC Content: **[100]<Insert value>** g/L or less.
 4. Low-Emitting Materials: Coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 5. VOC Content: **[100]<Insert value>** g/L or less.
 6. Low-Emitting Materials: VOC emissions of coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 7. VOC Content: **[100]<Insert value>** g/L or less.
 8. Low-Emitting Materials: Coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 9. VOC Emissions: Coatings shall contain no more than half of the chronic REL of VOCs when tested according to the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- K. Finish Coat: EIFS manufacturer's **[standard acrylic-based coating][standard acrylic-based coating with enhanced mildew resistance][siliconized acrylic-based coating][elastomeric coating]<Insert coating>** complying with the following:
1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
 2. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, and fillers used with stone particles for embedding in finish coat to produce an applied-aggregate finish.
 - a. Aggregate: Marble chips of size and color **[as indicated by manufacturer's designations][to match Architect's sample][as selected by Architect from manufacturer's full range]**.
 3. Colors: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]**.
 4. Textures: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]**.
- L. Sealer: Manufacturer's waterproof, clear acrylic-based sealer for protecting finish coat.
- M. Water: Potable.
- N. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D1784, manufacturer's standard cell class for use intended, and ASTM C1063.

1. Casing Bead: Prefabricated, one-piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
2. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
3. Weep Screed/Track: Prefabricated, one-piece type for attachment behind insulation with perforated face leg[**extended to form a drip**] and weep holes in track bottom, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg; designed to drain incidental moisture that gets into wall construction to the exterior at terminations of EIFS with drainage.
4. Expansion Joint: Closed-cell polyethylene backer rod and elastomeric sealant **3/4-inch- (19-mm-)** minimum.
5. Windowsill Flashing: Prefabricated type for both flashing and sloping sill over framing beneath windows; with end and back dams; designed to direct water to exterior.
6. Parapet Cap Flashing: Type for both flashing and covering parapet top, with design complying with ASTM C1397[**and ANSI/SPRI/FM 4435/ES-1**].

2.4 MIXING

- A. Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials, except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
 1. Begin coating application only after surfaces are dry.
 2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.
- B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind drainage plane of EIFS and deterioration of substrates.
- C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum

bond between substrate and adhesive for insulation.

1. Concrete Substrates: Provide clean, dry, neutral-pH substrate for insulation installation. Verify suitability of substrate by performing bond and moisture tests recommended by EIFS manufacturer.

3.3 INSTALLATION OF EIFS, GENERAL

- A. Comply with ASTM C1397, ASTM E2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

3.4 APPLICATION OF SUBSTRATE PROTECTION

- A. Water-Resistive Barrier Coating: Apply over [**sheathing**]**<Insert substrate>** to provide a water-resistive barrier.
 1. Tape and seal joints, exposed edges, terminations, and inside and outside corners of sheathing unless otherwise indicated by EIFS manufacturer's written instructions.
- B. Flexible-Membrane Flashing: Install over water-resistive barrier coating, applied and lapped to shed water; seal at openings, penetrations, and terminations. Prime substrates with flashing primer if required and install flashing.

3.5 INSTALLATION OF TRIM

- A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, [**at windowsills,**] and elsewhere as indicated. Coordinate with installation of insulation.
 1. Weep Screed/Track: Use at bottom termination edges, at window and door heads, [**and at floor line expansion joints**] of water-drainage EIFS unless otherwise indicated.
 2. Windowsill Flashing: Use at windows unless otherwise indicated.
 3. Expansion Joint: Use where indicated on Drawings.
 4. Casing Bead: Use at other locations.
 5. Parapet Cap Flashing: Use where indicated on Drawings.
 6. **<Insert trim and requirements>**.

3.6 INSTALLATION OF DRAINAGE MAT

- A. Drainage Mat: Apply wrinkle free, continuously, with edges [**butted**]**[overlapped]** and mechanically secured with fasteners over water-resistive barrier coating.

3.7 INSTALLATION OF INSULATION

- A. Board Insulation: [**Adhesively**]**[Mechanically]****[Adhesively and mechanically]** attach insulation to substrate in compliance with ASTM C1397 and the following:
 1. Apply adhesive to insulation by notched-trowel method, with notches oriented vertically to produce drainage channels that remain functional after the insulation is adhered to substrate.
 2. Apply adhesive to insulation by notched-trowel method in a manner that results in coating the

- entire surface of drainage mat with adhesive once insulation is adhered to drainage mat.
3. Apply adhesive to ridges on back of channeled insulation by notched-trowel method in a manner that results in full adhesive contact over the entire surface of ridges, leaving channels free of adhesive once insulation is adhered to substrate.
4. Press and slide insulation into place. Apply pressure over entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.
5. Allow adhered insulation to remain undisturbed for not less than 24 hours, before[**installing mechanical fasteners,**] beginning rasping and sanding insulation or applying base coat and reinforcing mesh.
6. Mechanically attach insulation to substrate. Install top surface of fastener heads flush with plane of insulation. Install fasteners into or through substrates with the following minimum penetration:
 - a. Steel Framing: **5/16 inch (8 mm).**
 - b. Wood Framing: **1 inch (25 mm).**
 - c. Concrete and Masonry: **1 inch (25 mm).**
7. Apply insulation over substrates in courses with long edges of boards oriented horizontally.
8. Begin first course of insulation from a level base line and work upward.
9. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
10. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints, so no piece of insulation is less than **12 inches (300 mm)** wide or **6 inches (150 mm)** high. Offset joints not less than **6 inches (150 mm)** from corners of window and door openings[**and not less than 4 inches (100 mm) from aesthetic reveals**].
 - a. Adhesive Attachment: Offset joints of insulation not less than **6 inches (150 mm)** from horizontal and **4 inches (100 mm)** from vertical joints in sheathing.
 - b. Mechanical Attachment: Offset joints of insulation from horizontal joints in sheathing.
11. Apply channeled insulation, with drainage channels aligned vertically.
12. Interlock ends at internal and external corners.
13. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than **1/16 inch (1.6 mm)** occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
14. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
15. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than [**1/32 inch (0.8 mm)**][**1/16 inch (1.6 mm)**] from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than **1/16 inch (1.6 mm)**. Prevent airborne dispersal and immediately collect insulation raspings or sandings.
16. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than **3/4 inch (19 mm)**.
17. Install foam buildouts and attach to structural substrate by [**adhesive**][**mechanical fastening**][**adhesive and mechanical fastening**].
18. Interrupt insulation for expansion joints where indicated.
19. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
20. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.
21. Before installing insulation and before applying field-applied reinforcing mesh, fully wrap board

- edges. Cover edges of board and extend encapsulating mesh not less than **2-1/2 inches (64 mm)** over front and back face unless otherwise indicated on Drawings.
22. Treat exposed edges of insulation as follows:
- Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
 - Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
 - At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.
23. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and water-resistive barrier coating.
- B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:
- At expansion joints in substrates behind EIFS.
 - Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
 - At floor lines in multilevel wood-framed construction.
 - Where wall height or building shape changes.
 - Where EIFS manufacturer requires joints in long continuous elevations.

3.8 APPLICATION OF BASE COAT

- A. Water-Resistant Base Coat: Apply full-thickness coverage [**to exposed insulation and**] to exposed surfaces of [**sloped shapes**][**window sills**][**parapets**][**foam build-outs**]<Insert location> and to other surfaces indicated on Drawings.
- B. Base Coat: Apply full coverage to exposed insulation [**and foam build-outs**]with not less than [**1/16-inch (1.6-mm)**]<Insert dimension> dry-coat thickness.
- C. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than **2-1/2 inches (64 mm)** or otherwise treated at joints to comply with ASTM C1397. Do not lap reinforcing mesh within **8 inches (200 mm)** of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.
- D. Double-Layer Reinforcing-Mesh Application: Where indicated or required, apply second base coat and second layer of reinforcing mesh, overlapped not less than **2-1/2 inches (64 mm)** or otherwise treated at joints to comply with ASTM C1397 in same manner as first application. Do not apply until first base coat has cured.
- E. Additional Reinforcing Mesh: Apply strip-reinforcing mesh around openings, extending **4 inches (100 mm)** beyond perimeter. Apply additional **9-by-12-inch (230-by-300-mm)** strip-reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply **8-inch- (200-mm-)** wide, strip-reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than **4 inches (100 mm)** on each side of corners.
- At aesthetic reveals, apply strip-reinforcing mesh not less than **8 inches (200 mm)** wide.
 - Embed strip-reinforcing mesh in base coat before applying first layer of reinforcing mesh.
- F. Foam Buildouts: Fully embed reinforcing mesh in base coat.



- G. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application, except without reinforcing mesh. Do not apply until first base coat has cured.

3.9 APPLICATION OF FINISH COAT

- A. Primer: Apply over dry base coat.
- B. Finish Coat: Apply full-thickness coverage over dry **[primed]** base coat, maintaining a wet edge at all times for uniform appearance, to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.
 - 1. Embed aggregate in finish coat to produce a uniform applied-aggregate finish of color and texture matching approved sample.
- C. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.

3.10 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Water-resistive barrier coatings applied over sheathing.
 - 2. **<Insert special inspections>**.
- B. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
- C. EIFS Tests and Inspections: In accordance with ASTM E2359/E2359M **<Insert tests and inspections>**.
- D. EIFS will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.11 CLEANING AND PROTECTION

- A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION 07 24 13 00A



SECTION 07 25 00 00 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Weather barrier types.
2. Accessory materials.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show details of **[building paper][building wrap][drainage wrap]** at terminations, openings, and penetrations. Show details of flexible flashing applications.

C. Sustainable Design Submittals:

1. Environmental Product Declaration (EPD): For each product.
2. Health Product Declaration (HPD): For each product.
3. Environmental Product Declaration (EPD): For each product.
4. Health Product Declaration (HPD): For each product.
5. Environmental Product Declaration (EPD): For each product.
6. Environmental Product Declaration (EPD): For each product.
7. Environmental Product Declaration (EPD): For each product.
8. Third-Party Certifications: For each product.
9. Third-Party-Certified Life-Cycle Assessment: For each product.
10. Health Product Declaration (HPD): For each product.
11. Health Product Declaration (HPD): Provide HPD.

1.3 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For weather barrier, by a qualified testing agency.

B. Product Test Reports: For weather barrier, for tests performed by **[a qualified testing agency][manufacturer and witnessed by a qualified testing agency]**.

C. Research Reports: For weather barrier, from **[an agency acceptable to authorities having jurisdiction][ICC-ES]<Insert evaluation agency>** showing compliance with **<Insert requirement>**.

D. Evaluation Reports: Report Type: **[Water-resistive barrier][and][flexible flashing]**, from ICC-ES.

E. Source Quality Control Reports: For weather barriers.

F. Field Quality Control Reports: For weather barriers.

G. Qualification Statements: For Installer.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: **[Fabricator of products][Entity that employs installers and supervisors who are trained and approved by manufacturer][Authorized representative who is trained and approved by manufacturer].**
- B. Specialist Qualifications: **<Insert Section-related qualifications>.**

1.5 MOCKUPS

- A. Build mockups **[to verify selections made under Sample submittals][to demonstrate aesthetic effects][to set quality standards for materials and execution][to set quality standards for fabrication and installation][and][for preconstruction testing].**
 - 1. Build mockup **[as indicated on Drawings]<Insert mockup requirements>.**
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver weather barrier materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

1.7 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit weather barrier materials to be installed in accordance with manufacturer's written installation instructions and warranty requirements.

1.8 WARRANTY

- A. Warranty Period: **[10][15][20]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WEATHER BARRIER TYPES

- A. Building Paper:
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings &**



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(Procedure A).

6. Air Permeance: Not more than [0.001 cfm/sq. ft. at 1.57 lbf/sq. ft. (0.005 L/s x sq. m at 75 Pa)][0.004 cfm/sq. ft. at 1.57 lbf/sq. ft. (0.02 L/s x sq. m at 75 Pa)] when tested in accordance with ASTM E2178.
7. Allowable UV Exposure Time: Not more than [120][180][270]<Insert number> days.
8. Flame Propagation Test: Materials and construction to be as tested in accordance with NFPA 285.

C. Drainage Wrap: Dimensional water-resistive barrier that also creates a drainage plane; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance with ASTM E84; and acceptable to authorities having jurisdiction.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Alpha ProTech]
 - b. [Barricade Building Products]
 - c. [Benjamin Obdyke Incorporated]
 - d. [DuPont de Nemours, Inc.]
 - e. [Kingspan Insulation LLC]
 - f. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Alpha ProTech]
 - b. [Barricade Building Products]
 - c. [Benjamin Obdyke Incorporated]
 - d. [DuPont de Nemours, Inc.]
 - e. [Kingspan Insulation LLC]
 - f. <Insert manufacturer's name>
3. Drainage Wrap Materials: [Type I, ASTM E2556/E2556M][Type I, ASTM E1677][Type II, ASTM E2556/E2556M][ICC-ES AC38].
4. Composition Type: [Nonperforated][Nonwoven polyolefin with nondirectional drainage pattern].
5. Water-Vapor Permeance: Minimum [55 perms (3147 ng/Pa x s x sq. m)][35 perms (2002 ng/Pa x s x sq. m)][15 perms (858 ng/Pa x s x sq. m)][5 perms (286 ng/Pa x s x sq. m)]<Insert value> in accordance with ASTM E96/E96M, Desiccant Method (Procedure A).
6. Air Permeance: Maximum [0.004 cfm/sq. ft. at 0.3 inch wg (0.02 L/s x sq. m at 75 Pa)]<Insert value> when tested in accordance with ASTM E2178.
7. Drainage: Not less than [90][95][98]<Insert number> percent when tested in accordance with ASTM E2273.
8. Allowable UV Exposure Time: Not more than [120][180]<Insert number> days.

2.2 ACCESSORY MATERIALS

- A. Requirement: Provide primers, fasteners, seam tapes, flashing, transition strips, termination strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory

materials that are recommended in writing by weather barrier manufacturer to produce a complete weather barrier assembly and that are compatible with primary weather barrier material and adjacent construction to which they may seal.

- B. Drainage Mat: Free-draining, polymer-strand mesh sheets or strips materials to provide a continuous open space behind exterior cladding.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Advanced Building Products Inc.]**
 - b. **[CavClear; a division of Archovations, Inc.]**
 - c. **[Dorken Systems Inc.]**
 - d. **[DuPont de Nemours, Inc.]**
 - e. **[Keene Building Products]**
 - f. **[Mortar Net Solutions]**
 - g. **[Stuc-O-Flex International, Inc.]**
 - h. **[Wire-Bond]**
 - i. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Advanced Building Products Inc.]**
 - b. **[CavClear; a division of Archovations, Inc.]**
 - c. **[Dorken Systems Inc.]**
 - d. **[DuPont de Nemours, Inc.]**
 - e. **[Keene Building Products]**
 - f. **[Mortar Net Solutions]**
 - g. **[Stuc-O-Flex International, Inc.]**
 - h. **[Wire-Bond]**
 - i. **<Insert manufacturer's name>**
 3. Drainage Mat Size: Thickness not less than **[full depth of cavity][3/4 inch (19 mm)][1 inch (25 mm)][1-1/2 inches (38 mm)][2 inches (51 mm)]<Insert thickness>** and installed to full height of cavity, **[with additional strips 4 inches (102 mm) high above flashing locations and thick enough to fill entire depth of cavity]** to maintain a continuous open space behind exterior cladding.
 4. Location: **[Underneath siding][Behind portland cement plaster][Behind adhered masonry veneer][As indicated on Drawings]<Insert component>**.
- C. Drainage Accessories:
1. Component: **[Furring strips]<Insert component>** installed between water-resistive barrier and exterior cladding to create a continuous open space behind exterior cladding.

PART 3 - EXECUTION

3.1 INSTALLATION OF WEATHER BARRIERS

- A. Weather Barriers:

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1. Building Paper: Comply with manufacturer's written instructions and warranty requirements.
 2. Building Wrap or Drainage Wrap: Comply with manufacturer's written instructions and warranty requirements.
 3. Drainage Material: Comply with manufacturer's written instructions.
- B. Install weather barrier accessories for a complete installation with weather barriers in accordance with manufacturer's written instructions.

END OF SECTION 07 25 00 00



SECTION 07 26 00 00 - VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polyethylene vapor retarders.
2. Reinforced-polyethylene vapor retarders.
3. Fire-retardant, reinforced-polyethylene vapor retarders.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for under-slab vapor retarders.
2. Section 072100 "Thermal Insulation" for vapor retarders integral with insulation products.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Polyethylene vapor retarders.
2. Reinforced-polyethylene vapor retarders.
3. Fire-retardant, reinforced-polyethylene vapor retarders.

1.3 INFORMATIONAL SUBMITTALS

- ##### A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 POLYETHYLENE VAPOR RETARDERS

- ##### A. Polyethylene Vapor Retarders: ASTM D4397, [6-mil- (0.15-mm-)][10-mil- (0.25-mm-)] thick sheet, with maximum permeance rating of 0.1 perm (5.7 ng/Pa x s x sq. m).

2.2 REINFORCED-POLYETHYLENE VAPOR RETARDERS

- ##### A. Reinforced-Polyethylene Vapor Retarders: Sheet with outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than [20 lb/1000 sq. ft. (9 kg/100 sq. m)]<Insert weight>, with maximum permeance rating of 0.1 perm (5.7 ng/Pa x s x sq. m).

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. **[ISI Building Products]**
 - b. **[Reef Industries, Inc.]**
 - c. **[Viaflex]**
 - d. **[W. R. Meadows, Inc]**
 - e. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ISI Building Products]**
 - b. **[Reef Industries, Inc.]**
 - c. **[Viaflex]**
 - d. **[W. R. Meadows, Inc]**
 - e. **<Insert manufacturer's name>**

2.3 FIRE-RETARDANT, REINFORCED-POLYETHYLENE VAPOR RETARDERS

- A. Fire-Retardant, Reinforced-Polyethylene Vapor Retarders: Sheet with outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nonwoven grid of nylon cord or polyester scrim and weighing not less than **[20 lb/1000 sq. ft. (9 kg/100 sq. m)]<Insert weight>**, with maximum permeance rating of **0.1 perm (5.7 ng/Pa x s x sq. m)**.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Reef Industries, Inc.]**
 - b. **[Viaflex]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Reef Industries, Inc.]**
 - b. **[Viaflex]**
 - c. **<Insert manufacturer's name>**
 3. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes of **[75 and 200]<Insert values>**, respectively, per ASTM E84.

2.4 ACCESSORIES

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- B. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.
- C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.



PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.2 INSTALLATION OF VAPOR RETARDERS ON FRAMING

- A. Place vapor retarders on side of construction indicated on Drawings.
- B. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- C. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.
- D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- E. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.3 INSTALLATION OF VAPOR RETARDERS IN CRAWL SPACES

- A. Install vapor retarders over prepared grade. Lap joints a minimum of **12 inches (305 mm)** and seal with manufacturer's recommended tape. Install second layer over pathways to equipment.
- B. Extend vapor retarder over footings and seal to foundation wall or grade beam with manufacturer's recommended tape.
 - 1. Extend vapor retarder vertically minimum **[16 inches (406 mm)][24 inches (610 mm)]<Insert dimension>** above top of footing.
- C. Seal around penetrations such as utilities and columns in order to create a monolithic, airtight membrane at grade surface, perimeter, and all vertical penetrations.

3.4 PROTECTION

- A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION 07 26 00 00



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Task	Specification	Specification Description
07 26 00 00	07 25 00 00	Weather Barriers
07 26 13 00	06 10 00 00	Rough Carpentry
07 26 13 00	07 25 00 00	Weather Barriers
07 26 13 00	07 26 00 00	Vapor Retarders



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SECTION 07 27 00 00 - NONBITUMINOUS SELF-ADHERING SHEET AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Self-adhering air barrier.
 - 1. Vapor-retarding nonbituminous sheet.
 - 2. Vapor-permeable nonbituminous sheet.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.
 - 2. Section 072500 "Weather Barriers" for weather barriers, including **[building paper][flexible flashing][and][building wraps with air-barrier properties]**.

1.2 DEFINITIONS

- A. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- B. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.
- C. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.
 - 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

- A. Product Data: Self-adhering air barrier. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; and tested physical and performance properties of products.
 - 1. Vapor-retarding nonbituminous sheet.
 - 2. Vapor-permeable nonbituminous sheet.
- B. Shop Drawings: For air-barrier assemblies.
 - 1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
 - 2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

3. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer. **[Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.]**
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with air barrier.
- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.
- D. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 1. Installer to be licensed by ABAA in accordance with ABAA's Quality Assurance Program and to employ ABAA-certified installers and supervisors on Project.
- B. Mockups: Build mockups to set quality standards for materials and execution **[and for preconstruction testing]**.
 1. Build integrated mockups of exterior wall assembly **[as indicated on Drawings]**, **150 sq. ft. (14 sq. m)]<Insert requirement>**, incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
 - b. Include junction with roofing membrane[, **building corner condition,**][**and**][**foundation wall intersection**].
 - c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: **[Owner will engage][Engage]** a qualified testing agency to perform preconstruction testing on field mockups.
- B. Mockup Testing: Air-barrier assemblies to comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.

1. Air-Leakage-Location Testing: Mockups will be tested for evidence of air leakage in accordance with **[ASTM E1186, chamber pressurization or depressurization with smoke tracers][ASTM E1186, chamber depressurization with detection liquids]<Insert requirement>**.
2. Air-Leakage-Volume Testing: Mockups will be tested for air-leakage rate in accordance with **[ASTM E783][or][ASTM E2357]**.
3. Adhesion Testing: Mockups will be tested for required air-barrier adhesion to substrate in accordance with ASTM D4541.
4. Notify Architect **[seven]<Insert number>** days in advance of the dates and times when mockups will be tested.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
 1. Protect substrates from environmental conditions that affect air-barrier performance.
 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction to be capable of performing as a continuous air barrier **[and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration]**. Air-barrier assemblies to be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations **[, tie-ins to installed waterproofing]**, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum **[0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa)]<Insert value>**, when tested in accordance with ASTM E2357.

2.3 NONBITUMINOUS SHEET AIR BARRIER

- A. Vapor-Retarding Nonbituminous Sheet: Minimum **10-mil- (0.25-mm-)** thick, self-adhering sheet consisting of **5 mils (0.13 mm)** of air-barrier film and a **5-mil- (0.13-mm-)** thick, acrylic adhesive with release liner on adhesive side **[and formulated for application with primer that complies with VOC**

limits].

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [3M Building and Construction]
 - b. [3M Industrial Adhesives and Tapes Division]
 - c. [Hohmann & Barnard, Inc]
 - d. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [3M Building and Construction]
 - b. [3M Industrial Adhesives and Tapes Division]
 - c. [Hohmann & Barnard, Inc]
 - d. <Insert manufacturer's name>
3. Physical and Performance Properties:
 - a. Air Permeance: Maximum [0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa)]<Insert value> pressure difference; ASTM E2178.
 - b. Puncture Resistance: Minimum [40 lbf (180 N)]<Insert value>; ASTM E154/E154M.
 - c. Vapor Permeance: Maximum [1.0 perm (57.5 ng/Pa x s x sq. m)]<Insert value>; ASTM E96/E96M, Desiccant Method.
 - d. Adhesion to Substrate: Minimum [16 lbf/sq. in. (110 kPa)]<Insert value> when tested in accordance with ASTM D4541 as modified by ABAA.
 - e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - f. UV Resistance: Can be exposed to sunlight for [150]<Insert number> days in accordance with manufacturer's written instructions.

B. Vapor-Permeable Nonbituminous Sheet: Minimum **20-mil- (0.5-mm-)** thick, self-adhering sheet consisting of a breathable carrier film or fabric and an adhesive with release liner on adhesive side[**and formulated for application with primer that complies with VOC limits**].

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [3M Building and Construction]
 - b. [Carlisle Coatings & Waterproofing Inc]
 - c. [Dorken Systems Inc.]
 - d. [GCP Applied Technologies Inc.]
 - e. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
 - f. [VaproShield LLC]
 - g. [W. R. Meadows, Inc]
 - h. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert

manufacturer's name; product name or designation> or comparable product by one of the following:

- a. **[3M Building and Construction]**
- b. **[Carlisle Coatings & Waterproofing Inc]**
- c. **[Dorken Systems Inc.]**
- d. **[GCP Applied Technologies Inc.]**
- e. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
- f. **[VaproShield LLC]**
- g. **[W. R. Meadows, Inc]**
- h. **<Insert manufacturer's name>**

3. Physical and Performance Properties:

- a. Air Permeance: Maximum **[0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa)]<Insert value>** pressure difference; ASTM E2178.
- b. Puncture Resistance: Minimum **[40 lbf (180 N)]<Insert value>**; ASTM E154/E154M.
- c. Vapor Permeance: Minimum **[15 perms (860 ng/Pa x s x sq. m)]<Insert value>**; ASTM E96/E96M, Desiccant Method, Procedure A.
- d. Adhesion to Substrate: Minimum **[16 lbf/sq. in. (110 kPa)]<Insert value>** when tested in accordance with ASTM D4541 as modified by ABAA.
- e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- f. UV Resistance: Can be exposed to sunlight for **[50][150]<Insert number>** days in accordance with manufacturer's written instructions.

2.4 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
 - B. Primer: Liquid **[waterborne][solvent-borne]** primer recommended for substrate by air-barrier material manufacturer.
 - C. Stainless Steel Sheet: ASTM A240/A240M, Type 304, **[0.0187 inch (0.5 mm)][0.0250 inch (0.64 mm)]<Insert dimension>** thick, and Series 300 stainless steel fasteners.
 - D. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
- a. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - b. **[Pecora Corporation]**
 - c. **[The Dow Chemical Company]**
 - d. **[Tremco Incorporated]**
 - e. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - b. **[Pecora Corporation]**
 - c. **[The Dow Chemical Company]**
 - d. **[Tremco Incorporated]**
 - e. **<Insert manufacturer's name>**

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
 3. Verify that substrates are visibly dry and free of moisture. **[Test concrete substrates for capillary moisture by plastic sheet method in accordance with ASTM D4263.]**
 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate in accordance with manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

- H. Bridge ~~[isolation joints]~~~~[expansion joints]~~~~[and]~~~~[discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints]~~ with air-barrier accessory material that accommodates joint movement in accordance with manufacturer's written instructions and details.

3.3 INSTALLATION OF NONBITUMINOUS SHEET AIR BARRIER

- A. Install materials in accordance with air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
 - 1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
- B. Prepare, treat, and seal inside and outside corners and vertical and horizontal surfaces at terminations and penetrations with termination mastic.
- C. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Reprime areas exposed for more than 24 hours.
- D. Apply and firmly adhere air-barrier sheets over area to receive air barrier. Accurately align sheets and maintain uniform **2-1/2-inch- (64-mm-)** minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.
 - 1. Apply sheets in a shingled manner to shed water.
 - 2. Roll sheets firmly to enhance adhesion to substrate.
- E. Apply continuous air-barrier sheets over accessory strips bridging substrate cracks, construction, and contraction joints.
- F. CMU: Install air-barrier sheet horizontally against the CMU beginning at base of wall. Align top edge of air-barrier sheet immediately below protruding masonry ties or joint reinforcement or ties, and firmly adhere in place.
 - 1. Overlap horizontally adjacent sheets a minimum of **2 inches (50 mm)** and roll seams.
 - 2. Apply overlapping sheets with bottom edge slit to fit around masonry reinforcing or ties. Roll firmly into place.
 - 3. Seal around masonry reinforcing or ties and penetrations with termination mastic.
 - 4. Continue the sheet into all openings in the wall, such as doors and windows, and terminate at points to maintain an airtight barrier that is not visible from interior.
- G. Seal top of through-wall flashings to air-barrier sheet with an additional **6-inch- (150-mm-)** wide, transition strip.
- H. Seal exposed edges of sheet at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- I. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.
 - 1. Coordinate air-barrier installation with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install transition strip on roofing membrane or base flashing so that a minimum of **3 inches (75 mm)** of coverage is achieved over each substrate.
- J. Connect and seal exterior wall air-barrier sheet continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-

wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

- K. At end of each working day, seal top edge of air-barrier material to substrate with termination mastic.
- L. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- M. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply **[transition strip][preformed silicone extrusion]** so that a minimum of **3 inches (75 mm)** of coverage is achieved over each substrate. Maintain **3 inches (75 mm)** of contact over firm bearing to perimeter frames, with not less than **1 inch (25 mm)** of full contact.
 - 1. Transition Strip: Roll firmly to enhance adhesion.
 - 2. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.
- N. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- O. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending **6 inches (150 mm)** beyond repaired areas in all directions.
- P. Do not cover air barrier until it has been tested and inspected by testing agency.
- Q. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.4 FIELD QUALITY CONTROL

- A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.
- B. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
- C. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. **[Inspections may include the following:]**
 - 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 - 2. Continuous structural support of air-barrier system has been provided.
 - 3. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 - 4. Site conditions for application temperature and dryness of substrates have been maintained.
 - 5. Maximum exposure time of materials to UV deterioration has not been exceeded.
 - 6. Surfaces have been primed.
 - 7. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
 - 8. Termination mastic has been applied on cut edges.
 - 9. Air barrier has been firmly adhered to substrate.
 - 10. Compatible materials have been used.

11. Transitions at changes in direction and structural support at gaps have been provided.
12. Connections between assemblies (air barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
13. All penetrations have been sealed.

D. Tests: As determined by testing agency from among the following tests:

1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage in accordance with **[ASTM E1186, chamber pressurization or depressurization with smoke tracers][ASTM E1186, chamber depressurization using detection liquids]<Insert requirement>**.
2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate in accordance with **[ASTM E783][or][ASTM E2357]<Insert test>**.
3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate in accordance with ASTM D4541 for each **[600 sq. ft. (56 sq. m)]<Insert value>** of installed air barrier or part thereof.

E. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, in accordance with manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient air-barrier components for retesting as specified above.

F. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

G. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, in accordance with manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials in accordance with air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed Work, using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 07 27 00 00

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07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 27 00 00	07 25 00 00	Weather Barriers
07 27 23 00	07 25 00 00	Weather Barriers
07 27 23 00	07 27 00 00	Nonbituminous Self-Adhering Sheet Air Barriers



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SECTION 07 31 13 00 - ASPHALT SHINGLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass-fiber-reinforced asphalt shingles.
2. Underlayment materials.
3. Ridge vents.
4. Sheet metal flashing and trim.

B. Related Requirements:

1. Section 077200 "Roof Accessories" for roof ventilators.

1.2 ALLOWANCES

- A. See Section 012100 "Allowances" for description of allowances affecting items specified under this Section.

1.3 UNIT PRICES

- A. See Section 012200 "Unit Prices" for description of unit prices affecting items specified under this Section.

1.4 ALTERNATES

- A. See Section 012300 "Alternates" for description of alternates affecting items specified under this Section.

1.5 DEFINITIONS

- A. Roofing Terminology: See ASTM D1079 for definitions of terms related to roofing Work in this Section.

1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference **[at Project site][by web conference]<Insert location>**.

1. **<Insert participant requirements>**.

1.7 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Asphalt shingles.
2. Underlayment materials.
3. Ridge vents.
4. Sheet metal flashing and trim.
5. Asphalt roofing cement.
6. Elastomeric flashing sealant.

B. Shop Drawings: For sheet metal flashing and trim.

C. Samples: For each exposed product and for each color and blend specified, in sizes indicated.

1. Asphalt Shingles: Full size.
2. Ridge and Hip Cap Shingles: Full size.
3. Ridge Vent: **12-inch- (305-mm-)** long Sample.
4. Exposed Valley Lining: **12 inches (305 mm)** square.

D. Samples for Initial Selection:

1. For each type of asphalt shingle indicated.
2. For each type of accessory involving color selection.

E. Samples for Verification: For the following products, in sizes indicated:

1. Asphalt Shingles: Full size.
2. Ridge and Hip Cap Shingles: Full size.
3. Ridge Vent: **12-inch- (305-mm-)** long Sample.
4. Exposed Valley Lining: **12 inches (305 mm)** square.

F. Sustainable Design Submittals:

1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.

1.8 INFORMATIONAL SUBMITTALS

- A. Qualification Statements: For roofing system Installer.
- B. Product Test Reports: For each type of asphalt shingle and underlayment product indicated, for tests performed by **[manufacturer and witnessed by a qualified testing agency][a qualified testing agency]**.
- C. Research Reports: For synthetic underlayment, from **[an agency acceptable to authorities having jurisdiction][ICC-ES]<Insert evaluation agency>**, indicating that product is suitable for intended use under applicable building codes.
- D. Sample warranties.

1.9 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For asphalt shingles to include in maintenance manuals.
- B. Materials warranties.

- C. Roofing system Installer's warranty.

1.10 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Asphalt Shingles: **[100 sq. ft. (9.3 sq. m)]<Insert area>** of each type and in each color and blend, in unbroken bundles.

1.11 QUALITY ASSURANCE

- A. Roofing System Installer Qualifications: Entity that employs **[a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified asphalt shingle system installers][a supervisor who is an NRCA ProCertified Roofing Foreman][a supervisor who is an NRCA ProCertified Roofing Foreman and not less than 20 percent of installers who are NRCA ProCertified asphalt shingle system installers]**.

1.12 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockups of asphalt shingles, including related roofing materials.
 - a. Size: **[48 inches (1219 mm) long by 96 inches (2438 mm) wide]<Insert dimensions>**.
 - b. Include gutter and downspout complying with requirements in **[Section 076200 "Sheet Metal Flashing and Trim."][Section 077100 "Roof Specialties."]**
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated location protected from weather, sunlight, and moisture in accordance with manufacturer's written instructions.
- B. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double-stack rolls.
- C. Protect unused roofing materials from weather, sunlight, and moisture when left overnight or when roofing Work is not in progress.
- D. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

1.14 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with installation only when existing and forecasted weather conditions permit product installation and related Work to be performed in accordance with manufacturer's written instructions and warranty requirements.
1. Install self-adhering, polymer-modified bitumen sheet underlayment within the range of ambient and substrate temperatures recommended in writing by manufacturer.

1.15 WARRANTY

- A. Materials Warranty: Manufacturer agrees to repair or replace asphalt shingles that fail within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Manufacturing defects.
 - b. **<Insert failure modes>**.
 2. Materials Warranty Period: **[25][30][35][40][50]<Insert number>** years from date of Substantial Completion, prorated, with first **[three][five][seven][10][15][20]<Insert number>** years nonprorated.
 3. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds of up to **[60 mph (27 m/s)][70 mph (31 m/s)][80 mph (36 m/s)][100 mph (45 m/s)][110 mph (49 m/s)][130 mph (58 m/s)][135 mph (60 m/s)]<Insert value>** for **[five][15]<Insert number>** years from date of Substantial Completion.
 4. Algae-Resistance Warranty Period: Asphalt shingles will not discolor for **[five][10][15][20][25]<Insert number>** years from date of Substantial Completion.
 5. Workmanship Warranty Period: **[Two][20][25]<Insert number>** years from date of Substantial Completion.
- B. Roofing System Installer's Warranty: On warranty form at end of this Section, signed by Installer, in which Installer agrees to repair or replace components of asphalt shingle roofing that fail in materials or workmanship within specified warranty period.
1. Warranty Period: **[Two][Five]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of product from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Exterior Fire-Test Exposure: Provide asphalt shingles and related roofing materials identical to those of assemblies tested for Class A fire resistance in accordance with ASTM E108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

- B. Wind Resistance: Provide asphalt shingles that comply with requirements of ASTM D3161/D3161M, Class F, and with ASTM D7158/D7158M, Class H.
- C. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][32]** or initial SRI not less than **[82][39]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- D. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][25]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- E. Solar Reflectance Index (SRI): Not less than **[78][29]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.

2.3 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Laminated-Strip Asphalt Shingles: ASTM D3462/D3462M, laminated, multi-ply overlay construction; glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[Building Products of Canada Corp.]**
 - c. **[CertainTeed; SAINT-GOBAIN]**
 - d. **[GAF]**
 - e. **[IKO Industries Inc.]**
 - f. **[Malarkey Roofing Products]**
 - g. **[Owens Corning]**
 - h. **[PABCO Roofing Products]**
 - i. **[Tamko Building Products LLC]**
 - j. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[Building Products of Canada Corp.]**
 - c. **[CertainTeed; SAINT-GOBAIN]**
 - d. **[GAF]**
 - e. **[IKO Industries Inc.]**
 - f. **[Malarkey Roofing Products]**
 - g. **[Owens Corning]**
 - h. **[PABCO Roofing Products]**
 - i. **[Tamko Building Products LLC]**
 - j. **<Insert manufacturer's name>**
 - 3. Butt Edge: **[Straight][Notched][Crenelated]** cut.
 - 4. Strip Size: **[Manufacturer's standard]<Insert strip size>**.
 - 5. Algae Resistance: Granules resist algae discoloration.
 - 6. Color and Blends: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and blends>**.

- B. Impact-Resistant, Laminated-Strip Asphalt Shingles: ASTM D3462/D3462M, laminated, multi-ply overlay construction; glass-fiber reinforced, mineral-granule surfaced, and self-sealing; with impact resistance complying with UL 2218, Class 4.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[Building Products of Canada Corp.]**
 - c. **[CertainTeed; SAINT-GOBAIN]**
 - d. **[GAF]**
 - e. **[Malarkey Roofing Products]**
 - f. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[Building Products of Canada Corp.]**
 - c. **[CertainTeed; SAINT-GOBAIN]**
 - d. **[GAF]**
 - e. **[Malarkey Roofing Products]**
 - f. **<Insert manufacturer's name>**
 3. Butt Edge: **[Straight][Notched][Crenelated]** cut.
 4. Strip Size: **[Manufacturer's standard]<Insert strip size>**.
 5. Algae Resistance: Granules resist algae discoloration.
 6. Color and Blends: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and blends>**.
- C. Three-Tab-Strip Asphalt Shingles: ASTM D3462/D3462M; glass-fiber reinforced, mineral-granule surfaced, and self-sealing; with tabs regularly spaced.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[Building Products of Canada Corp.]**
 - c. **[CertainTeed; SAINT-GOBAIN]**
 - d. **[GAF]**
 - e. **[IKO Industries Inc.]**
 - f. **[Malarkey Roofing Products]**
 - g. **[Owens Corning]**
 - h. **[PABCO Roofing Products]**
 - i. **[Tamko Building Products LLC]**
 - j. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[Building Products of Canada Corp.]**
 - c. **[CertainTeed; SAINT-GOBAIN]**
 - d. **[GAF]**
 - e. **[IKO Industries Inc.]**
 - f. **[Malarkey Roofing Products]**
 - g. **[Owens Corning]**
 - h. **[PABCO Roofing Products]**
 - i. **[Tamko Building Products LLC]**
 - j. **<Insert manufacturer's name>**
 3. Strip Size: **[Manufacturer's standard]<Insert strip size>**.
 4. Algae Resistance: Granules resist algae discoloration.
 5. Color and Blends: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and blends>**.
- D. Impact-Resistant, Three-Tab-Strip Asphalt Shingles: ASTM D3462/D3462M; glass-fiber reinforced, mineral-granule surfaced, and self-sealing; with tabs regularly spaced and with impact resistance complying with UL 2218, Class 4.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **<Insert manufacturer's name>**
 3. Strip Size: **[Manufacturer's standard]<Insert strip size>**.
 4. Algae Resistance: Granules resist algae discoloration.
 5. Color and Blends: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and blends>**.
- E. Hip and Ridge Shingles: **[Manufacturer's standard units to match asphalt shingles][Site-fabricated units cut from asphalt shingle strips. Trim each side of lapped portion of unit to taper approximately 1 inch (25 mm)]**.
- 2.4 UNDERLAYMENT MATERIALS
- A. Organic Felt: Asphalt-saturated organic felts, nonperforated and complying with the following:
 1. ASTM D226/D226M: **[Type I][Type II]**.
 2. ASTM D4869/D4869M: **[Type I][Type II][Type III][Type IV]**.
 - B. Glass-Reinforced Felt: ASTM D6757/D6757M, asphalt-saturated, glass-reinforced organic felt or inorganic fiber-based felt.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the**

following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
- b. [CertainTeed; SAINT-GOBAIN]
- c. [GAF]
- d. [Owens Corning]
- e. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
- b. [CertainTeed; SAINT-GOBAIN]
- c. [GAF]
- d. [Owens Corning]
- e. <Insert manufacturer's name>

- C. Synthetic Underlayment: UV-resistant polypropylene, polyolefin, or polyethylene polymer fabric with surface coatings or treatments to improve traction underfoot and abrasion resistance; evaluated and documented to be suitable for use as a roof underlayment under applicable codes by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [ALCO Products LLC]
- b. [Atlas Polyiso Roof and Wall Insulation]
- c. [Building Products of Canada Corp.]
- d. [CertainTeed; SAINT-GOBAIN]
- e. [Drexel Metals Corp.]
- f. [G.A.P. Roofing, Inc.]
- g. [GAF]
- h. [GCP Applied Technologies Inc.]
- i. [IKO Industries Inc.]
- j. [Malarkey Roofing Products]
- k. [Owens Corning]
- l. [PrimeSource Building Products, Inc.]
- m. [SDP Advanced Polymer Products Inc.]
- n. [SystemComponents Corporation]
- o. [Tamko Building Products LLC]
- p. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [ALCO Products LLC]
- b. [Atlas Polyiso Roof and Wall Insulation]
- c. [Building Products of Canada Corp.]
- d. [CertainTeed; SAINT-GOBAIN]

- e. [Drexel Metals Corp.]
 - f. [G.A.P. Roofing, Inc.]
 - g. [GAF]
 - h. [GCP Applied Technologies Inc.]
 - i. [IKO Industries Inc.]
 - j. [Malarkey Roofing Products]
 - k. [Owens Corning]
 - l. [PrimeSource Building Products, Inc.]
 - m. [SDP Advanced Polymer Products Inc.]
 - n. [SystemComponents Corporation]
 - o. [Tamko Building Products LLC]
 - p. <Insert manufacturer's name>
- D. Self-Adhering, Polymer-Modified Bitumen Sheet: ASTM D1970/D1970M, glass-fiber-mat-reinforced, polymer-modified asphalt; with slip-resistant top surface and release backing; cold applied. [**Provide primer for adjoining concrete, masonry, and metal surfaces to receive underlayment.**]
- 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [ALCO Products LLC]
 - b. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - c. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
 - d. [CertainTeed; SAINT-GOBAIN]
 - e. [Drexel Metals Corp.]
 - f. [GAF]
 - g. [GCP Applied Technologies Inc.]
 - h. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
 - i. [IKO Industries Inc.]
 - j. [Malarkey Roofing Products]
 - k. [Owens Corning]
 - l. [SDP Advanced Polymer Products Inc.]
 - m. [Tamko Building Products LLC]
 - n. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [ALCO Products LLC]
 - b. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - c. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
 - d. [CertainTeed; SAINT-GOBAIN]
 - e. [Drexel Metals Corp.]
 - f. [GAF]
 - g. [GCP Applied Technologies Inc.]
 - h. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
 - i. [IKO Industries Inc.]
 - j. [Malarkey Roofing Products]
 - k. [Owens Corning]
 - l. [SDP Advanced Polymer Products Inc.]
 - m. [Tamko Building Products LLC]

n. <Insert manufacturer's name>

3. Sheet Thickness: Minimum [55 mils (1.4 mm)][50 mils (1.3 mm)][40 mils (1.0 mm)]<Insert dimension>.

4. Top Surface: [Sand][Granule][Textured polymer film][Polyester].

E. Granular-Surfaced Valley Lining: [ASTM D6380/D6380M, Class M, organic][ASTM D3909/D3909M, mineral-granular-surfaced, glass]-felt-based, asphalt roll roofing; 36 inches (914 mm) wide.

2.5 RIDGE VENTS

A. Rigid Ridge Vent: Manufacturer's standard, rigid-section, high-density, UV-stabilized plastic ridge vent for use under ridge shingles.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Air Vent, Inc.; Gibraltar Industries, Inc.]
- b. [Benjamin Obdyke Incorporated]
- c. [CertainTeed; SAINT-GOBAIN]
- d. [Cor-A-Vent, Inc]
- e. [GAF]
- f. [Lomanco, Inc]
- g. [Owens Corning]
- h. [Tamko Building Products LLC]
- i. [Tapco International Corporation; Mid-America Components]
- j. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Air Vent, Inc.; Gibraltar Industries, Inc.]
- b. [Benjamin Obdyke Incorporated]
- c. [CertainTeed; SAINT-GOBAIN]
- d. [Cor-A-Vent, Inc]
- e. [GAF]
- f. [Lomanco, Inc]
- g. [Owens Corning]
- h. [Tamko Building Products LLC]
- i. [Tapco International Corporation; Mid-America Components]
- j. <Insert manufacturer's name>

3. Minimum Net Free Area: <Insert area>.

4. Width: <Insert dimension>.

5. Thickness: <Insert dimension>.

6. Features:

- a. Nonwoven geotextile filter strips.
- b. External deflector baffles.
- c. <Insert feature>.

- B. Flexible Ridge Vent: Manufacturer's standard, compression-resisting, three-dimensional, open-nylon or polyester-mat filter[**bonded to a nonwoven, nonwicking, geotextile fabric cover**].
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Air Vent, Inc.; Gibraltar Industries, Inc.]
 - b. [Benjamin Obdyke Incorporated]
 - c. [GAF]
 - d. [Owens Corning]
 - e. [Tamko Building Products LLC]
 - f. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Air Vent, Inc.; Gibraltar Industries, Inc.]
 - b. [Benjamin Obdyke Incorporated]
 - c. [GAF]
 - d. [Owens Corning]
 - e. [Tamko Building Products LLC]
 - f. <Insert manufacturer's name>
 3. Minimum Net Free Area: <Insert area>.
 4. Width: <Insert dimension>.
 5. Thickness: <Insert dimension>.

2.6 SHEET METAL FLASHING AND TRIM

- A. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
1. Sheet Metal: [Copper][Stainless steel][Zinc-tin alloy coated copper][Anodized aluminum][Aluminum, mill finished]<Insert requirements>.
- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of the item unless otherwise specified in this Section or indicated on Drawings.
1. Apron Flashings: Fabricate with lower flange a minimum of [4 inches (102 mm)][5 inches (127 mm)]<Insert dimension> over and [4 inches (102 mm)]<Insert dimension> beyond each side of downslope asphalt shingles and [6 inches (152 mm)]<Insert dimension> up the vertical surface.
 2. Step Flashings: Fabricate with a headlap of 2 inches (51 mm) and a minimum extension of [4 inches (102 mm)][5 inches (127 mm)]<Insert dimension> over the underlying asphalt shingle and up the vertical surface.
 3. Cricket and Backer Flashings: Fabricate with concealed flange extending a minimum of [18 inches (457 mm)][24 inches (610 mm)]<Insert dimension> beneath upslope asphalt shingles and [6 inches (152 mm)]<Insert dimension> beyond each side of [chimney][skylight] and [6 inches (152 mm)]<Insert dimension> above the roof plane.
 4. Counterflashings: Fabricate to cover [4 inches (102 mm)]<Insert dimension> of base flashing measured vertically; and in lengths required so that no step exceeds [8 inches (203 mm)]<Insert dimension> and overall length is no more than [10 feet (3 m)]<Insert dimension>.

- a. Provide metal **[reglets][receivers]** for installation.
5. Open-Valley Flashings: Fabricate from metal sheet not less than **[24 inches (610 mm)]<Insert dimension>** wide in lengths not exceeding **[10 feet (3 m)]<Insert dimension>**, with **[1-inch- (25-mm-)]<Insert dimension>** high, inverted-V profile water diverter at center of valley and equal flange widths of not less than **[11 inches (279 mm)]<Insert dimension>**.
 - a. Hem flange edges for fastening with metal cleats.
 - b. Add stiffening ribs in flashings to promote drainage.
6. Drip Edges: Fabricate in lengths not exceeding **[10 feet (3 m)]<Insert dimension>** with minimum **2-inch (51-mm)** roof-deck flange and **1-1/2-inch (38-mm)** fascia flange with **3/8-inch (10-mm)** drip at lower edge.
7. Vent-Pipe Flashings: ASTM B749, Type L51121, at least **1/16 inch (1.6 mm)** thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof, and extending at least **4 inches (102 mm)** from pipe onto roof.

2.7 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D4586/D4586M Type II, asbestos free.
- B. Elastomeric Flashing Sealant: ASTM C920, Type S, Grade NS, one-part, non-sag, elastomeric polymer sealant; of class and use classifications required to seal joints and remain watertight; recommended in writing by manufacturer for installation of flashing systems.
- C. Roofing Nails: ASTM F1667, aluminum, stainless steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum **0.120-inch- (3-mm-)** diameter, sharp-pointed, with a **3/8- to 7/16-inch- (10- to 11-mm-)** diameter flat head and of sufficient length to penetrate **3/4 inch (19 mm)** into solid wood decking or extend at least **1/8 inch (3 mm)** through sheathing less than **3/4 inch (19 mm)** thick.
 1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- D. Underlayment Nails: Aluminum, stainless steel, or hot-dip galvanized-steel wire nails with low-profile metal or plastic caps, **1-inch- (25-mm-)** minimum diameter.
 1. Provide with minimum **0.0134-inch- (0.34-mm-)** thick metal cap, **0.010-inch- (0.25-mm-)** thick power-driven metal cap, or **0.035-inch- (0.89-mm-)** thick plastic cap; and with minimum **0.083-inch- (2.11-mm-)** thick ring shank or **0.091-inch- (2.31-mm-)** thick smooth shank of length to penetrate at least **3/4 inch (19 mm)** into roof sheathing or to penetrate through roof sheathing less than **3/4 inch (19 mm)** thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with roofing system Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored

- and that provisions have been made for flashings and penetrations through asphalt shingles.
3. Verify that vent stacks and other penetrations through roofing are installed and securely fastened.

- B. Prepare written report, endorsed by roofing system Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT MATERIALS

- A. Comply with asphalt shingle and underlayment manufacturers' written installation instructions and with recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems" applicable to products and applications indicated unless more stringent requirements are specified in this Section or indicated on Drawings.
- B. Organic Felt: Install on roof deck parallel with and starting at eaves and fasten with **[underlayment][roofing]** nails.
 1. Single-Layer Installation:
 - a. Lap sides a minimum of **[2 inches (51 mm)][4 inches (102 mm)]** over underlying course.
 - b. Lap ends a minimum of **4 inches (102 mm)**.
 - c. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 2. Double-Layer Installation:
 - a. Install a **19-inch- (483-mm-)** wide starter course at eaves and completely cover with a **36-inch- (914-mm-)** wide second course.
 - b. Install succeeding **36-inch- (914-mm-)** wide courses lapping previous courses **19 inches (483 mm)** in shingle fashion.
 - c. Lap ends a minimum of **4 inches (102 mm)**. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 - d. Apply a continuous layer of asphalt roofing cement over starter course and on felt surface to be concealed by succeeding courses as each felt course is installed. Apply **[over entire roof][at locations indicated on Drawings]**.
 3. Install felt underlayment **[on roof deck not covered][over areas protected]** by self-adhering, polymer-modified bitumen sheet unless otherwise specified in this Section or indicated on Drawings.
 - a. Lap sides of felt over self-adhering sheet not less than **4 inches (102 mm)** in direction that sheds water.
 - b. Lap ends of felt not less than **6 inches (152 mm)** over self-adhering sheet.
 4. Install fasteners in a grid pattern of **12 inches (305 mm)** between side laps with **6-inch (152-mm)** spacing at side and end laps.
 5. Terminate felt **[flush][extended up not less than 4 inches (102 mm)]**<Insert requirements> against sidewalls, curbs, chimneys, and other roof projections.
- C. Synthetic Underlayment:
 1. Install on roof deck parallel with and starting at the eaves.
 - a. Lap sides and ends as recommended in writing by manufacturer, but not less than **[2 inches (51 mm)][4 inches (102 mm)]** for side laps and **6 inches (152 mm)** for end laps.

- b. Stagger end laps between succeeding courses at interval recommended in writing by manufacturer, but not less than **72 inches (1829 mm)**.
 - c. Fasten with underlayment nails in accordance with manufacturer's written instructions.
 - d. Cover underlayment within period recommended in writing by manufacturer.
 2. Install in single layer on roofs sloped at 4:12 and greater.
 3. Install in double layer on roofs sloped at less than 4:12.
 4. Install synthetic underlayment [**on roof deck not covered**][**over areas protected**] by self-adhering, polymer-modified bitumen sheet unless otherwise specified in this Section or indicated on Drawings.
 - a. Lap sides of underlayment over self-adhering sheet not less than **4 inches (102 mm)** in direction to shed water.
 - b. Lap ends of underlayment not less than **6 inches (152 mm)** over self-adhering sheet.
 5. Install fasteners in a grid pattern of **12 inches (305 mm)** between side laps with **6-inch (152-mm)** spacing at side and end laps.
 6. Terminate synthetic underlayment [**flush**][**extended up not less than 4 inches (102 mm)**]**<Insert requirements>** against sidewalls, curbs, chimneys, and other roof projections.
- D. Self-Adhering, Polymer-Modified Bitumen Sheet: Install, wrinkle free, on roof deck.
1. Comply with low-temperature installation restrictions of underlayment manufacturer.
 2. Install lapped in direction that sheds water.
 - a. Lap sides not less than **4 inches (102 mm)**.
 - b. Lap ends not less than **6 inches (152 mm)**, staggered **24 inches (610 mm)** between succeeding courses.
 - c. Roll laps with roller.
 3. Prime concrete, masonry, and metal surfaces to receive self-adhering sheet.
 4. Eaves: Extend from edges of eaves [**24 inches (610 mm)**][**36 inches (914 mm)**]**<Insert dimension>** beyond interior face of exterior wall.
 5. Rakes: Extend from edges of rakes [**24 inches (610 mm)**][**36 inches (914 mm)**]**<Insert dimension>** beyond interior face of exterior wall.
 6. Valleys: Extend from lowest to highest point [**18 inches (457 mm)**]**<Insert dimension>** on each side of centerline.
 7. Hips: Extend [**18 inches (457 mm)**]**<Insert dimension>** on each side.
 8. Ridges: Extend [**36 inches (914 mm)**]**<Insert dimension>** on each side[**without obstructing continuous ridge vent slot**].
 9. Sidewalls: Extend [**18 inches (457 mm)**]**<Insert dimension>** beyond sidewalls and return vertically against sidewalls not less than [**4 inches (102 mm)**]**<Insert dimension>**.
 10. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend [**18 inches (457 mm)**]**<Insert dimension>** beyond penetrating elements and return vertically against penetrating elements not less than [**4 inches (102 mm)**]**<Insert dimension>**.
 11. Roof-Slope Transitions: Extend [**18 inches (457 mm)**]**<Insert dimension>** on each roof slope.
 12. Cover underlayment within seven days.
- E. Granular-Surfaced, Concealed Valley Lining: For [**woven**][**closed-cut**] valleys. Comply with recommendations in NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."
1. Lap roof-deck underlayment over valley lining at least **6 inches (152 mm)**.
 2. Install a **36-inch- (914-mm-)** wide strip of granular-surfaced valley lining, with granular-surface face up, centered in valley and fastened to roof deck.
 3. Lap ends of strips at least **12 inches (305 mm)** in direction to shed water, and seal with asphalt

- roofing cement.
 4. Fasten to roof deck.
- F. Metal-Flashed, Open-Valley Underlayment: Install two layers of minimum **36-inch- (914-mm-)** wide underlayment centered in valley.
1. Use same underlayment as installed on field of roof.
 2. Stagger end laps between layers at least **72 inches (1829 mm)**.
 3. Lap ends of each layer at least **12 inches (305 mm)** in direction that sheds water, and seal with asphalt roofing cement.
 4. Fasten each layer to roof deck with underlayment nails located as far from valley center as possible and only to extent necessary to hold underlayment in place until installation of valley flashing.
 5. Lap roof-deck underlayment over first layer of valley underlayment at least **6 inches (152 mm)**.
- G. Granular-Surfaced, Open-Valley Lining: Before installing valley lining, install **36-inch- (914-mm-)** wide felt underlayment centered in valley. Fasten to roof deck with **[underlayment][roofing]** nails.
1. Lap roof-deck felt underlayment over valley felt underlayment at least **6 inches (152 mm)**.
 2. Install an **18-inch- (457-mm-)** wide strip of valley lining centered in valley, with granular-surface face down.
 3. Install a second **36-inch- (914-mm-)** wide strip of valley lining centered in valley, with granular-surface face up.
 4. Lap ends of each strip at least **12 inches (305 mm)** in direction to shed water, and seal with asphalt roofing cement.
 5. Stagger end laps between succeeding strips at least **72 inches (1829 mm)**.
 6. Fasten each strip to roof deck.

3.3 INSTALLATION OF SHEET METAL FLASHING AND TRIM

- A. Install metal flashings and trim to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
1. Install metal flashings in accordance with recommendations in[**ARMA's "Asphalt Roofing Residential Manual - Design and Application Methods"** and] NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."
 2. Bed flanges of metal flashings using asphalt roofing cement or elastomeric flashing sealant.
- B. Apron Flashings: Extend lower flange over and beyond each side of downslope asphalt shingles and up the vertical surface.
- C. Step Flashings: Install with a headlap of **2 inches (51 mm)** and extend over underlying shingle and up the vertical face.
1. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying shingle.
 2. Fasten to roof deck only.
- D. Cricket and Backer Flashings: Install against roof-penetrating elements extending concealed flange beneath upslope asphalt shingles and beyond each side.
- E. Counterflashings: Coordinate with installation of base flashing and fit tightly to base flashing. Lap joints a minimum of **4 inches (102 mm)** secured in a waterproof manner.
1. Install in reglets or receivers.

- F. Open-Valley Flashings: Install centered in valleys, lapping ends at least **[8 inches (203 mm)]<Insert dimension>** in direction that sheds water. Fasten upper end of each length to roof deck beneath overlap.
1. Secure hemmed flange edges into metal cleats spaced **[8 inches (203 mm)][12 inches (305 mm)][24 inches (610 mm)]<Insert dimension>** apart and fastened to roof deck.
 2. Adhere minimum **[9-inch- (229-mm-)]<Insert dimension>** wide strips of self-adhering, polymer-modified bitumen sheet to metal flanges and to underlying self-adhering sheet, polymer-modified bitumen sheet.
 - a. Place strips parallel to and over flanges so that they will be just concealed by installed shingles.
 3. Provide a closure at the end of the inverted-V profile of the valley metal to minimize water and ice infiltration.
- G. Rake Drip Edges: Install over underlayment materials and fasten to roof deck.
- H. Eave Drip Edges: Install below underlayment materials and fasten to roof deck.
- I. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.4 INSTALLATION OF GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Install asphalt shingles in accordance with manufacturer's written instructions and recommendations in **ARMA's "Asphalt Roofing Residential Manual - Design and Application Methods"** and **NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."**
- B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip **[with tabs removed][at least 7 inches (178 mm) wide]** with self-sealing strip face up at roof edge.
1. Extend asphalt shingles **[1/2 inch (13 mm)][3/4 inch (19 mm)]<Insert dimension>** over fasciae at eaves and rakes.
 2. Install starter strip along rake edge.
- C. Install first and remaining courses of laminated asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- D. Install first and remaining courses of three-tab-strip asphalt shingles stair-stepping diagonally across roof deck with **[4-inch (102-mm)][5-inch (127-mm)][6-inch (152-mm)][half-tab][one-third-tab][manufacturer's recommended]** offset pattern at succeeding courses, maintaining uniform exposure.
- E. Fasten asphalt shingle strips with a minimum of **[four][five][six]<Insert number>** roofing nails, but not less than the number indicated in manufacturer's written instructions for roof slope and design wind speed indicated on Drawings and for warranty requirements specified in this Section.
1. Locate fasteners in accordance with manufacturer's written instructions.
 2. Where roof slope exceeds 18:12, hand seal self-sealing asphalt shingles to improve the shingles' positive bond by applying asphalt roofing cement spots between course overlaps after nailing the upper course.
 3. Where roof slope is less than 4:12, hand seal self-sealing asphalt shingles to improve the

- shingles' positive bond by applying asphalt roofing cement spots between course overlaps after nailing the upper course.
4. When ambient temperature during installation is below **[50 deg F (10 deg C)]<Insert temperature>**, hand seal self-sealing asphalt shingles by applying asphalt roofing cement spots between course overlaps after nailing the upper course.
- F. Woven Valleys: Extend succeeding asphalt shingle courses from both sides of valley **[12 inches (305 mm)]<Insert dimension>** beyond center of valley, weaving intersecting shingle-strip courses over each other. Use one-piece shingle strips without joints in valley.
1. Do not nail asphalt shingles within **6 inches (152 mm)** of valley center.
- G. Closed-Cut Valleys: Extend asphalt shingle strips from one side of valley **[12 inches (305 mm)]<Insert dimension>** beyond center of valley.
1. Use one-piece shingle strips without joints in valley.
 2. Fasten with extra nail in upper end of shingle. Install asphalt shingle courses from other side of valley and cut back to a straight line **2 inches (51 mm)** short of valley centerline.
 3. Trim upper concealed corners of cut-back shingle strips.
 4. Do not nail asphalt shingles within **6 inches (152 mm)** of valley center.
 5. Set trimmed, concealed-corner asphalt shingles in a **3-inch- (76-mm-)** wide bed of asphalt roofing cement.
- H. Open Valleys: Cut and fit asphalt shingles at open valleys, trimming upper concealed corners of shingle strips.
1. **[Maintain uniform width of exposed open valley][Widen exposed portion of open valley 1/8 inch in 12 inches (1:96)]** from highest to lowest point.
 2. Extend shingle a minimum of **4 inches (102 mm)** over valley metal.
 3. Set valley edge of asphalt shingles in a **3-inch- (76-mm-)** wide bed of asphalt roofing cement.
 4. Do not nail asphalt shingles to metal open-valley flashings.
- I. Ridge Vents: Install continuous ridge vents over asphalt shingles in accordance with manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.
- J. Hip and Ridge Shingles: Maintain same exposure of cap shingles as roofing-shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds.
1. Fasten with roofing nails of sufficient length to penetrate sheathing.
 2. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

3.5 ROOFING SYSTEM INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing System Installer," has performed roofing and associated Work on the following Project:
1. Owner: **<Insert name of Owner>**.
 2. Owner Address: **<Insert address>**.
 3. Building Name/Type: **<Insert information>**.
 4. Building Address: **<Insert address>**.
 5. Area of the Work: **<Insert information>**.
 6. Warranty Period: **[Two][Five]<Insert number>** years from date of Substantial Completion.
 7. Date of Substantial Completion: _____.
- B. AND WHEREAS Roofing System Installer has contracted (either directly with Owner or indirectly as a

subcontractor) to warrant said Work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

- C. NOW THEREFORE Roofing System Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period, Roofing System, Installer will, at Roofing System Installer's own cost and expense, make or cause to be made such repairs to or replacements of said Work as are necessary to correct faulty and defective work and as are necessary to maintain said Work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to the Work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding **<Insert mph (m/s)>**;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the Work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When the Work has been damaged by any of foregoing causes, Warranty becomes null and void until such damage has been repaired by Roofing System Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing System Installer is responsible for damage to the Work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of the Work.
 4. During Warranty Period, if Owner allows alteration of the Work by anyone other than Roofing System Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty becomes null and void on date of the alterations, but only to the extent the alterations affect the Work covered by this Warranty. If Owner engages Roofing System Installer to perform the alterations, Warranty does not become null and void unless Roofing System Installer, before starting the alterations, has notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate the Work, thereby reasonably justifying a limitation or termination of this Warranty.
 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a use or service more severe than originally specified, this Warranty becomes null and void on date of the change, but only to the extent the change affects the Work covered by this Warranty.
 6. Owner to promptly notify Roofing System Installer of observed, known, or suspected leaks, defects, or deterioration and afford reasonable opportunity for Roofing System Installer to inspect the Work and to examine evidence of such leaks, defects, or deterioration.
 7. This Warranty is recognized to be the only warranty of Roofing System Installer on said Work and does not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty does not operate to relieve Roofing System Installer of responsibility for performance of the Work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of



_____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 07 31 13 00



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07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 31 13 13	07 31 13 00	Asphalt Shingles



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SECTION 07 31 16 00 - METAL SHINGLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal shingles.
2. Underlayment materials.
3. Ridge vents.
4. Sheet metal flashing and trim.

B. Related Requirements:

1. Section 074113.13 "Formed Metal Roof Panels" for sheet metal roofing panels that are installed as single panels extending from eave to ridge.
2. Section 077253 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface, allowing it to melt and drain off slowly.

1.2 ALLOWANCES

- A. See Section 012100 "Allowances" for description of allowances affecting items specified under this Section.

1.3 UNIT PRICES

- A. See Section 012200 "Unit Prices" for description of unit prices affecting items specified under this Section.

1.4 ALTERNATES

- A. See Section 012300 "Alternates" for description of alternates affecting items specified under this Section.

1.5 DEFINITIONS

- A. Roofing Terminology: See ASTM D1079 for definitions of terms related to roofing Work in this Section.

1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference [at Project site][by web conference]<Insert location>.

1. <Insert participant requirements>.

1.7 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each of the following:
 - a. Metal shingles.
 - b. Underlayment materials.
 - c. Ridge vents.
 - d. Bituminous coating.
 - e. Asphalt roofing cement.
 - f. Sealant.
- B. Shop Drawings: For metal shingles. Include roof plans; sections at hips, gables, ridges, valleys, and eaves; details of metal shingles and joint patterns, flashing, trim, accessories, and attachments to other Work.
- C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard size.
- D. Samples for Initial Selection:
 - 1. For each type of metal shingle.
 - 2. For each type of accessory involving color selection.
- E. Samples for Verification: Full-size Samples of each type and finish of metal shingle indicated.
- F. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.
 - 2. Recycled Content: Provide manufacturer documentation for recycled content, indicating postconsumer and preconsumer recycled content.

1.8 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For metal shingles, for tests performed by a qualified testing agency.
- B. Research Reports: From **[an agency acceptable to authorities having jurisdiction][ICC-ES]<Insert evaluation agency>**, indicating that product is suitable for intended use under applicable building codes for the following:
 - 1. Polymer-modified bitumen sheet underlayment.
 - 2. Synthetic underlayment.
- C. Qualification Statements: For roofing system Installer.
- D. Sample warranties.

1.9 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal shingles to include in maintenance manuals.
- B. Materials warranties.
- C. Roofing system Installer's warranty.

1.10 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Metal Shingles: **[100 sq. ft. (9.3 sq. m)]<Insert area>** of exposed area, in each type and color, in unbroken bundles.

1.11 QUALITY ASSURANCE

- A. Roofing System Installer Qualifications: Entity that employs **[a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified metal shingle system installers][a supervisor who is an NRCA ProCertified Roofing Foreman][a supervisor who is an NRCA ProCertified Roofing Foreman and not less than 20 percent of installers who are NRCA ProCertified metal shingle system installers]**.

1.12 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockups of metal shingles, including related roofing materials.
 - a. Size: **[48 inches (1219 mm) long by 96 inches (2438 mm) wide]<Insert dimensions>**.
 - b. Include gutter and downspout complying with requirements in **[Section 076200 "Sheet Metal Flashing and Trim."][Section 077100 "Roof Specialties."]**
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. Store metal shingle materials in a dry, well-ventilated location protected from weather and moisture in accordance with manufacturer's written instructions. Do not allow metal shingles to contact with other materials that might cause staining, denting, or other surface damage. Store metal shingle materials away from uncured and wet concrete and masonry.
 - 1. Retain strippable protective covering on metal shingles during installation.
- B. Store underlayment rolls in a dry, well-ventilated location protected from weather, sunlight, and moisture

in accordance with manufacturer's written instructions.

1. Store on end, on pallets or other raised surfaces.
2. Do not double-stack rolls.

- C. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing Work is not in progress.
- D. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

1.14 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with installation only when existing and forecasted weather conditions permit product installation and related Work to be performed in accordance with manufacturer's written instructions and warranty requirements.
 1. Install self-adhering, polymer-modified bitumen sheet underlayment within the range of ambient and substrate temperatures recommended in writing by manufacturer.

1.15 WARRANTY

- A. Materials Warranty: Manufacturer agrees to repair or replace metal shingles and accessories that fail within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures including wind uplift.
 - b. Water penetration[**and hail perforation**].
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. High-Performance Organic Coating: Deterioration of fluoropolymer finish including, but not limited to, the following:
 - 1) Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - 2) Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - 3) Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - e. **<Insert failure modes>**.
 2. Metal Shingle Warranty Period: **[15][25][50]<Insert number>** years from date of Substantial Completion.
 3. High-Performance Organic Coating Warranty Period: **[10][20]<Insert number>** years from date of Substantial Completion.
- B. Roofing System Installer's Warranty: On warranty form at end of this Section, signed by Installer, in which Installer agrees to repair or replace components of metal shingle roofing that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: **[Two][Five]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of product from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Exterior Fire-Test Exposure: Provide metal shingles and related roofing materials identical to those of assemblies tested for Class A fire resistance in accordance with ASTM E108 or UL 790 by ULSE or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
- B. Wind-Uplift Resistance: Provide metal shingle assemblies that comply with the following wind-uplift requirements:
1. Class: **[15][30][60][90]** when tested in accordance with UL 580.
 2. Uplift Resistance: **[75 lbf/sq. ft. (3.6 kPa)][120 lbf/sq. ft. (5.75 kPa)][165 lbf/sq. ft. (7.9 kPa)]<Insert value>** when tested in accordance with UL 1897.
- C. Impact Resistance: **[Class 3][Class 4]<Insert class designation>** when tested in accordance with UL 2218.
- D. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][32]** or initial SRI not less than **[82][39]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- E. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][25]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- F. Solar Reflectance Index (SRI): Not less than **[78][29]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.

2.3 METAL SHINGLES

- A. Aluminum Shingle Panels: Factory-formed, interlocking stamped units.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ATAS International, Inc.]**
 - b. **[Classic Metal Roofing Systems; Isaiah Industries, Inc.]**
 - c. **[Custom-Bilt Metals Inc.]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ATAS International, Inc.]**

- b. **[Classic Metal Roofing Systems; Isaiah Industries, Inc.]**
 - c. **[Custom-Bilt Metals Inc.]**
 - d. **<Insert manufacturer's name>**
3. Material: Formed aluminum, **[0.019 inch (0.48 mm)][0.024 inch (0.61 mm)][0.032 inch (0.81 mm)][0.040 inch (1.02 mm)]<Insert dimension>** thick.
 4. Shape: **[Shakes][Shingles][Spanish tiles][Flat tiles][Scalloped tiles]<Insert shape>**.
 5. Panel Size: **[24 by 12 inches (610 by 305 mm)][39-3/4 by 18-1/2 inches (1010 by 470 mm)][48 by 12 inches (1219 by 305 mm)]<Insert dimensions>**.
 6. Finish: **[High-performance organic coating]<Insert requirements>**.
 - a. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.

B. Aluminum, Individual Shingles: Factory-formed, interlocking units.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ATAS International, Inc.]**
 - b. **[Reinke Shakes; Division of Jame Kari LLC]**
 - c. **[Zappone Manufacturing, LLC]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ATAS International, Inc.]**
 - b. **[Reinke Shakes; Division of Jame Kari LLC]**
 - c. **[Zappone Manufacturing, LLC]**
 - d. **<Insert manufacturer's name>**
3. Material: Formed aluminum, **[0.020 inch (0.51 mm)][0.032 inch (0.81 mm)]<Insert dimension>** thick.
4. Shape: **[Rectangular][Diamond]**.
5. Exposure: **[12 by 8 inches (305 by 203 mm)][13-1/2 by 13-1/2 inches (343 by 343 mm)][14-1/2 by 8-1/8 inches (368 by 206 mm)]<Insert dimensions>**.
6. Features: **[Polystyrene backing]<Insert requirements>**.
7. Finish: **[High-performance organic coating]<Insert requirements>**.
 - a. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.

C. Steel Shingle Panels: Factory-formed, interlocking stamped units.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Allmet Roofing Products; a division of Metals USA Building Products Canada Inc.; Boral]**

- b. [ATAS International, Inc.]
 - c. [Decra Roofing Systems, Inc.]
 - d. [Gerard Roofing Technologies; Boral Steel Stone Coated Roofing]
 - e. [Metro Roof Products; Boral Steel Stone Coated Roofing]
 - f. [Tamko Building Products LLC]
 - g. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Allmet Roofing Products; a division of Metals USA Building Products Canada Inc.; Boral]
 - b. [ATAS International, Inc.]
 - c. [Decra Roofing Systems, Inc.]
 - d. [Gerard Roofing Technologies; Boral Steel Stone Coated Roofing]
 - e. [Metro Roof Products; Boral Steel Stone Coated Roofing]
 - f. [Tamko Building Products LLC]
 - g. <Insert manufacturer's name>
 3. Material: [Aluminum-zinc alloy coated][Zinc-coated (galvanized)] steel sheet, minimum nominal [0.0162 inch (0.41 mm)][0.017 inch (0.43 mm)]<Insert dimension> thickness.
 4. Shape: [Shakes][Shingles][Spanish tiles][Flat tiles][Scalloped tiles]<Insert shape>.
 5. Exposure: [36 by 12 inches (914 by 305 mm)][39-3/8 by 11-7/8 inches (1000 by 302 mm)]<Insert dimensions>.
 6. Finish: [Mill, acrylic-coated][Granular coating][High-performance organic coating]<Insert requirements>.
 - a. Color: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.
- D. Steel Individual Shingles: Factory-formed, interlocking rectangular units.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Berridge Manufacturing Company]
 - b. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Berridge Manufacturing Company]
 - b. <Insert manufacturer's name>
 3. Material: Aluminum-zinc alloy coated steel sheet, nominal [0.028 inch (0.71 mm) thick]<Insert thickness>.
 4. Shape: [Fish scale][Victorian][Classic stamped]<Insert shape>.
 5. Exposure: [8-1/2 by 11-1/2 inches (216 by 392 mm)][9 by 12 inches (229 by 305 mm)]<Insert dimensions>.
 6. Finish: [Mill, acrylic coated][High-performance organic coating]<Insert requirements>.
 - a. Color: [As indicated by manufacturer's designations][Match Architect's sample][As

selected by Architect from manufacturer's full range]<Insert color>.

- E. Copper, Individual Shingles: Factory-formed, interlocking units.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [ATAS International, Inc.]
 - b. [Reinke Shakes; Division of Jame Kari LLC]
 - c. [Zappone Manufacturing, LLC]
 - d. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [ATAS International, Inc.]
 - b. [Reinke Shakes; Division of Jame Kari LLC]
 - c. [Zappone Manufacturing, LLC]
 - d. <Insert manufacturer's name>
 3. Material: Copper sheet, minimum [12 oz./sq. ft. (0.41 mm thick)][16 oz./sq. ft. (0.55 mm thick)]<Insert requirements>.
 4. Shape: [Rectangular][Diamond].
 5. Exposure: [12 by 8 inches (305 by 203 mm)][13-1/2 by 13-1/2 inches (343 by 343 mm)][14-1/2 by 8-1/8 inches (368 by 206 mm)]<Insert dimensions>.
 6. Features: [Polystyrene backing]<Insert requirements>.
 7. Finish: [Mill][Pre-patinated dark brown][Pre-patinated verdigris]<Insert requirements>.
- F. Zinc, Individual Shingles: Factory-formed, interlocking units.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [ATAS International, Inc.]
 - b. [Rheinzink America]
 - c. [VM Building Solutions USA]
 - d. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [ATAS International, Inc.]
 - b. [Rheinzink America]
 - c. [VM Building Solutions USA]
 - d. <Insert manufacturer's name>
 3. Material: Zinc-alloy sheet, minimum [0.026 inch (0.65 mm)][0.028 inch (0.70 mm)][0.031 inch (0.80 mm)]<Insert dimension> thick.
 4. Shape: [Rectangular][Diamond]<Insert shape>.

5. Exposure: [13-1/2 by 13-1/2 inches (343 by 343 mm)][16-1/16 by 22-1/16 inches (408 by 560 mm)]<Insert dimensions>.
 6. Features: [Polystyrene backing]<Insert requirements>.
 7. Finish: [Bright rolled][Prewheathered gray][Prewheathered black]<Insert requirements>.
- G. Finish Protection: Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.4 SHEET METAL MATERIALS

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- B. Aluminum Sheet: **ASTM B209 (ASTM B209M)**, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
 1. Mill Finish: Uncoated aluminum sheet.
 2. High-Performance Organic Coating (Coil-Coated Finishes): Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight.
 - b. Three-Coat Fluoropolymer: AAMA 2605. System consisting of primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight.
 3. <Insert finish requirements>.
 4. Concealed Surface: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat and with a minimum total dry film thickness of **0.5 mil (0.013 mm)**.
- C. Aluminum-Zinc Alloy Coated Steel Sheet: **ASTM A792/A792M, Class AZ50 coating designation, Grade 37 (Class AZM150 coating designation, Grade 255)**; structural quality.
 1. Mill Finish: Satin-finish, aluminum-zinc alloy coated steel sheet without additional coating.
 2. Granular-Coating Finish: Entire upper surface of shingle, including flange edges, coated with ceramic-colored quartz granules or crushed stone chips bonded to shingle with a resin adhesive and sealed with a clear overglaze.
- D. Zinc-Coated (Galvanized) Steel Sheet: **ASTM A653/A653M, G90 (Z275)** coating designation; structural quality.
 1. Mill Finish: Zinc-coated (galvanized) steel sheet [**without additional coating**][**with manufacturer's standard mill-phosphatized finish**].
 2. High-Performance Organic Coating (Coil-Coated Finishes): Prepainted by the coil-coating process to comply with ASTM A755/A755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight.
 - b. Three-Coat Fluoropolymer: AAMA 621. System consisting of primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight.

3. <Insert finish requirements>.

- E. Copper Sheet: ASTM B370; Temper H00, cold rolled unless Temper 060 is required for forming.
 - 1. Mill Finish: Nonpatinated and exposed.
 - 2. Pre-Patinated Finish: Pre-patinated in accordance with ASTM B882.
- F. Zinc-Alloy Sheet: **[Alloy of 99.995 percent pure electrolytic high-grade zinc with alloy additives of copper (0.08 to 0.20 percent), titanium (0.07 to 0.12 percent), and aluminum (0.015 percent)][Zinc alloy consisting of 99 percent pure zinc with 0.08 to 1.00 percent copper, 0.06 to 0.20 percent titanium, and up to 0.015 percent aluminum].**
 - 1. Back Coating: Manufacturer's standard factory-applied, flexible, protective back coating.
 - 2. Bright-Rolled Finish: Uncoated, bright-rolled zinc-alloy sheet.
 - 3. Preweathered Finish: Factory-applied preweathering to uniform color.

2.5 UNDERLAYMENT MATERIALS

- A. Organic Felt: Asphalt-saturated organic felts, nonperforated and complying with the following.
 - 1. ASTM D226/D226M: **[Type I][Type II].**
 - 2. ASTM D4869/D4869M: **[Type I][Type II][Type III][Type IV].**
- B. Synthetic Underlayment: UV-resistant polypropylene, polyolefin, or polyethylene polymer fabric with surface coatings or treatments to improve traction underfoot and abrasion resistance; recommended in writing by manufacturer for use under metal shingles; and evaluated and documented to be suitable for use as a roof underlayment under applicable codes by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Drexel Metals Corp.]**
 - c. **[G.A.P. Roofing, Inc.]**
 - d. **[GAF]**
 - e. **[Malarkey Roofing Products]**
 - f. **[Owens Corning]**
 - g. **[SDP Advanced Polymer Products Inc.]**
 - h. **[SystemComponents Corporation]**
 - i. **[Tamko Building Products LLC]**
 - j. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Drexel Metals Corp.]**
 - c. **[G.A.P. Roofing, Inc.]**
 - d. **[GAF]**
 - e. **[Malarkey Roofing Products]**

- f. [Owens Corning]
 - g. [SDP Advanced Polymer Products Inc.]
 - h. [SystemComponents Corporation]
 - i. [Tamko Building Products LLC]
 - j. <Insert manufacturer's name>
- C. Polymer-Modified Bitumen Sheet, Mechanically Fastened: Styrene-butadiene-styrene- (SBS) modified asphalt, glass-fiber-mat-reinforced sheet; in minimum thickness as recommended in writing by manufacturer; and acceptable to authorities having jurisdiction for use as underlayment in metal steep-slope roofing systems; designed for mechanical fastening; and with manufacturer's standard non-abrasive, slip-resistant surface that will not scratch the underside of metal shingles. Granular or sand surfacings are unacceptable.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [Boral Roofing LLC; Boral USA]
 - c. [G.A.P. Roofing, Inc.]
 - d. [GMC Roofing & Building Paper Products, Inc.]
 - e. [Tarco]
 - f. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [Boral Roofing LLC; Boral USA]
 - c. [G.A.P. Roofing, Inc.]
 - d. [GMC Roofing & Building Paper Products, Inc.]
 - e. [Tarco]
 - f. <Insert manufacturer's name>
 3. <Insert testing requirements>.
- D. Self-Adhering, Polymer-Modified Bitumen Sheet: ASTM D1970/D1970M, glass-fiber-mat-reinforced, polymer-modified asphalt; with slip-resistant, polymer-film or polyester-fabric top surface and release backing; cold applied; in minimum thickness as recommended in writing by manufacturer for use under metal roof shingles. **[Provide primer for adjoining concrete, masonry, and metal surfaces to receive underlayment.]**
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. [ALCO Products LLC]
 - b. [Atlas Polyiso Roof and Wall Insulation]
 - c. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
 - d. [CertainTeed; SAINT-GOBAIN]
 - e. [Drexel Metals Corp.]
 - f. [GAF]
 - g. [GCP Applied Technologies Inc.]

- h. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
- i. [IKO Industries Inc.]
- j. [Malarkey Roofing Products]
- k. [SDP Advanced Polymer Products Inc.]
- l. [Tamko Building Products LLC]
- m. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [ALCO Products LLC]
- b. [Atlas Polyiso Roof and Wall Insulation]
- c. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
- d. [CertainTeed; SAINT-GOBAIN]
- e. [Drexel Metals Corp.]
- f. [GAF]
- g. [GCP Applied Technologies Inc.]
- h. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
- i. [IKO Industries Inc.]
- j. [Malarkey Roofing Products]
- k. [SDP Advanced Polymer Products Inc.]
- l. [Tamko Building Products LLC]
- m. <Insert manufacturer's name>

- E. Self-Adhering, Polymer-Modified Bitumen Sheet, High Temperature: ASTM D1970/D1970M, glass-fiber-mat-reinforced, polymer-modified asphalt; with slip-resistant polymer-film or polyester-fabric top surface and release backing; cold applied; in minimum thickness as recommended in writing by manufacturer for use under metal roof shingles. [Provide primer for adjoining concrete, masonry, and metal surfaces to receive underlayment.]

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [ALCO Products LLC]
- b. [Atlas Polyiso Roof and Wall Insulation]
- c. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
- d. [CertainTeed; SAINT-GOBAIN]
- e. [Drexel Metals Corp.]
- f. [GCP Applied Technologies Inc.]
- g. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
- h. [Malarkey Roofing Products]
- i. [SDP Advanced Polymer Products Inc.]
- j. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [ALCO Products LLC]

- b. [Atlas Polyiso Roof and Wall Insulation]
 - c. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
 - d. [CertainTeed; SAINT-GOBAIN]
 - e. [Drexel Metals Corp.]
 - f. [GCP Applied Technologies Inc.]
 - g. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
 - h. [Malarkey Roofing Products]
 - i. [SDP Advanced Polymer Products Inc.]
 - j. <Insert manufacturer's name>
3. Thermal Stability: Stable after testing at **240 deg F (116 deg C)** in accordance with ASTM D1970/D1970M.

2.6 RIDGE VENTS

- A. Ridge Vents: Metal shingle manufacturer's continuous vented ridge caps matching material and finish of metal shingles[**with insect screen or insect-resisting geotextile filter strips**][and][**with external deflector baffles**]; for use with specified metal shingles.
 - 1. Minimum Net Free Area: <Insert free area>.
 - 2. Accessories: Splices, end caps, and other accessories matching metal and finish.

2.7 SHEET METAL FLASHING AND TRIM

- A. Sheet Metal Flashing and Trim: Metal shingle manufacturer's flashing and trim components matching shingle material, color, and finish unless otherwise specified in this Section, indicated on Drawings, or recommended in writing by metal shingle manufacturer. Fabricate to sizes and configurations required for a weathertight installation. Unless otherwise specified in this Section or indicated on Drawings, fabricate sheet metal flashing and trim to comply with recommendations that apply to design, dimensions, metal, and other characteristics of the item in SMACNA's "Architectural Sheet Metal Manual."
 - 1. Valley Flashing: Fabricate to extend not less than **[8 inches (203 mm)]<Insert dimension>** from the centerline of the valley with a splash-diverter rib not less than **[3/4 inch (19 mm)]<Insert dimension>** high at the flowline formed as part of the flashing.

2.8 ACCESSORIES

- A. Wood Battens: Nominal **[2-by-2-inch (51-by-51-mm)]<Insert dimensions>** untreated wood complying with requirements in Section 061000 "Rough Carpentry."
- B. Metal Battens: Hat channels formed from zinc-coated (galvanized) steel sheet; ASTM A653/A653M, **G90 (Z275)** coating designation, not less than **[0.025-inch (0.64-mm)]<Insert dimension>** nominal thickness.
 - 1. Size: **[Minimum 2-inch- (51-mm-) wide surface for fastening metal shingles and 1-1/2 inches (38 mm) deep]<Insert requirements>**.
- C. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- D. Asphalt Roofing Cement: ASTM D4586/D4586M Type II, asbestos free.

- E. Sealant: ASTM C920, Type S, Grade NS, one-part, non-sag elastomeric polymer joint sealant as recommended in writing by metal shingle manufacturer for installation indicated; of class and use classifications required to seal joints and remain watertight. Where sealant is exposed, provide in color matching shingle.
- F. Sheet Metal Fasteners: Noncorrosive screws, nails, and anchors designed to withstand design loads and recommended in writing by metal shingle manufacturer.
 - 1. Exposed Fasteners: Heads matching color of metal shingles using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC washers under heads of exposed fasteners bearing on weather side of shingles.
 - 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - 3. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
 - 4. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 5. Fasteners for Aluminum-Zinc Alloy Coated Steel Sheet: Hot-dip galvanized steel in accordance with ASTM A153/A153M, ASTM F2329, or Series 300 stainless steel.
 - 6. Fasteners for Zinc-Coated Steel Sheet: Hot-dip galvanized steel in accordance with ASTM A153/A153M, ASTM F2329, or Series 300 stainless steel.
 - 7. Fasteners for Copper Sheet: Copper, hardware bronze, or Series 300 stainless steel.
 - 8. Fasteners for Zinc Sheet: Hot-dip galvanized steel in accordance with ASTM A153/A153M, ASTM F2329, or Series 300 stainless steel.
- G. Underlayment Nails: Aluminum, stainless steel, or hot-dip galvanized-steel wire nails with low-profile metal or plastic caps, **1-inch- (25-mm-)** minimum diameter.
 - 1. Provide with minimum **0.0134-inch- (0.34-mm-)** thick metal cap, **0.010-inch- (0.25-mm-)** thick power-driven metal cap, or **0.035-inch- (0.89-mm-)** thick plastic cap; and with minimum **0.083-inch- (2.11-mm-)** thick ring shank or **0.091-inch- (2.31-mm-)** thick smooth shank of length to penetrate at least **3/4 inch (19 mm)** into roof sheathing or to penetrate through roof sheathing less than **3/4 inch (19 mm)** thick.
 - 2. Where nails are in contact with metal shingles or flashing, use nails made from same metal as metal shingles.
- H. Wood Batten Nails: ASTM F1667; common or box, steel wire, flat head, and smooth shank; hot-dip galvanized.
- I. **<Insert snow guard requirements>**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with roofing system Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking, that tops of fasteners are flush with surface, and that installation is within flatness tolerances.
 - 2. Verify that substrate is sound, dry to the maximum moisture content recommended in writing by metal shingle manufacturer, smooth, clean, sloped for drainage, and completely anchored and that provisions have been made for flashings and penetrations through metal shingles.
 - 3. Verify that vent stacks and other penetrations through roofing are installed and securely fastened.

- B. Prepare written report, endorsed by roofing system Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT MATERIALS

- A. Comply with metal shingle and underlayment manufacturers' written installation instructions and with recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems" applicable to products and applications indicated unless more stringent requirements are specified in this Section or indicated on Drawings.
- B. Organic Felt: Install on roof deck parallel with and starting at eaves and fasten with underlayment nails.
 - 1. Single-Layer Installation:
 - a. Lap sides a minimum of **2 inches (51 mm)****[4 inches (102 mm)]** over underlying course.
 - b. Lap ends a minimum of **4 inches (102 mm)**.
 - c. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 - 2. Double-Layer Installation:
 - a. Install a **19-inch- (483-mm-)** wide starter course at eaves and completely cover with a **36-inch- (914-mm-)** wide second course.
 - b. Install succeeding **36-inch- (914-mm-)** wide courses lapping previous courses **19 inches (483 mm)** in shingle fashion.
 - c. Lap ends a minimum of **4 inches (102 mm)**.
 - d. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 - e. Apply a continuous layer of asphalt roofing cement over starter course and on felt surface to be concealed by succeeding courses as each felt course is installed. Apply **[over entire roof][at locations indicated on Drawings]**.
 - 3. Install felt underlayment on roof deck not covered by self-adhering, polymer-modified bitumen sheet unless otherwise specified in this Section or indicated on Drawings.
 - a. Lap sides of felt over self-adhering sheet not less than **4 inches (102 mm)** in direction that sheds water.
 - b. Lap ends of felt not less than **6 inches (152 mm)** over self-adhering sheet underlayment.
 - 4. Install fasteners in a grid pattern of **12 inches (305 mm)** between side laps with **6-inch (152-mm)** spacing at side and end laps.
 - 5. Terminate felt **[flush][extended up not less than 4 inches (102 mm)]****<Insert requirements>** against sidewalls, curbs, chimneys, and other roof projections.
- C. Synthetic Underlayment:
 - 1. Install on roof deck parallel with and starting at the eaves.
 - a. Lap sides and ends and treat laps as recommended in writing by manufacturer, but not less than **2 inches (51 mm)****[4 inches (102 mm)]** for side laps and **6 inches (152 mm)** for end laps.
 - b. Stagger end laps between succeeding courses at interval recommended in writing by manufacturer, but not less than **72 inches (1829 mm)**.
 - c. Fasten with underlayment nails in accordance with manufacturer's written instructions.
 - d. Cover underlayment within period recommended in writing by manufacturer.

2. Install in double layer on roofs sloped at less than 4:12.
 3. Install synthetic underlayment on roof deck not covered by self-adhering, polymer-modified bitumen sheet unless otherwise specified in this Section or indicated on Drawings.
 - a. Lap sides of underlayment over self-adhering sheet not less than **4 inches (102 mm)** in direction to shed water.
 - b. Lap ends of underlayment not less than **6 inches (152 mm)** over self-adhering sheet.
 4. Install fasteners in a grid pattern of **12 inches (305 mm)** between side laps with **6-inch (152-mm)** spacing at side and end laps.
 5. Terminate synthetic underlayment [**flush**][**extended up not less than 4 inches (102 mm)**]**<Insert requirements>** against sidewalls, curbs, chimneys, and other roof projections.
- D. Polymer-Modified Bitumen Sheet, Mechanically Fastened: Install on roof deck parallel with and starting at eaves. Fasten with underlayment nails.
1. Single-Layer Installation:
 - a. Lap sides a minimum of [**2 inches (51 mm)**][**4 inches (102 mm)**] over underlying course.
 - b. Lap ends a minimum of **6 inches (152 mm)**.
 - c. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 2. Double-Layer Installation:
 - a. Install in overlapping layers with a half-width plus **1-inch- (25-mm-)** wide starter course at eaves completely covered by full-width second course. Install succeeding courses lapping previous courses by a half-width plus **1 inch (25 mm)** in shingle fashion.
 - b. Lap ends a minimum of **6 inches (152 mm)**.
 - c. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 3. Install mechanically fastened sheet on roof deck not covered by self-adhering, polymer-modified bitumen sheet unless otherwise specified in this Section or indicated on Drawings.
 - a. Lap sides of mechanically fastened sheets over self-adhering sheet not less than **4 inches (102 mm)** in direction to shed water.
 - b. Lap ends of mechanically fastened sheets not less than **6 inches (152 mm)** over self-adhering sheets.
 4. Install fasteners in a grid pattern of **12 inches (305 mm)** between side laps with **6-inch (152-mm)** spacing at side and end laps.
 5. Terminate sheets [**flush**][**extended up not less than 4 inches (102 mm)**]**<Insert requirements>** against sidewalls, curbs, chimneys, and other roof projections.
- E. Self-Adhering, Polymer-Modified Bitumen Sheet: Install, wrinkle free, on roof deck.
1. Comply with low-temperature installation restrictions of underlayment manufacturer.
 2. Install lapped in direction that sheds water.
 - a. Lap sides not less than **4 inches (102 mm)**.
 - b. Lap ends not less than **6 inches (152 mm)**, staggered **24 inches (610 mm)** between succeeding courses.
 - c. Roll laps with roller.
 3. Prime concrete and masonry surfaces to receive self-adhering sheet underlayment.
 4. Single-Layer Installation: Install over entire roof deck.

5. Water and Ice-Dam Protection Installation: Install where indicated [below][on Drawings].
 - a. Eaves: Extend from edges of eaves [24 inches (610 mm)][36 inches (914 mm)]<Insert dimension> beyond interior face of exterior wall.
 - b. Rakes: Extend from edges of rakes [24 inches (610 mm)][36 inches (914 mm)]<Insert dimension> beyond interior face of exterior wall.
 - c. Valleys: Extend from lowest to highest point [18 inches (457 mm)]<Insert dimension> on each side of centerline.
 - d. Hips: Extend [18 inches (457 mm)]<Insert dimension> on each side.
 - e. Ridges: Extend [36 inches (914 mm)]<Insert dimension> on each side[without obstructing continuous ridge vent slot].
 - f. Sidewalls: Extend [18 inches (457 mm)]<Insert dimension> beyond sidewalls, and return vertically against sidewalls not less than [4 inches (102 mm)]<Insert dimension>.
 - g. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend [18 inches (457 mm)]<Insert dimension> beyond penetrating elements, and return vertically against penetrating elements not less than [4 inches (102 mm)]<Insert dimension>.
 - h. Roof-Slope Transitions: Extend [18 inches (457 mm)]<Insert dimension> on each roof slope.

6. Cover underlayment within seven days.

- F. Valley Underlayment: Install one layer of **36-inch- (914-mm-)** wide underlayment centered in valley, running full length of valley, and on top of underlayment on field of roof that is woven through valley. Install all layers of underlayment in and through valley tight with no bridging.
 1. Use same underlayment as installed on field of roof.
 2. Lap ends at least **12 inches (305 mm)** in direction that sheds water, and seal with asphalt roofing cement.
 3. Fasten to roof deck with underlayment nails located as far from valley center as possible and only to extent necessary to hold underlayment in place until installation of valley flashing.
 4. Solidly cement valley underlayment to roof-field underlayment that is woven through valley using asphalt roofing cement.

3.3 INSTALLATION OF SHEET METAL FLASHING AND TRIM

- A. Install metal flashings and trim in accordance with manufacturer's written instructions and recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems" unless more stringent requirements are specified in this Section or indicated on Drawings.
 1. Install with minimum **4-inch (102-mm)** end laps.

3.4 INSTALLATION OF RIDGE VENTS

- A. Install ridge vents with end closures at locations indicated on Drawings in accordance with manufacturer's written instructions unless more stringent requirements are specified in this Section or indicated on Drawings.

3.5 INSTALLATION OF ACCESSORIES

- A. Install accessories in accordance with manufacturer's written instructions unless more stringent requirements are specified in this Section or indicated on Drawings.
- B. Battens: Install battens in accordance with metal shingle manufacturer's written instructions.



1. Wood Battens: Install wood battens horizontally over installed underlayment with ends separated by **1/2 inch (13 mm)**, at spacing required by metal shingle manufacturer, and securely fasten to roof deck with wood batten nails.
 2. Metal Battens: Install metal battens horizontally over installed underlayment with ends separated by **1/2 inch (13 mm)**, at spacing required by metal shingle manufacturer, and securely fasten to roof deck with sheet metal fasteners.
- C. Metal Protection: Where dissimilar metals contact each other, protect against galvanic action by painting contact surfaces with bituminous coating, by applying self-adhering, polymer-modified bitumen sheet to each contact surface, or by other means of permanent separation recommended in writing by manufacturer of metal shingles or of the metals in contact.

3.6 INSTALLATION OF METAL SHINGLES

- A. Install metal shingles in accordance with manufacturer's written instructions true in line.
 - B. Maintain uniform exposure and coursing of metal shingles throughout roof.
 - C. Apply sealant between shingles, flashing, trim, and exposed fasteners to achieve a weathertight system.
 - D. Interlock and overlap shingles, and **[stagger end joints from][align joints of tile-form]** shingle courses above and below.
 - E. Metal Protection: Where dissimilar metals contact each other, protect against galvanic action by painting contact surfaces with bituminous coating, by applying self-adhering, polymer-modified bitumen sheet to each contact surface, or by other means of permanent separation recommended in writing by manufacturer of metal shingles or of the metals in contact.
1. Do not use graphite pencils to mark metal surfaces.

3.7 ADJUSTING

- A. Remove and replace damaged or deformed metal shingles. Replace shingles with damaged or deteriorated finishes and other components of the Work that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as metal shingles are installed unless otherwise indicated in manufacturer's written installation instructions.
- C. On completion of installation, touch up minor nicks and abrasions in finish, in accordance with manufacturer's written instructions.
- D. Remove excess sealants.

3.8 ROOFING SYSTEM INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing System Installer," has performed roofing and associated Work on the following Project:
 1. Owner: **<Insert name of Owner>**.
 2. Owner Address: **<Insert address>**.

3. Building Name/Type: **<Insert information>**.
 4. Building Address: **<Insert address>**.
 5. Area of Work: **<Insert information>**.
 6. Warranty Period: **[Two][Five]<Insert number>** years from date of Substantial Completion.
 7. Date of Substantial Completion: _____.
- B. AND WHEREAS Roofing System Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said Work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing System Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period, Roofing System Installer will, at Roofing System Installer's own cost and expense, make or cause to be made such repairs to or replacements of said Work as are necessary to correct faulty and defective Work and as are necessary to maintain said Work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to the Work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding **<Insert mph (m/s)>**;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the Work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When the Work has been damaged by any of foregoing causes, Warranty becomes null and void until such damage has been repaired by Roofing System Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing System Installer is responsible for damage to the Work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of the Work.
 4. During Warranty Period, if Owner allows alteration of the Work by anyone other than Roofing System Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty becomes null and void on date of said alterations, but only to the extent said alterations affect the Work covered by this Warranty. If Owner engages Roofing System Installer to perform the alterations, Warranty does not become null and void unless Roofing System Installer, before starting said Work, has notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate the Work, thereby reasonably justifying a limitation or termination of this Warranty.
 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a use or service more severe than originally specified, this Warranty becomes null and void on date of the change, but only to the extent said change affects the Work covered by this Warranty.
 6. Owner to promptly notify Roofing System Installer of observed, known, or suspected leaks, defects, or deterioration and afford reasonable opportunity for Roofing System Installer to inspect the Work and to examine evidence of such leaks, defects, or deterioration.
 7. This Warranty is recognized to be the only warranty of Roofing System Installer on said Work and does not operate to restrict or cut off Owner from other remedies and resources lawfully available



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to Owner in cases of roofing failure. Specifically, this Warranty does not operate to relieve Roofing System Installer of responsibility for performance of the Work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

- 1. Authorized Signature: _____.
- 2. Name: _____.
- 3. Title: _____.

END OF SECTION 07 31 16 00



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 31 16 00	07 31 13 00	Asphalt Shingles



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SECTION 07 31 26 00 - SLATE SHINGLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Slate shingles.
2. Underlayment materials.
3. Ridge accessories.
4. Sheet metal flashing and trim.

B. Related Requirements:

1. Section 077253 "Snow Guards" for snow guards.

1.2 ALLOWANCES

- A. See Section 012100 "Allowances" for description of allowances affecting items specified under this Section.

1.3 UNIT PRICES

- A. See Section 012200 "Unit Prices" for description of unit prices affecting items specified under this Section.

1.4 ALTERNATES

- A. See Section 012300 "Alternates" for description of alternates affecting items specified under this Section.

1.5 DEFINITIONS

- A. Roofing Terminology: See ASTM D1079 for definitions of terms related to roofing Work in this Section.

1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference [at Project site][by web conference]<Insert location>.

1. <Insert participant requirements>.

1.7 ACTION SUBMITTALS

- A. Product Data: For each type of product.

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- B. Shop Drawings: For sheet metal flashing and trim.
- C. Samples: For each exposed product and for each color and texture specified, in sizes indicated.
 - 1. Slate Shingles: Full size, of each color, size, texture, and shape.
 - 2. Metal Ridge Cap: **12-inch- (305-mm-)** long Sample.
 - 3. Rigid-Plastic Ridge Vent: **12-inch- (305-mm-)** long Sample.
 - 4. Metal Valley Flashing: **12 inches (305 mm)** square.
- D. Samples for Initial Selection:
 - 1. For each type of slate shingle.
 - 2. For each type of accessory involving color selection.
- E. Samples for Verification: For the following products, in sizes indicated:
 - 1. Slate Shingle: Full size, of each color, size, texture, and shape.
 - 2. Metal Ridge Cap: **12-inch- (305-mm-)** long Sample.
 - 3. Rigid-Plastic Ridge Vent: **12-inch- (305-mm-)** long Sample.
 - 4. Metal Valley Flashing: **12 inches (305 mm)** square.

1.8 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each slate variety, by a qualified testing agency.
- B. Research Reports: From **[an agency acceptable to authorities having jurisdiction][ICC-ES]<Insert evaluation agency>**, indicating that product is suitable for intended use under applicable building codes for the following:
 - 1. Polymer-modified bitumen sheet underlayment.
 - 2. Synthetic underlayment.
- C. Qualification Statements: For roofing system Installer.
- D. Sample warranties.

1.9 CLOSEOUT SUBMITTALS

- A. Roofing system Installer's warranty.

1.10 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Slate Shingles: **[100 sq. ft. (9.3 sq. m)]<Insert area>** of each size, type, and color, in unbroken bundles.

1.11 QUALITY ASSURANCE

- A. Roofing System Installer Qualifications: Entity that employs **[a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified slate system installers][a supervisor who is an NRCA ProCertified Roofing Foreman][a supervisor who is an NRCA ProCertified Roofing Foreman and not less than 20 percent of installers who are NRCA ProCertified slate system installers]**.

1.12 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Build mockups for slate shingles including related roofing materials.
 - a. Size: **[48 inches (1219 mm) long by 48 inches (1219 mm) wide]<Insert dimensions>**.
 - b. Include gutter and downspout complying with requirements in **[Section 076200 "Sheet Metal Flashing and Trim."][Section 077100 "Roof Specialties."]**
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. Store underlayment rolls in a dry, well-ventilated location protected from weather, sunlight, and moisture in accordance with manufacturer's written instructions.
1. Store on end, on pallets or other raised surfaces.
 2. Do not double-stack rolls.
- B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.
- C. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

1.14 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with installation only when existing and forecasted weather conditions permit product installation and related Work to be performed in accordance with manufacturer's written instructions and warranty requirements.
1. Install self-adhering, polymer-modified bitumen sheet underlayment within the range of ambient and substrate temperatures recommended in writing by manufacturer.

1.15 WARRANTY

- A. Roofing System Installer's Warranty: On warranty form at end of this Section, signed by Installer, in which Installer agrees to repair or replace components of slate-shingle roofing that fail in materials or

workmanship within specified warranty period.

1. Warranty Period: [Two][Five]<Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of product from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Exterior Fire-Test Exposure: Provide slate shingles and related roofing materials identical to those of assemblies tested for Class A fire resistance in accordance with ASTM E108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

2.3 SLATE SHINGLES

- A. Slate Shingles: ASTM C406/C406M, [Grade S1][Grade S2]; hard, dense, and sound; with chamfered edges and nail holes machine punched or drilled and countersunk; with no broken or cracked slates, no broken exposed corners, and no broken corners on covered ends that could sacrifice nailing strength or laying of a watertight roof.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [American Slate Company]
 - b. [Black Diamond Slate, LLC]
 - c. [BUCKINGHAM SLATE, A PRODUCT OF BOXLEY MATERIALS COMPANY]
 - d. [Evergreen Slate Company, Inc]
 - e. [Greenstone Slate Company, Inc]
 - f. [New England Slate]
 - g. [North Country Slate]
 - h. [Sheldon Slate Products Company, Inc.]
 - i. [Slate International, Inc]
 - j. [Structural Slate Company (The)]
 - k. [Vermont Structural Slate Company, Inc]
 - l. [Virginia Slate Company]
 - m. [Williams & Sons Slate & Tile, Inc]
 - n. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [American Slate Company]
 - b. [Black Diamond Slate, LLC]

- c. [BUCKINGHAM SLATE, A PRODUCT OF BOXLEY MATERIALS COMPANY]
 - d. [Evergreen Slate Company, Inc]
 - e. [Greenstone Slate Company, Inc]
 - f. [New England Slate]
 - g. [North Country Slate]
 - h. [Sheldon Slate Products Company, Inc.]
 - i. [Slate International, Inc]
 - j. [Structural Slate Company (The)]
 - k. [Vermont Structural Slate Company, Inc]
 - l. [Virginia Slate Company]
 - m. [Williams & Sons Slate & Tile, Inc]
 - n. <Insert manufacturer's name>
- 3. Thickness and Surface Texture: Nominal [1/4 inch (6 mm), smooth][1/4 to 3/8 inch (6 to 10 mm), rough][3/8 to 1/2 inch (10 to 13 mm), rough]<Insert dimension and surface texture>.
 - 4. Length: [16 inches (406 mm)][18 inches (457 mm)][20 inches (508 mm)]<Insert dimension>.
 - 5. Width: [14 inches (356 mm)][12 inches (305 mm)][11 inches (279 mm)][10 inches (254 mm)][9 inches (229 mm)][8 inches (203 mm)][random widths, but not less than one-half-length]<Insert dimension>.
 - 6. Nail Holes: [Two][Four] per shingle.
 - 7. Butt Shape: [Standard square cut][Pointed][Deep bevel][Shallow bevel][Deep scallop][Shallow scallop][Round]<Insert shape>.
 - 8. Color: [Black][Gray][Purple][Green][Blue-black][Blue-gray][Mottled purple and green][Red][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.
 - 9. Weather-Exposure Color Change: [Unfading][Weathering].
- B. Starter Slate: Slate shingles with chamfered nail holes front-side punched.
 - 1. Length: Exposure of slate shingle plus headlap.
 - C. Ridge Slate: Slate shingles fabricated with [vertical][horizontal] grain orientation.

2.4 UNDERLAYMENT MATERIALS

- A. Asphalt-Saturated Organic Felt: [ASTM D226/D226M Type I][ASTM D226/D226M Type II][ASTM D4869/D4869M Type III][ASTM D4869/D4869M Type IV]<Insert requirements>, unperforated.
- B. Synthetic Underlayment: UV-resistant polypropylene, polyolefin, or polyethylene polymer fabric with surface coatings or treatments to improve traction underfoot and abrasion resistance; recommended, in writing, by manufacturer for use under slate shingles; and evaluated and documented to be suitable for use as a roof underlayment under applicable codes by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Building Products of Canada Corp.]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [Drexel Metals Corp.]
 - d. [G.A.P. Roofing, Inc.]
 - e. [GAF]
 - f. [Malarkey Roofing Products]

- g. [Owens Corning]
- h. [SDP Advanced Polymer Products Inc.]
- i. [SystemComponents Corporation]
- j. [Tamko Building Products LLC]
- k. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Building Products of Canada Corp.]
- b. [CertainTeed; SAINT-GOBAIN]
- c. [Drexel Metals Corp.]
- d. [G.A.P. Roofing, Inc.]
- e. [GAF]
- f. [Malarkey Roofing Products]
- g. [Owens Corning]
- h. [SDP Advanced Polymer Products Inc.]
- i. [SystemComponents Corporation]
- j. [Tamko Building Products LLC]
- k. <Insert manufacturer's name>

- C. Polymer-Modified Bitumen Sheet: Styrene-butadiene-styrene- (SBS) modified asphalt, glass-fiber-mat-reinforced sheet; minimum [55-mil (1.4-mm)][40-mil (1.0-mm)]<Insert dimension> nominal thickness; recommended in writing by manufacturer and acceptable to authorities having jurisdiction for use as underlayment in slate steep-slope roofing systems; and designed for mechanical fastening or adhesive attachment using roofing asphalt or cold-applied adhesive.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Atlas Polyiso Roof and Wall Insulation]
- b. [Boral Roofing LLC; Boral USA]
- c. [CertainTeed; SAINT-GOBAIN]
- d. [G.A.P. Roofing, Inc.]
- e. [GMC Roofing & Building Paper Products, Inc.]
- f. [Malarkey Roofing Products]
- g. [Tarco]
- h. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Atlas Polyiso Roof and Wall Insulation]
- b. [Boral Roofing LLC; Boral USA]
- c. [CertainTeed; SAINT-GOBAIN]
- d. [G.A.P. Roofing, Inc.]
- e. [GMC Roofing & Building Paper Products, Inc.]
- f. [Malarkey Roofing Products]
- g. [Tarco]
- h. <Insert manufacturer's name>

3. <Insert testing requirements>.

- D. Self-Adhering, Polymer-Modified Bitumen Sheet: ASTM D1970/D1970M, minimum [55-mil- (1.4-mm-)][50-mil- (1.3-mm-)][40-mil- (1.0-mm-)]<Insert dimension> thick sheet; glass-fiber-mat-reinforced, polymer-modified asphalt; with slip-resistant top surface and release backing; cold applied.[**Provide primer for adjoining concrete, masonry, and metal surfaces to receive underlayment.**]

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [ALCO Products LLC]
 - b. [Atlas Polyiso Roof and Wall Insulation]
 - c. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
 - d. [CertainTeed; SAINT-GOBAIN]
 - e. [Drexel Metals Corp.]
 - f. [GAF]
 - g. [GCP Applied Technologies Inc.]
 - h. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
 - i. [IKO Industries Inc.]
 - j. [Malarkey Roofing Products]
 - k. [Owens Corning]
 - l. [SDP Advanced Polymer Products Inc.]
 - m. [Tamko Building Products LLC]
 - n. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [ALCO Products LLC]
 - b. [Atlas Polyiso Roof and Wall Insulation]
 - c. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
 - d. [CertainTeed; SAINT-GOBAIN]
 - e. [Drexel Metals Corp.]
 - f. [GAF]
 - g. [GCP Applied Technologies Inc.]
 - h. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
 - i. [IKO Industries Inc.]
 - j. [Malarkey Roofing Products]
 - k. [Owens Corning]
 - l. [SDP Advanced Polymer Products Inc.]
 - m. [Tamko Building Products LLC]
 - n. <Insert manufacturer's name>

3. Top Surface: [Sand][Granule][Textured polymer film][Polyester].

- E. Self-Adhering, Polymer-Modified Bitumen Sheet, High Temperature: ASTM D1970/D1970M, minimum [55-mil- (1.4-mm-)][50-mil- (1.3-mm-)][40-mil- (1.0-mm-)]<Insert thickness> thick sheet; glass-fiber-mat-reinforced, polymer-modified asphalt; with slip-resistant top surface and release backing; cold applied.[**Provide primer for adjoining concrete, masonry, and metal surfaces to receive underlayment.**]

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ALCO Products LLC]**
 - b. **[Atlas Polyiso Roof and Wall Insulation]**
 - c. **[Carlisle WIP Products; a brand of Carlisle Construction Materials]**
 - d. **[CertainTeed; SAINT-GOBAIN]**
 - e. **[Drexel Metals Corp.]**
 - f. **[GCP Applied Technologies Inc.]**
 - g. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - h. **[Malarkey Roofing Products]**
 - i. **[SDP Advanced Polymer Products Inc.]**
 - j. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ALCO Products LLC]**
 - b. **[Atlas Polyiso Roof and Wall Insulation]**
 - c. **[Carlisle WIP Products; a brand of Carlisle Construction Materials]**
 - d. **[CertainTeed; SAINT-GOBAIN]**
 - e. **[Drexel Metals Corp.]**
 - f. **[GCP Applied Technologies Inc.]**
 - g. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - h. **[Malarkey Roofing Products]**
 - i. **[SDP Advanced Polymer Products Inc.]**
 - j. **<Insert manufacturer's name>**
3. Thermal Stability: Stable after testing at **240 deg F (116 deg C)** in accordance with ASTM D1970/D1970M.
4. Top Surface: **[Granule][Textured polymer film][Polyester]**.

2.5 RIDGE ACCESSORIES

- A. Metal Ridge Cap: Metal covers with noncorrosive components complete with internal anchoring lag screws, compression plates, and snap-on caps, fabricated for slate roof system indicated.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Castle Metal Products]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Castle Metal Products]**
 - b. **<Insert manufacturer's name>**
 3. Type: **[Exposed-metal][Slate-covered]** legs.
 4. Venting:
 - a. Continuous, low-profile, compression-resistant ventilating base that provides a net free area of **[18 sq. in./ft. (380 sq. cm/m)]<Insert requirements>** of ridge.
 - b. **[With][Without]** external baffles.
 5. Metal Components: **[Copper, 20-oz./sq. ft.- (0.7-mm-) thick sheet][Aluminum, 0.050-inch- (1.3-mm-) thick sheet, with manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight on exposed surfaces]<Insert requirements>**.
 6. Accessories:
 - a. Splices, end caps, and other accessories of matching metal and finish.
- B. Rigid-Plastic Ridge Vent: Manufacturer's standard, rigid section high-density polypropylene or other UV-stabilized plastic ridge vent for use under slate ridge shingles.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Cor-A-Vent, Inc]**
 - b. **[GAF]**
 - c. **[Tapco International Corporation; Mid-America Components]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Cor-A-Vent, Inc]**
 - b. **[GAF]**
 - c. **[Tapco International Corporation; Mid-America Components]**
 - d. **<Insert manufacturer's name>**
 3. Minimum Net Free Area: **<Insert area>**.
 4. Width: **<Insert dimension>**.
 5. Thickness: **<Insert dimension>**.

2.6 SHEET METAL FLASHING AND TRIM

- A. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
 1. Sheet Metal: **[Copper][Stainless steel][Zinc-tin alloy coated copper][Anodized aluminum][Aluminum, mill finished]<Insert requirements>**.
- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for design, dimensions, metal, and other characteristics of the item unless otherwise specified in this Section or indicated on Drawings.

1. Apron Flashings: Fabricate with lower flange extending a minimum of [4 inches (102 mm)][6 inches (152 mm)]<Insert dimension> over and [4 inches (102 mm)]<Insert dimension> beyond each side of downslope slate shingles and [6 inches (152 mm)]<Insert dimension> up the vertical surface.
2. Step Flashings: Fabricate with a headlap of 3 inches (76 mm) and a minimum extension of [4 inches (102 mm)][5 inches (127 mm)]<Insert dimension> both horizontally and vertically.
3. Cricket and Backer Flashings: Fabricate with concealed flange extending a minimum of [24 inches (610 mm)]<Insert dimension> beneath upslope slate shingles, [6 inches (152 mm)]<Insert dimension> beyond each side of [chimney][skylight], and [6 inches (152 mm)]<Insert dimension> above the roof plane.
4. Counterflashings: Fabricate to cover [4 inches (102 mm)]<Insert dimension> of base flashing measured vertically; and in lengths required so that no step exceeds [8 inches (203 mm)]<Insert dimension> and overall length is no more than [10 ft. (3 m)]<Insert dimension>.

a. Provide metal [reglets][receivers] for installation.

5. Hip Flashings: Fabricate to length of slate shingle and to extend [3 inches (76 mm)]<Insert dimension> beyond joint of hip shingle with adjoining roof shingle.
6. Open-Valley Flashings: Fabricate from metal sheet not less than [18 inches (457 mm)]<Insert dimension> wide in lengths not exceeding [10 ft. (3 m)]<Insert dimension>, with [1-inch- (25-mm-)]<Insert dimension> high, inverted-V profile water diverter at center of valley and equal flange widths of not less than [8 inches (203 mm)]<Insert dimension>.

a. Hem flange edges for fastening with metal cleats.

7. Closed-Valley Flashings: Fabricate in lengths not exceeding [10 ft. (3 m)]<Insert dimension> and equal flange widths of [9 inches (229 mm)][10 inches (254 mm)][12 inches (305 mm)]<Insert dimension>.

a. Hem flange edges for fastening with metal cleats.

8. Interwoven Closed-Valley Flashings: Fabricate in lengths [equal to shingle exposure plus headlap plus 2 inches (51 mm)]<Insert dimension> and equal flange widths of [9 inches (229 mm)][10 inches (254 mm)][12 inches (305 mm)]<Insert dimension>.
9. Drip Edges: Fabricate in lengths not exceeding [10 ft. (3 m)]<Insert dimension> with roof-deck flange and 1-1/2-inch (38-mm) fascia flange with 3/8-inch (10-mm) drip at lower edge.

a. Roof-Deck Flange at Eaves: [Form to cover cant strip and fasten to roof deck]<Insert description>.

b. Roof-Deck Flange at Rakes: Form to extend minimum of [2 inches (51 mm)]<Insert dimension> onto roof deck.

- C. Vent-Pipe Flashings: ASTM B749, Type L51121, at least 1/16 inch (1.6 mm) thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least 4 inches (102 mm) from pipe onto roof.

- D. <Insert snow-guard requirements>.

2.7 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D4586/D4586M Type II, asbestos free.
- B. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied.

- C. Elastomeric Sealant: ASTM C920, Type S, Grade NS, one-part, non-sag, elastomeric polymer sealant; of class and use classifications required to seal joints in slate-shingle roofing and remain watertight; recommended in writing by manufacturer for applications indicated.
- D. Roofing Asphalt: ASTM D312/D312M Type IV.
- E. Cold-Applied Adhesive: Manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with underlayments.
- F. Slating Nails: ASTM F1667, **[copper][stainless steel][silicon-bronze][cut-brass]**, smooth-shanked, wire nails; **0.135-inch- (3.4-mm-)** minimum thickness; sharp pointed; with **3/8-inch- (10-mm-)** minimum diameter flat head; of sufficient length to penetrate a minimum of **3/4 inch (19 mm)** into sheathing or extend at least **1/8 inch (3 mm)** through sheathing less than **3/4 inch (19 mm)** thick.
 - 1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- G. Underlayment Nails: Aluminum, stainless steel, or hot-dip galvanized-steel wire nails with low-profile metal or plastic caps, **1-inch- (25-mm-)** minimum diameter.
 - 1. Provide with minimum **0.0134-inch- (0.34-mm-)** thick metal cap, **0.010-inch- (0.25-mm-)** thick power-driven metal cap, or **0.035-inch- (0.89-mm-)** thick plastic cap; and with minimum **0.083-inch- (2.11-mm-)** thick ring shank or **0.091-inch- (2.31-mm-)** thick smooth shank of length to penetrate at least **3/4 inch (19 mm)** into roof sheathing or to penetrate through roof sheathing less than **3/4 inch (19 mm)** thick.
- H. Nailer Strips: Comply with requirements in Section 061000 "Rough Carpentry."
- I. Nails for Wood Strips: ASTM F1667; common or box, steel wire, flat head, and smooth shank; hot-dip galvanized.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with roofing system Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored and that provisions have been made for flashings and penetrations through roofing.
 - 3. Verify that vent stacks and other penetrations through roofing are installed and securely fastened.
- B. Prepare written report, endorsed by roofing system Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT MATERIALS

- A. Comply with slate-shingle and underlayment manufacturers' written installation instructions and with recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems" applicable to

products and applications indicated unless more stringent requirements are specified in this Section or indicated on Drawings.

- B. Asphalt-Saturated Organic Felt: Install on roof deck parallel with and starting at eaves and fasten with underlayment nails.
1. Single-Layer Installation:
 - a. Lap sides a minimum of **[2 inches (51 mm)][4 inches (102 mm)]** over underlying course.
 - b. Lap ends a minimum of **4 inches (102 mm)**.
 - c. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 2. Double-Layer Installation:
 - a. Install a **19-inch- (483-mm-)** wide starter course at eaves and completely cover with a **36-inch- (914-mm-)** wide second course.
 - b. Install succeeding **36-inch- (914-mm-)** wide courses lapping previous courses **19 inches (483 mm)** in shingle fashion.
 - c. Lap ends a minimum of **4 inches (102 mm)**.
 - d. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 - e. Apply a continuous layer of asphalt roofing cement over starter course and on felt surface to be concealed by succeeding courses as each felt course is installed. Apply **[over entire roof][at locations indicated on Drawings]**.
 3. Install fasteners in a grid pattern of **12 inches (305 mm)** between side laps with **6-inch (152-mm)** spacing at side and end laps.
 4. Install felt over areas protected by self-adhering, polymer-modified bitumen sheet.
 5. Terminate felt **[flush][extended up not less than 4 inches (102 mm)]<Insert requirements>** against sidewalls, curbs, chimneys, and other roof projections.
- C. Synthetic-Underlayment Top Layer: Install in accordance with manufacturer's written installation instructions and as second layer over anchor-layer underlayment.
1. Completely cover anchor-layer underlayment and install parallel with and starting at the eaves, with side laps offset halfway between side laps of underlying anchor layer.
 2. Lap sides and ends as recommended in writing by manufacturer, but not less than **[2 inches (51 mm)][4 inches (102 mm)]** for side laps and **6 inches (152 mm)** for end laps.
 3. Stagger end laps from anchor-layer end laps and between succeeding top courses at interval recommended in writing by manufacturer, but not less than **72 inches (1829 mm)**.
 4. Fasten with underlayment nails.
 5. Install fasteners in a grid pattern of **12 inches (305 mm)** between side laps with **6-inch (152-mm)** spacing at side and end laps.
- D. Polymer-Modified Bitumen Sheet: Install parallel with and starting at eaves.
1. Single- or Anchor-Layer Installation:
 - a. Install on roof deck.
 - b. Lap sides a minimum of **[2 inches (51 mm)][4 inches (102 mm)]** over underlying course.
 - c. Lap ends a minimum of **6 inches (152 mm)**.
 - d. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 - e. Fasten with underlayment nails.
 2. Top-Layer Installation:

- a. Install as a second layer over anchor-layer underlayment.
 - b. Completely cover anchor layer, with side laps offset halfway between side laps of underlying anchor layer.
 - c. Lap sides a minimum of **2 inches (51 mm)**[**4 inches (102 mm)**].
 - d. Lap ends a minimum of **6 inches (152 mm)**.
 - e. Stagger end laps from anchor-layer end laps and between succeeding top-layer courses at least **72 inches (1829 mm)**.
 - f. **[Fasten with underlayment nails][Adhere to anchor layer in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature][Adhere to anchor layer in uniform coating of cold-applied adhesive].**
 3. Double-Layer Installation:
 - a. Install on roof deck in overlapping layers with a half-width plus **1-inch- (25-mm-)** wide starter course at eaves completely covered by full-width second course.
 - b. Install succeeding courses lapping previous courses by a half-width plus **1 inch (25 mm)** in shingle fashion.
 - c. Lap ends a minimum of **6 inches (152 mm)**.
 - d. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 - e. Fasten with underlayment nails.
 4. Install fasteners in a grid pattern of **12 inches (305 mm)** between side laps with **6-inch (152-mm)** spacing at side and end laps.
 5. Install sheets over areas protected by self-adhering, polymer-modified bitumen sheet.
 6. Terminate sheets **[flush][extended up not less than 4 inches (102 mm)]<Insert requirements>** against sidewalls, curbs, chimneys, and other roof projections.
- E. Self-Adhering, Polymer-Modified Bitumen Sheet: Install, wrinkle free.
1. Comply with low-temperature installation restrictions of underlayment manufacturer.
 2. Install lapped in direction that sheds water. Lap sides not less than **4 inches (102 mm)**.
 3. Lap ends not less than **6 inches (152 mm)**, staggered **24 inches (610 mm)** between succeeding courses.
 4. Roll laps with roller.
 5. Prime concrete, masonry, and metal surfaces to receive self-adhering, polymer-modified bitumen sheet.
 6. Single- or Anchor-Layer Installation: Install over entire roof deck.
 7. Top-Layer Installation: Install as second layer over anchor-layer underlayment.
 - a. Completely cover anchor-layer underlayment.
 - b. Offset side laps halfway between side laps of underlying anchor layer and offset end laps from those of underlying anchor layer at least **72 inches (1829 mm)**.
 8. Water and Ice-Dam Protection Installation: Install on roof deck where indicated **[below][on Drawings]**.
 - a. Eaves: Extend from edges of eaves **[24 inches (610 mm)][36 inches (914 mm)]<Insert dimension>** beyond interior face of exterior wall.
 - b. Rakes: Extend from edges of rakes **[24 inches (610 mm)][36 inches (914 mm)]<Insert dimension>** beyond interior face of exterior wall.
 - c. Valleys: Extend from lowest to highest point **[18 inches (457 mm)]<Insert dimension>** on each side of centerline.
 - d. Hips: Extend **[18 inches (457 mm)]<Insert dimension>** on each side.
 - e. Ridges: Extend **[36 inches (914 mm)]<Insert dimension>** on each side[**without obstructing continuous ridge vent slot**].
 - f. Sidewalls: Extend **[18 inches (457 mm)]<Insert dimension>** beyond sidewalls and return

- g. vertically against sidewalls not less than **[4 inches (102 mm)]<Insert dimension>**.
Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend **[18 inches (457 mm)]<Insert dimension>** beyond penetrating elements and return vertically against penetrating elements not less than **[4 inches (102 mm)]<Insert dimension>**.
- h. Roof-Slope Transitions: Extend **[18 inches (457 mm)]<Insert dimension>** on each roof slope.

9. Cover underlayment within seven days.

F. Valley Underlayment: Install one layer of **36-inch- (914-mm-)** wide underlayment centered in valley, running full length of valley, and on top of underlayment on field of roof that is woven through valley. Install all layers of underlayment in and through valley tight with no bridging.

- 1. Use **[same underlayment as installed on field of roof]<Insert requirements>**.
- 2. Lap ends at least **12 inches (305 mm)** in direction that sheds water, and seal with asphalt roofing cement.
- 3. Fasten to roof deck with underlayment nails located as far from valley center as possible and only to extent necessary to hold underlayment in place until installation of valley flashing.

3.3 INSTALLATION OF RIDGE ACCESSORIES

A. Metal Ridge Caps: Install units in accordance with manufacturer's written instructions.

- 1. Install slate shingles into retention channels, butting adjacent shingles.

B. Rigid-Plastic Ridge Vents: Install continuous ridge vents in accordance with manufacturer's written instructions. Fasten with slating nails of sufficient length to penetrate sheathing.

3.4 INSTALLATION OF SHEET METAL FLASHING AND TRIM

A. Install metal flashings and other sheet metal to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

- 1. Install metal flashings in accordance with recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems."

B. Apron Flashings: Extend lower flange over and beyond each side of downslope slate shingles and up the vertical surface.

C. Step Flashings: Install with a headlap of **3 inches (76 mm)** and extend both horizontally and vertically. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying slate shingle. Fasten to roof deck only.

D. Cricket and Backer Flashings: Install against roof-penetrating elements, extending concealed flange beneath upslope slate shingles and beyond each side.

E. Counterflashings: Coordinate with installation of base flashing and fit tightly to base flashing. Lap joints a minimum of **4 inches (102 mm)** secured in a waterproof manner.

- 1. Install in reglets or receivers.

F. Hip Flashings: Install centered over hip with lower edge of flashing concealed by butt of overlying slate

shingle. Fasten to roof deck.

- G. Open-Valley Flashings: Install centered in valleys, lapping ends at least **[8 inches (203 mm)]<Insert dimension>** in direction that sheds water.
 - 1. Fasten upper end of each length to roof deck beneath overlap.
 - 2. Secure hemmed flange edges into metal cleats spaced **[12 inches (305 mm)][24 inches (610 mm)]<Insert dimension>** apart and fastened to roof deck.
 - 3. Adhere minimum **[9-inch- (229-mm-)]<Insert dimension>** wide strips of self-adhering, polymer-modified bitumen sheet to metal flanges and to **[underlying self-adhering, polymer-modified bitumen sheet]<Insert requirements>**. Place strips parallel to and over flanges so that they will be just concealed by installed shingles.
 - 4. Provide a closure at the end of the inverted-V profile of the valley metal to minimize water and ice infiltration.
- H. Closed-Valley Flashings: Install centered in valleys, lapping ends at least **[8 inches (203 mm)]<Insert dimension>** in direction that sheds water. Fasten upper end of each length to roof deck beneath overlap.
 - 1. Secure hemmed flange edges into metal cleats spaced **[12 inches (305 mm)][24 inches (610 mm)]<Insert dimension>** apart and fastened to roof deck.
 - 2. Adhere minimum **[9-inch- (229-mm-)]<Insert dimension>** wide strips of self-adhering, polymer-modified bitumen sheet to metal flanges and to **[underlying self-adhering, polymer-modified bitumen]<Insert requirements>** valley underlayment.
- I. Interwoven Closed-Valley Flashings: Install centered in valleys at every shingle course overlapping the shingles in the preceding course similar to a step flashing treatment so that the butts just conceal the end of the flashing after installing the course. Fasten to roof approximately **8 inches (203 mm)** away from center of the valley.
- J. Rake Drip Edges: Install over underlayment materials and fasten to roof deck.
- K. Eave Drip Edges: **[Install over wood cant strip and under underlayment materials; fasten to roof deck]<Insert description>**.
- L. Pipe Flashings: Form flashing around pipe penetrations and slate shingles. Fasten and seal to slate shingles.

3.5 INSTALLATION OF SLATE SHINGLES

- A. Beginning at eaves, install slate shingles in accordance with manufacturer's written instructions and with details and recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems."
 - 1. Install wood strip cant at eave edges **[under underlayment materials]<Insert description>**.
 - 2. Install shingle starter course chamfered face down.
- B. Install first and succeeding shingle courses chamfered face up. Install full-width first course at rake edge.
 - 1. Offset joints of uniform-width slate shingles by half the shingle width in succeeding courses.
 - 2. Offset joints of random-width slate shingles a minimum of **3 inches (76 mm)** in succeeding courses.
- C. Maintain a **[4-inch- (102-mm-)][3-inch- (76-mm-)]<Insert dimension>** minimum headlap between succeeding shingle courses.

- D. Maintain uniform exposure of shingle courses **[between eaves and ridge][midway between eaves and ridge, and increase headlap of succeeding shingle courses to ensure uniform exposure on remaining shingle courses]**.
- E. At eaves, extend shingle starter course and first course **1 inch (25 mm)** over fasciae.
- F. At rakes, extend shingle starter course and succeeding courses **[1 inch (25 mm)][2 inches (51 mm)]** over fasciae.
- G. Cut and fit slate neatly around roof vents, pipes, ventilators, and other projections through roof.
- H. Hang slate with **[two][four]** slating nails for each shingle, with nail heads lightly touching slate.
 1. Do not drive nails home, which draws slates downward, and do not leave nail heads protruding enough to interfere with the overlapping shingle above.
 2. At vented ridges, terminate slate shingles to produce a uniform airspace on each side of ridge apex.
- I. Ridges: Install ridge slate in **[saddle][strip saddle][combed]** configuration.
 1. Install and anchor wood nailer strips of thicknesses to match abutting courses of slate shingles, terminating nailer strip **3 to 4 inches (76 to 102 mm)** from the eave. Cover with **[self-adhering, polymer-modified bitumen sheet]<Insert requirement>**, extending to underlying slate but concealed by ridge slate.
 2. Lay ridge slate in bed of **[asphalt roofing cement][butyl sealant]**.
 3. Anchor ridge slate to supporting wood nailer strip with **[two][four]<Insert number>** nails for each slate shingle, without nails penetrating underlying slate.
 4. Extend combed-ridge slate over leeward ridge slate by **1/8 to 1/4 inch (3 to 6 mm)**. Seal ridge joint with elastomeric sealant.
 5. Cover heads of exposed nails at final ridge shingle with **[asphalt roofing cement][butyl sealant]**.
- J. Hips: Install and anchor slate hips in **[saddle][mitered][fantail]** configuration.
 1. Install and anchor wood nailer strips of thickness to match abutting courses of slate shingles.
 - a. Cover nailer strip with **[self-adhering, polymer-modified bitumen sheet]<Insert requirement>**, extending on to underlying slate but concealed by hip slate.
 - b. Anchor hip slate to nailer strip with **[two]<Insert number>** nails located in upper third of hip-slate length.
 2. Notch starter shingle and first shingle course at hip to fit around nailer strips so no wood is exposed at ridge eave.
 3. Lay hip slate in bed of **[asphalt roofing cement][butyl sealant]**.
 4. Seal hip centerline joint with elastomeric sealant.
- K. Open Valleys: Cut slate shingles to form straight lines at open valleys, trimming upper concealed corners of shingles. **[Maintain uniform width of exposed open valley][Widen exposed portion of open valley 1/8 inch in 12 inches (1:96)]** from highest to lowest point.
 1. Do not nail shingles to valley metal flashings.
- L. Closed Valleys: Cut slate shingles to form straight lines at closed valleys, trimming upper concealed corners of shingles.
 1. Maintain uniform gap at centerline of valley of **[1/2 to 3/4 inch (13 to 19 mm)][3/4 to 1 inch (19**

- to 25 mm)].
- 2. Do not nail shingles to valley metal flashings.
- 3. Wire-tie shingles to roof deck on either side of flashing as required to secure shingles.

M. Remove and replace damaged or broken slate shingles.

3.6 ROOFING SYSTEM INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing System Installer," has performed roofing and associated Work on the following Project:
- 1. Owner: **<Insert name of Owner>**.
 - 2. Owner Address: **<Insert address>**.
 - 3. Building Name/Type: **<Insert information>**.
 - 4. Building Address: **<Insert address>**.
 - 5. Area of the Work: **<Insert information>**.
 - 6. Warranty Period: **[Two][Five]<Insert number>** years from date of Substantial Completion.
 - 7. Date of Substantial Completion: _____.
- B. AND WHEREAS Roofing System Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said Work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing System Installer hereby warrants, subject to terms and conditions herein set forth, that, during Warranty Period, Roofing System Installer will, at Roofing System Installer's own cost and expense, make or cause to be made such repairs to or replacements of said Work as are necessary to correct faulty and defective work and as are necessary to maintain said Work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
- 1. Specifically excluded from this Warranty are damages to the Work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding **<Insert mph (m/s)>**;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 - 2. When the Work has been damaged by any of foregoing causes, Warranty becomes null and void until such damage has been repaired by Roofing System Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 - 3. Roofing System Installer is responsible for damage to the Work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of the Work.
 - 4. During Warranty Period, if Owner allows alteration of the Work by anyone other than Roofing System Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty becomes null and void on date of the alterations, but only to the extent the alterations affect the Work covered by



this Warranty. If Owner engages Roofing System Installer to perform the alterations, Warranty does not become null and void unless Roofing System Installer, before starting the alterations, has notified Owner in writing, showing reasonable cause for claim, that the alterations would likely damage or deteriorate the Work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a use or service more severe than originally specified, this Warranty becomes null and void on date of the change, but only to the extent the change affects the Work covered by this Warranty.
6. Owner to promptly notify Roofing System Installer of observed, known, or suspected leaks, defects, or deterioration and affords reasonable opportunity for Roofing System Installer to inspect the Work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing System Installer on said Work and does not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty does not operate to relieve Roofing System Installer of responsibility for performance of the Work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 07 31 26 00



SECTION 07 31 29 00 - WOOD SHINGLES AND SHAKES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood roof shingles.
2. Wood roof shakes.
3. Underlayment and shake interlayment materials.
4. Ridge vents.
5. Metal flashing and trim.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring.
2. Section 074624 "Wood Shingle and Shake Siding" for wood shingles and shakes applied to exterior walls.
3. Section 077200 "Roof Accessories" for accessories not specified in this Section.

1.2 ALLOWANCES

- A. See Section 012100 "Allowances" for description of allowances affecting items specified under this Section.

1.3 UNIT PRICES

- A. See Section 012200 "Unit Prices" for description of unit prices affecting items specified under this Section.

1.4 ALTERNATES

- A. See Section 012300 "Alternates" for description of alternates affecting items specified under this Section.

1.5 DEFINITIONS

- A. Roofing Terminology: See ASTM D1079 for definitions of terms related to roofing Work in this Section.

1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1. **<Insert participant requirements>**.

1.7 ACTION SUBMITTALS

- A. Product Data:
 - 1. Wood roof shingles.
 - 2. Wood roof shakes.
 - 3. Underlayment and shake interlayment materials.
 - 4. Ridge vents.
 - 5. Metal flashing and trim.
- B. Sustainable Design Submittals:
 - 1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
 - 2. Chain-of-Custody Qualification Data: For manufacturer and vendor.
- C. Shop Drawings: For metal flashing and trim.
- D. Samples: For each exposed product, in sizes indicated.
 - 1. Wood Roof Shingles: Full size.
 - 2. Wood Roof Shakes: Full size.
 - 3. Ridge Units: Full size.
 - 4. Ridge Vent: **12 inches (305 mm)** long.
- E. Samples for Initial Selection: For each type of wood product indicated.
 - 1. Include Samples of accessories involving color selection.
- F. Samples for Verification: For the following products, in sizes indicated:
 - 1. Wood Roof Shingles: Full size.
 - 2. Wood Roof Shakes: Full size.
 - 3. Ridge Units: Full size.
 - 4. Ridge Vent: **12 inches (305 mm)** long.

1.8 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Research Reports: For wood products, from **[an agency acceptable to authorities having jurisdiction][ICC-ES]<Insert evaluation agency>**, indicating that product is suitable for intended use under applicable building codes.
- C. Sample Warranty: For manufacturer's materials warranty.

1.9 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For wood products to include in maintenance manuals.
- B. Materials warranties.
- C. Roofing Installer's warranty.



1.10 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Wood Roof Shingles: **[100 sq. ft. (9.3 sq. m)]<Insert area>** of each size and type, in unbroken bundles.
 - 2. Wood Roof Shakes: **[100 sq. ft. (9.3 sq. m)]<Insert area>** of each size and type, in unbroken bundles.
 - 3. **<Insert materials requirements>**.

1.11 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.
- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- D. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- E. Installer Qualifications: CSSB member.
- F. Grading Agency Qualifications: An independent testing and inspecting agency recognized by authorities having jurisdiction as qualified to label wood products for compliance with referenced grading rules.
- G. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockups for wood products including accessories.
 - a. Size: **[48 inches (1219 mm) long by 48 inches (1219 mm) wide]<Insert dimensions>**.
 - b. Include gutter and downspout complying with requirements in **[Section 076200 "Sheet Metal Flashing and Trim."][Section 077100 "Roof Specialties."]**
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Store roofing materials in a dry, well-ventilated location protected from weather, sunlight, and moisture in accordance with manufacturer's written instructions.
- B. Store underlayment rolls on end, on pallets or other raised surfaces. Do not double-stack rolls.
- C. Protect unused roofing materials from weather, sunlight, and moisture when left overnight or when roofing Work is not in progress.

- D. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

1.13 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with installation only when existing and forecasted weather conditions permit product installation and related Work to be performed in accordance with manufacturer's written instructions and warranty requirements.
 - 1. Install self-adhering, polymer-modified bitumen sheet underlayment within the range of ambient and substrate temperatures recommended in writing by manufacturer.

1.14 WARRANTY

- A. Materials Warranty: Manufacturer's warranty administered by CSSB and on CSSB's standard form in which manufacturer agrees to repair or replace CSSB-labeled products that fail in materials within specified warranty period. Material failures include manufacturing defects that result in leaks.
 - 1. Materials Warranty Period: Limited lifetime from date of Substantial Completion.
- B. Roofing Installer's Warranty: On warranty form at end of this Section, signed by Installer, in which Installer agrees to repair or replace installed products that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: **[Two][Five]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of product from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Exterior Fire-Test Exposure: Provide roofing materials identical to those of assemblies tested for fire resistance in accordance with ASTM E108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
 - 1. Wood Products: **[Class B][Class C]**.
 - a. Fire-Retardant Treatment: Exterior-type pressure treatment complying with AWP A U1 and AWP A T1.
 - b. Accelerated Weathering: Subject test specimens to ASTM D2898 Method A before testing.
 - c. Identification: Attach a label to each bundle of wood products; include identification mark of testing agency acceptable to authorities having jurisdiction and identify manufacturer, chemical treatment, method of application, purpose of treatment, and warranties available.
- B. Decay Resistance: Provide wood products treated in accordance with AWP A U1 and AWP A T1,

chromated copper arsenate (CCA) pressure treatment; with a minimum of **0.40-lb/cu. ft. (6.4-kg/cu. m)** retention.

1. Identification: Attach a label to each bundle of wood products; identify manufacturer, chemical treatment, method of application, purpose of treatment, and warranties available.
- C. Certified Wood: Wood products shall be certified as "FSC Pure"[**or "FSC Mixed Credit"**] according to FSC STD-01-001 and FSC STD-40-004.
- D. Certified Wood: Wood products shall be certified as "FSC Pure"[**or "FSC Mixed Credit"**] according to FSC STD-01-001 and FSC STD-40-004.
- E. Certified Wood: Wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
- F. Certified Wood: Wood products shall **[contain not less than 60 percent][be made from]** certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."
- G. Certified Wood: Wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
- H. Grading Rules: Provide wood products that comply with **[CSSB]<Insert organization>** grading rules for products indicated.
 1. Identification: Attach a label to each bundle of wood products that identifies manufacturer, type of product, grade, dimensions, and identification mark of grading agency acceptable to authorities having jurisdiction.

2.3 WOOD ROOF SHINGLES

- A. Cedar Shingles: Smooth-sawn western red cedar shingles.
 1. Grade: No. 1, with starter courses of **[No. 1][No. 2][No. 3]**.
 2. Size: **[16 inches (406 mm) long; 0.40 inch (10 mm) thick][18 inches (457 mm) long; 0.45 inch (11 mm) thick][24 inches (610 mm) long; 0.50 inch (13 mm) thick]** at butt.
- B. Cedar Shingle Ridge Units: **[Manufactured][Site-fabricated]**, smooth-sawn western red cedar caps for ridges and hips of same thickness as shingles, **7 inches (178 mm)** wide; beveled, alternately overlapped, and nailed.
 1. Grade: No. 1.
 2. Length: **[16 inches (406 mm)][18 inches (457 mm)]**.
- C. Fancy-Butt Cedar Shingles: Clear heartwood red cedar, No. 1 grade, with butt shape indicated.
 1. Butt Shape: **[Diagonal][Fish scale][Diamond][Square][Half cove][Hexagonal][Octagonal][Round][Arrow]<Insert shape>**.
 2. Size: **[16 inches (406 mm)][18 inches (457 mm)]** long by **5 inches (127 mm)** wide, in manufacturer's standard thickness.

2.4 WOOD ROOF SHAKES

- A. Split Cedar Shakes: Hand-split and resawn western red cedar shakes; rough split face and sawn back.
1. Grade:
 - a. Roof: **[Premium][No. 1]**.
 - b. Starter Courses: **[Premium][No. 1]**.
 2. Length: **[18 inches (457 mm)][24 inches (610 mm)]**, with **15-inch- (381-mm-)** long starter course.
 3. Thickness: **[3/8 inch (10 mm)][1/2 inch (13 mm)][3/4 inch (19 mm)]** at butt.
- B. Taper-Sawn Cedar Shakes: Western red cedar shakes; sawn both sides.
1. Grade:
 - a. Roof: **[Premium][No. 1]**.
 - b. Starter Courses: **[Premium][No. 1]**.
 2. Length: **[18 inches (457 mm)][24 inches (610 mm)]**, with **15-inch- (381-mm-)** long starter course.
 3. Thickness: **[5/8 inch (16 mm)][3/4 inch (19 mm)]<Insert dimension>** at butt.
- C. Cedar Shake Ridge Units: **[Manufactured][Site-fabricated]**, western red cedar caps for ridges and hips of same type and grade as exposed roof shakes, **9 inches (229 mm)** wide; beveled, alternately overlapped, and nailed.
1. Length: **[18 inches (457 mm)][24 inches (610 mm)]**.
 2. Thickness: **[1/2 inch (13 mm)][5/8 inch (16 mm)][3/4 inch (19 mm)]<Insert dimension>** at butt.

2.5 UNDERLAYMENT AND SHAKE INTERLAYMENT MATERIALS

- A. Felt: Asphalt-saturated organic felts, nonperforated and complying with the following:
1. ASTM D226/D226M: **[Type I][Type II]**.
 2. ASTM D4869/D4869M: **[Type I][Type II][Type III][Type IV]**.
 3. Use as **[underlayment][and][shake interlayment]**.
- B. Self-Adhering, Polymer-Modified Bitumen Sheet: ASTM D1970/D1970M, minimum **[55-mil- (1.4-mm-)][50-mil- (1.3-mm-)][40-mil- (1.0-mm-)]<Insert dimension>** thick sheet; glass-fiber-mat-reinforced, polymer-modified asphalt; with slip-resistant top surface and release backing; cold applied. **[Provide primer for adjoining concrete, masonry, and metal surfaces to receive underlayment.]**
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ALCO Products LLC]**
 - b. **[Atlas Polyiso Roof and Wall Insulation]**
 - c. **[Carlisle WIP Products; a brand of Carlisle Construction Materials]**
 - d. **[CertainTeed; SAINT-GOBAIN]**

- e. [Drexel Metals Corp.]
 - f. [GAF]
 - g. [GCP Applied Technologies Inc.]
 - h. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
 - i. [IKO Industries Inc.]
 - j. [Malarkey Roofing Products]
 - k. [Owens Corning]
 - l. [SDP Advanced Polymer Products Inc.]
 - m. [Tamko Building Products LLC]
 - n. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [ALCO Products LLC]
 - b. [Atlas Polyiso Roof and Wall Insulation]
 - c. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
 - d. [CertainTeed; SAINT-GOBAIN]
 - e. [Drexel Metals Corp.]
 - f. [GAF]
 - g. [GCP Applied Technologies Inc.]
 - h. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
 - i. [IKO Industries Inc.]
 - j. [Malarkey Roofing Products]
 - k. [Owens Corning]
 - l. [SDP Advanced Polymer Products Inc.]
 - m. [Tamko Building Products LLC]
 - n. <Insert manufacturer's name>
3. Top Surface: [Sand][Granule][Textured polymer film][Polyester].
- C. <Insert underlayment requirements>.

2.6 RIDGE VENTS

- A. Rigid Ridge Vent: Manufacturer's standard, rigid high-density, UV-stabilized plastic ridge vent for use under ridge shingles.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- a. [Air Vent, Inc.; Gibraltar Industries, Inc.]
 - b. [Benjamin Obdyke Incorporated]
 - c. [CertainTeed; SAINT-GOBAIN]
 - d. [Cor-A-Vent, Inc]
 - e. [GAF]
 - f. [Lomanco, Inc]
 - g. [Owens Corning]
 - h. [Tamko Building Products LLC]
 - i. [Tapco International Corporation; Mid-America Components]

- j. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Air Vent, Inc.; Gibraltar Industries, Inc.]
 - b. [Benjamin Obdyke Incorporated]
 - c. [CertainTeed; SAINT-GOBAIN]
 - d. [Cor-A-Vent, Inc]
 - e. [GAF]
 - f. [Lomanco, Inc]
 - g. [Owens Corning]
 - h. [Tamko Building Products LLC]
 - i. [Tapco International Corporation; Mid-America Components]
 - j. <Insert manufacturer's name>
3. Minimum Net Free Area: <Insert area>.
4. Width: <Insert dimension>.
5. Thickness: <Insert dimension>.
6. Features:
 - a. Nonwoven geotextile filter strips.
 - b. External deflector baffles.
 - c. <Insert feature>.
- B. Flexible Ridge Vent: Manufacturer's standard, compression-resisting, three-dimensional, open-nylon or polyester-mat filter[**bonded to a nonwoven, nonwicking, geotextile fabric cover**].
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Air Vent, Inc.; Gibraltar Industries, Inc.]
 - b. [Benjamin Obdyke Incorporated]
 - c. [GAF]
 - d. [Owens Corning]
 - e. [Tamko Building Products LLC]
 - f. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Air Vent, Inc.; Gibraltar Industries, Inc.]
 - b. [Benjamin Obdyke Incorporated]
 - c. [GAF]
 - d. [Owens Corning]
 - e. [Tamko Building Products LLC]
 - f. <Insert manufacturer's name>
 3. Minimum Net Free Area: <Insert area>.
 4. Width: <Insert dimension>.
 5. Thickness: <Insert dimension>.

2.7 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D4586/D4586M, Type II, asbestos free.
- B. Elastomeric Flashing Sealant: ASTM C920, Type S, Grade NS, one-part, non-sag, elastomeric polymer sealant; of class and use classifications required to seal joints and remain watertight; recommended in writing by manufacturer for installation of flashing systems.
- C. Drainage Mat: Manufacturer's standard, compression-resisting, three-dimensional, nonwoven, entangled filament, nylon mat designed to permit air movement and to drain incidental moisture by gravity.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Advanced Building Products Inc.]**
 - b. **[Benjamin Obdyke Incorporated]**
 - c. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Advanced Building Products Inc.]**
 - b. **[Benjamin Obdyke Incorporated]**
 - c. **<Insert manufacturer's name>**
- D. Roofing Nails: ASTM F1667, **[stainless steel, Type 304,][stainless steel, Type 316,][hot-dip galvanized-steel]** box-type wire nails, sharp pointed, and of sufficient length to penetrate a minimum of **3/4 inch (19 mm)** into sheathing or to penetrate through roof sheathing less than **3/4 inch (19 mm)** thick.
 - 1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- E. Underlayment Nails: Aluminum, stainless steel, or hot-dip galvanized-steel wire nails with low-profile metal or plastic caps, **1-inch- (25-mm-)** minimum diameter.
 - 1. Provide with minimum **0.0134-inch- (0.34-mm-)** thick metal cap, **0.010-inch- (0.25-mm-)** thick power-driven metal cap, or **0.035-inch- (0.89-mm-)** thick plastic cap; and with minimum **0.083-inch- (2.11-mm-)** thick ring shank or **0.091-inch- (2.31-mm-)** thick smooth shank of length to penetrate at least **3/4 inch (19 mm)** into roof sheathing or to penetrate through roof sheathing less than **3/4 inch (19 mm)** thick.

2.8 METAL FLASHING AND TRIM

- A. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
 - 1. Sheet Metal: **[Copper][Stainless steel][Zinc-tin alloy coated copper][Anodized aluminum][Aluminum, mill finished]<Insert requirements>**.
- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of the item unless otherwise specified in this Section or indicated on Drawings.

1. Apron Flashings: Fabricate with lower flange extending a minimum of [4 inches (102 mm)][6 inches (152 mm)]<Insert dimension> over and [4 inches (102 mm)]<Insert dimension> beyond each side of downslope wood roofing and [6 inches (152 mm)]<Insert dimension> up the vertical surface.
 2. Step Flashings: Fabricate with a headlap of 3 inches (76 mm) and a minimum extension of [4 inches (102 mm)][5 inches (127 mm)]<Insert dimension> both horizontally and vertically.
 3. Cricket and Backer Flashings: Fabricate with concealed flange extending a minimum of [18 inches (457 mm)][24 inches (610 mm)][30 inches (762 mm)]<Insert dimension> beneath upslope wood roofing and [6 inches (152 mm)]<Insert dimension> beyond each side of [chimney][skylight] and [6 inches (152 mm)]<Insert dimension> above the roof plane.
 4. Counterflashings: Fabricate to cover [4 inches (102 mm)]<Insert dimension> of base flashing measured vertically; and in lengths required so that no step exceeds [8 inches (203 mm)]<Insert dimension> and overall length is no more than [10 feet (3 m)]<Insert dimension>.
 - a. Provide metal [reglets][receivers] for installation.
 5. Open-Valley Flashings: Fabricate from metal sheet not less than [24 inches (610 mm)]<Insert dimension> wide in lengths not exceeding [10 feet (3 m)]<Insert dimension>, with [1-inch- (25-mm-)]<Insert dimension> high, inverted-V profile water diverter at center of valley and equal flange widths of not less than [11 inches (279 mm)]<Insert dimension>.
 6. Drip Edges: Fabricate in lengths not exceeding [10 feet (3 m)]<Insert dimension> with minimum 2-inch (51-mm) roof-deck flange and 1-1/2-inch (38-mm) fascia flange with 3/8-inch (10-mm) drip at lower edge.
- C. Vent-Pipe Flashings: ASTM B749, Type L51121, at least 1/16 inch (1.6 mm) thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least 6 inches (152 mm) from pipe onto roof.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored and that provisions have been made for flashings and penetrations through wood roofing.
 3. Verify that vent stacks and other penetrations through roofing are installed and securely fastened.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF WOOD ROOF SHINGLES

- A. Install wood roof shingles in accordance with manufacturer's written instructions and recommendations in CSSB's "New Roof Construction Manual" and NRCA's "The NRCA Roofing Manual: Steep-Slope Roofing Systems."
- B. Install drainage mat perpendicular to roof slope in parallel courses, butting edges and ends to form a

continuous layer, and fasten to roof deck.

- C. Install wood-shingle starter course along lowest roof edge.
 - 1. Install in **[single layer][double layer with joints offset a minimum of 1-1/2 inches (38 mm)]**.
 - 2. Extend **[1 inch (25 mm)][1-1/2 inches (38 mm)]** over fascia.
 - 3. Extend **[1 inch (25 mm)][1-1/2 inches (38 mm)]** over rake edge.
- D. Install first course of wood roof shingles directly over starter course and in continuous straight-line courses across roof deck. Install second and succeeding courses of wood roof shingles in continuous straight-line courses across roof deck.
 - 1. Extend **[1 inch (25 mm)][1-1/2 inches (38 mm)]** over rake edge.
 - 2. Offset joints between shingles in succeeding courses a minimum of **1-1/2 inches (38 mm)**. Do not align vertical joints in alternate courses.
 - 3. Space shingles a minimum of **1/4 inch (6 mm)** and a maximum of **3/8 inch (10 mm)** apart.
 - 4. Fasten each shingle with two nails spaced **3/4 to 1 inch (19 to 25 mm)** from edge of shingle and **1-1/2 to 2 inches (38 to 51 mm)** above butt line of succeeding course. Drive fasteners flush with top surface of shingles without crushing wood.
 - 5. Maintain weather exposure of **[5 inches (127 mm) for 16-inch- (406-mm-)][5-1/2 inches (140 mm) for 18-inch- (457-mm-)][7-1/2 inches (191 mm) for 24-inch- (610-mm-)]<Insert dimensions>** long shingles.
- E. Open Valleys: Cut and fit wood roof shingles at open valleys, trimming upper concealed corners of shingles. **[Maintain uniform width of exposed open valley][Widen exposed portion of open valley 1/8 inch in 12 inches (1:96)]** from highest to lowest point.
- F. Fancy-Butt Shingles: Center each shingle in succeeding courses between the two shingles below it with **1/8-inch (3-mm)** space between shingles.
 - 1. Install **[one][two][three]<Insert number>** course(s) of fancy-butt shingles in continuous straight-line courses across roof deck in locations indicated on Drawings.
 - 2. Maintain weather exposure of **5 inches (127 mm)**.
- G. Ridge Vents: Install continuous ridge vents over wood roof shingles in accordance with manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate roof sheathing.
- H. Ridge Units: Install units over wood roof shingles trimmed at apex of ridges and hips.
 - 1. Maintain same exposure dimension of units as roof-shingle exposure.
 - 2. Lap units at ridges to shed water away from direction of prevailing winds.
 - 3. Alternate overlaps of units and fasten with concealed roofing nails of sufficient length to penetrate sheathing.
 - 4. At unventilated ridges and hips, install concealed strip of **[felt][self-adhering, polymer-modified bitumen sheet]** underlayment over apex shingles and below ridge units.
 - 5. Fasten ridge units to cover ridge vent without obstructing airflow.

3.3 INSTALLATION OF WOOD ROOF SHAKES

- A. Install wood roof shakes in accordance with manufacturer's written instructions and recommendations in CSSB's "New Roof Construction Manual" and NRCA's "The NRCA Roofing Manual: Steep-Slope Roofing Systems."
- B. Install drainage mat perpendicular to roof slope in parallel courses, butting edges and ends to form a continuous layer, and fasten to roof deck.

- C. Install wood-shake starter course along lowest roof edge.
 - 1. Install in **[single layer][double layer with joints offset a minimum of 1-1/2 inches (38 mm)]**.
 - 2. Extend **[1 inch (25 mm)][1-1/2 inches (38 mm)]** over fascia.
 - 3. Extend **[1 inch (25 mm)][1-1/2 inches (38 mm)]** over rake edge.
- D. Install first course of wood roof shakes directly over starter course and in continuous straight-line courses across roof deck. Install second and succeeding courses of wood roof shakes in continuous straight-line courses across roof deck.
 - 1. Extend **[1 inch (25 mm)][1-1/2 inches (38 mm)]** over rake edge.
 - 2. Interlay **18-inch- (457-mm-)** wide strip of felt over top portion of first and each succeeding course. Set bottom edge of felt interlayment at a distance of twice the weather-exposure dimension above the shake butt. Stagger fasten to roof deck with felt-underlayment nails.
 - 3. Offset joints between shakes in succeeding courses a minimum of **1-1/2 inches (38 mm)**.
 - 4. Space shakes a minimum of **3/8 inch (10 mm)** and a maximum of **5/8 inch (16 mm)** apart.
 - 5. Fasten each shake with two nails spaced **3/4 to 1 inch (19 to 25 mm)** from edge of shake and **1-1/2 to 2 inches (38 to 51 mm)** above butt line of succeeding course. Drive fasteners flush with top surface of shakes without crushing wood.
 - 6. Maintain weather exposure of **[5-1/2 inches (140 mm) for 18-inch- (457-mm-)][7-1/2 inches (191 mm) for 18-inch- (457-mm-)][7-1/2 inches (191 mm) for 24-inch- (610-mm-)][10 inches (254 mm) for 24-inch- (610-mm-)]**<Insert dimensions> long shakes.
- E. Open Valleys: Cut and fit wood roof shakes at open valleys, trimming upper concealed corners of shakes. **[Maintain uniform width of exposed open valley][Widen exposed portion of open valley 1/8 inch in 12 inches (1:96)]** from highest to lowest point.
- F. Ridge Vents: Install continuous ridge vents over wood roof shakes in accordance with manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.
- G. Ridge Units: Install units over wood roof shakes trimmed at apex of ridges and hips.
 - 1. Maintain same exposure dimension of units as roof-shake exposure.
 - 2. Lap units at ridges to shed water away from direction of prevailing winds.
 - 3. Alternate overlaps of units and fasten with concealed roofing nails of sufficient length to penetrate sheathing.
 - 4. At unventilated ridges and hips, install concealed strip of **[felt][self-adhering, polymer-modified bitumen sheet]** underlayment over apex shingles and below ridge units.
 - 5. Fasten ridge units to cover ridge vent without obstructing airflow.

3.4 INSTALLATION OF UNDERLAYMENT AND SHAKE INTERLAYMENT MATERIALS

- A. Comply with underlayment manufacturer's written installation instructions and with recommendations in CSSB's "New Roof Construction Manual" and NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems" applicable to products and applications indicated unless more stringent requirements are specified in the Section or indicated on Drawings.
- B. Felt: Install on roof deck parallel with and starting at eaves and fasten with underlayment nails.
 - 1. Single-Layer Installation:
 - a. Lap sides a minimum of **[2 inches (51 mm)][4 inches (102 mm)]** over underlying course.
 - b. Lap ends a minimum of **4 inches (102 mm)**.
 - c. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.

2. Double-Layer Installation:

- a. Install a **19-inch- (483-mm-)** wide starter course at eaves and completely cover with a **36-inch- (914-mm-)** wide second course.
- b. Install succeeding **36-inch- (914-mm-)** wide courses lapping previous courses **19 inches (483 mm)** in shingle fashion.
- c. Lap ends a minimum of **4 inches (102 mm)**.
- d. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
- e. Apply a continuous layer of asphalt roofing cement over starter course and on felt-underlayment surface to be concealed by succeeding courses as each felt course is installed. Apply to a point not less than **24 inches (610 mm)** inside the exterior wall line of the building[**and at locations indicated on Drawings**].

3. Install felt underlayment [**on roof deck not covered**][**over areas protected**][**over eaves protected**] by self-adhering, polymer-modified bitumen sheet.

- a. Lap sides of felt over self-adhering sheet not less than **4 inches (102 mm)** in direction that sheds water.
 - b. Lap ends of felt not less than **6 inches (152 mm)** over self-adhering sheet.
4. Install fasteners in a grid pattern of **12 inches (305 mm)** between side laps with **6-inch (152-mm)** spacing at side and end laps.
 5. Terminate felt [**flush**][**extended up not less than 4 inches (102 mm)**]**<Insert requirements>** against sidewalls, curbs, chimneys, and other roof projections.

C. Self-Adhering, Polymer-Modified Bitumen Sheet: Install, wrinkle free, on roof deck.

1. Comply with low-temperature installation restrictions of underlayment manufacturer.
2. Install lapped in direction that sheds water.
3. Lap sides not less than **4 inches (102 mm)**. Lap ends not less than **6 inches (152 mm)**, staggered **24 inches (610 mm)** between succeeding courses.
4. Roll laps with roller.
5. Prime concrete, masonry, and metal surfaces to receive self-adhering sheet.
6. Eaves: Extend from edges of eaves [**24 inches (610 mm)**][**36 inches (914 mm)**]**<Insert dimension>** beyond interior face of exterior wall.
7. Rakes: Extend from edges of rakes [**24 inches (610 mm)**][**36 inches (914 mm)**]**<Insert dimension>** beyond interior face of exterior wall.
8. Valleys: Extend from lowest to highest point [**18 inches (457 mm)**]**<Insert dimension>** on each side of centerline.
9. Hips: Extend [**18 inches (457 mm)**]**<Insert dimension>** on each side.
10. Ridges: Extend [**36 inches (914 mm)**]**<Insert dimension>** on each side[**without obstructing continuous ridge vent slot**].
11. Sidewalls: Extend [**18 inches (457 mm)**]**<Insert dimension>** beyond sidewalls and return vertically against sidewalls not less than [**4 inches (102 mm)**]**<Insert dimension>**.
12. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend [**18 inches (457 mm)**]**<Insert dimension>** beyond penetrating elements and return vertically against penetrating elements not less than [**4 inches (102 mm)**]**<Insert dimension>**.
13. Roof-Slope Transitions: Extend [**18 inches (457 mm)**]**<Insert dimension>** on each roof slope.
14. Cover underlayment within seven days.

D. Metal-Flashed, Open-Valley Underlayment: Install one layer of **36-inch- (914-mm-)** wide felt underlayment centered in valley, running full length of valley, and on top of underlayment on field of roof that is woven through valley. Install all layers of underlayment in and through valley tight with no bridging.

1. Lap ends at least **12 inches (305 mm)** in direction that sheds water, and seal with asphalt roofing

- cement.
2. Fasten to roof deck with underlayment nails located as far from valley center as possible and only to extent necessary to hold underlayment in place until installation of valley flashing.
3. Solidly cement valley underlayment to roof-field underlayment that is woven through valley using asphalt roofing cement.

3.5 INSTALLATION OF RIDGE VENTS

- A. Rigid-Plastic Ridge Vents: Install continuous ridge vents over wood roof tiles in accordance with manufacturer's written instructions. Fasten with nails of sufficient length to penetrate substrate.
- B. Flexible Ridge Vent: Install continuous-roll ridge vents over wood roof tiles in accordance with manufacturer's written instructions.

3.6 INSTALLATION OF METAL FLASHING AND TRIM

- A. Install metal flashings and other sheet metal to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
 1. Install metal flashings in accordance with recommendations for wood roofing in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems."
- B. Apron Flashings: Extend lower flange over and beyond each side of downslope wood roofing and up the vertical surface.
- C. Step Flashings: Install with a headlap of **3 inches (76 mm)** and extend over underlying wood roofing and up the vertical face. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying wood roofing. Fasten to roof deck only.
- D. Cricket and Backer Flashings: Install against roof-penetrating elements extending concealed flange beneath upslope wood roofing and beyond each side.
- E. Counterflashings: Coordinate with installation of base flashing and fit tightly to base flashing. Lap joints a minimum of **4 inches (102 mm)** secured in a waterproof manner.
 1. Install in reglets or receivers.
- F. Open-Valley Flashings: Install centered in valleys, lapping ends at least **[8 inches (203 mm)]<Insert dimension>** in direction that sheds water. Fasten upper end of each length to roof deck beneath overlap.
 1. Adhere minimum **[9-inch- (229-mm-)]<Insert dimension>** wide strip of self-adhering, polymer-modified bitumen sheet to metal flanges and to underlying self-adhering, polymer-modified bitumen sheet. Place strips parallel to and over flanges so that they will be just concealed by installed roofing.
 2. Provide a closure at the end of the inverted-V profile of the valley metal to minimize water and ice infiltration.
- G. Rake Drip Edges: Install over underlayment materials and fasten to roof deck.
- H. Eave Drip Edges: Install below underlayment materials and fasten to roof deck.

- I. Pipe Flashings: Form flashing around pipe penetrations and wood roofing. Fasten and seal to wood roofing.

3.7 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS **<Insert name>** of **<Insert address>**, herein called the "Roofing Installer," has performed roofing and associated work ("the work") on the following project:
 1. Owner: **<Insert name of Owner>**.
 2. Owner Address: **<Insert address>**.
 3. Building Name/Type: **<Insert information>**.
 4. Building Address: **<Insert address>**.
 5. Area of the Work: **<Insert information>**.
 6. Acceptance Date: **<Insert date>**.
 7. Warranty Period: **<Insert time>**.
 8. Expiration Date: **<Insert date>**.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant the work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that, during Warranty Period, Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of the work as are necessary to correct faulty and defective work and as are necessary to maintain the work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
 1. Specifically excluded from this Warranty are damages to the work and other parts of the building, and to building contents, caused by:
 - a. Lightning;
 - b. Peak gust wind speed exceeding **<Insert mph (m/s)>**;
 - c. Fire;
 - d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. Faulty construction of copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. Vapor condensation on bottom of roofing; and
 - g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When the work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to the work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of the work.
 4. During Warranty Period, if Owner allows alteration of the work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of the alterations, but only to the extent the alterations affect the work covered by this Warranty. If Owner engages Roofing Installer to perform the alterations, Warranty shall not become null and void unless Roofing Installer, before starting the alterations, notified Owner in writing, showing reasonable cause for claim, that the alterations would likely damage or



- deteriorate the work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a use or service more severe than originally specified, this Warranty shall become null and void on date of the change, but only to the extent the change affects the work covered by this Warranty.
 6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect the work and to examine evidence of such leaks, defects, or deterioration.
 7. This Warranty is recognized to be the only warranty of Roofing Installer on the work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of the work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this **<Insert day>** day of **<Insert month>**, **<Insert year>**.

1. Authorized Signature: **<Insert signature>**.
2. Name: **<Insert name>**.
3. Title: **<Insert title>**.

END OF SECTION 07 31 29 00



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 31 29 13	07 31 29 00	Wood Shingles And Shakes
07 31 29 16	07 31 29 00	Wood Shingles And Shakes
07 31 29 19	01 11 19 00	No Specification Required
07 31 29 19	07 31 29 00	Wood Shingles And Shakes
07 31 33 00	01 11 19 00	No Specification Required



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SECTION 07 32 13 00 - CLAY ROOF TILES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Clay roof tiles.
2. Underlayment materials.
3. Ridge vents.
4. Sheet metal flashing and trim.

B. Related Requirements:

1. Section 077253 "Snow Guards" for snow guards.

1.2 ALLOWANCES

- A. See Section 012100 "Allowances" for description of allowances affecting items specified under this Section.

1.3 UNIT PRICES

- A. See Section 012200 "Unit Prices" for description of unit prices affecting items specified under this Section.

1.4 ALTERNATES

- A. See Section 012300 "Alternates" for description of alternates affecting items specified under this Section.

1.5 DEFINITIONS

- A. Roofing Terminology: See ASTM D1079 and glossary in TRI/WSRCA's "Concrete and Clay Roof Tile Installation Manual" for definitions of terms related to roofing Work in this Section.

1.6 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference **[at Project site][by web conference]<Insert location>**.

1. **<Insert participant requirements>**.

1.7 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For sheet metal flashing and trim.
- C. Samples: For each exposed product and for each color and texture specified, in sizes indicated.
 - 1. Clay Roof Tiles: Full size, showing full range of color values and blends.
 - 2. Accessory Tiles: Full size, each type.
 - 3. Sheet Metal Flashing: **12 inches (305 mm)** square.
 - 4. Ridge Vents: **12-inch- (305-mm-)** long Sample.
 - 5. Eave Closures: In manufacturer's standard size.
- D. Samples for Initial Selection: For each type of clay roof tile and accessory tile.
 - 1. Include Samples of accessories involving color selection.
- E. Samples for Verification: For the following products, in sizes indicated:
 - 1. Clay Roof Tiles: Full size, showing full range of color values and blends.
 - 2. Accessory Tiles: Full size, each type.
 - 3. Sheet Metal Flashing: **12 inches (305 mm)** square.
 - 4. Ridge Vents: **12-inch- (305-mm-)** long Sample.
 - 5. Eave Closures: In manufacturer's standard size.
- F. Sustainable Design Submittals:
 - 1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.

1.8 INFORMATIONAL SUBMITTALS

- A. Qualification Statements: For roofing system Installer.
- B. Product Test Reports: For each type of clay roof tile, based on evaluation of comprehensive tests performed by a qualified testing agency.
- C. Research Reports: From **[an agency acceptable to authorities having jurisdiction][ICC-ES]<Insert evaluation agency>**, indicating that product is suitable for intended use under applicable building codes for the following:
 - 1. **[Mortar][Adhesive]** tile-attachment systems.
 - 2. Wire-tie tile-attachment systems.
 - 3. Polymer-modified bitumen sheet underlayment.
 - 4. Synthetic underlayment.
- D. Sample warranties.

1.9 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing to include in maintenance manuals.

- B. Materials warranties.
- C. Roofing system Installer's warranty.

1.10 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Clay Roof Tiles: [100 sq. ft. (9.3 sq. m)]<Insert area> of each type, in unbroken bundles.

1.11 QUALITY ASSURANCE

- A. Roofing System Installer Qualifications: Entity that employs [a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified clay tile system installers][a supervisor who is an NRCA ProCertified Roofing Foreman][a supervisor who is an NRCA ProCertified Roofing Foreman and not less than 20 percent of installers who are NRCA ProCertified clay tile system installers].

1.12 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockups for clay roof tiles including related roofing materials.
 - a. Size: [48 inches (1219 mm) long by 48 inches (1219 mm) wide]<Insert dimensions>.
 - b. Include gutter and downspout complying with requirements in [Section 076200 "Sheet Metal Flashing and Trim."][Section 077100 "Roof Specialties."]
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. Store underlayment rolls in a dry, well-ventilated location protected from weather, sunlight, and moisture in accordance with manufacturer's written instructions.
 - 1. Store on end, on pallets or other raised surfaces. Do not double-stack rolls.
- B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing Work is not in progress.
- C. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

1.14 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with installation only when existing and forecasted weather conditions permit product installation and related Work to be performed in accordance with manufacturer's written instructions and warranty requirements.
 - 1. Install self-adhering, polymer-modified bitumen sheet underlayment within the range of ambient and substrate temperatures recommended in writing by manufacturer.

1.15 WARRANTY

- A. Materials Warranty: Manufacturer agrees to repair or replace clay roof tiles that fail in materials within specified warranty period.
 - 1. Warranty Period: **[50]**<Insert number> years from date of Substantial Completion.
- B. Roofing System Installer's Warranty: On warranty form at end of this Section, signed by Installer, in which Installer agrees to repair or replace components of clay-tile roofing that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: **[Two][Five]**<Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of product from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Exterior Fire-Test Exposure: Provide clay roof tiles and related roofing materials identical to those of assemblies tested for Class A fire resistance in accordance with ASTM E108 or UL 790 by UL Standards & Engagement Inc. or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
- B. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][32]** or initial SRI not less than **[82][39]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- C. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][25]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- D. Solar Reflectance Index (SRI): Not less than **[78][29]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.

2.3 CLAY ROOF TILES

- A. Clay Roof Tiles: ASTM C1167, molded- or extruded-clay roof tile units of shape and configuration indicated, kiln fired, and free of surface imperfections. Provide with fastening holes prepunched at

factory before firing.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Boral Roofing LLC; Boral USA]
 - b. [Claymex Brick and Tile, Inc.]
 - c. [D'Hanis Brick & Tile Company]
 - d. [Gladding, McBean; PABCO Clay Products, LLC; PABCO Building Products, LLC]
 - e. [Ludowici]
 - f. [MCA Clay Roof Tile]
 - g. [Zion Tile Corp.]
 - h. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Boral Roofing LLC; Boral USA]
 - b. [Claymex Brick and Tile, Inc.]
 - c. [D'Hanis Brick & Tile Company]
 - d. [Gladding, McBean; PABCO Clay Products, LLC; PABCO Building Products, LLC]
 - e. [Ludowici]
 - f. [MCA Clay Roof Tile]
 - g. [Zion Tile Corp.]
 - h. <Insert manufacturer's name>
3. Durability: [Grade 1][Grade 2][Grade 3].
4. High-Profile Shape: Type I, [Spanish or "S"] [two-piece tapered mission] [two-piece straight mission] [two-piece straight barrel mission] [two-piece Greek] [two-piece Roman] <Insert shape>.
 - a. Accessory Tiles: [Ridge] [ridge vent] [ridge end] [hip and hip starter] [header course] [L-shaped rake edge] [roll rake edge] [starter] [end band] [terminal] [eave closure] [and] [top fixture] <Insert accessory> units.
5. Low-Profile Shape: Type II, [French interlocking] <Insert shape>.
 - a. Accessory Tiles: [Ridge] [ridge vent] [ridge end] [hip and hip starter] [header course] [L-shaped rake edge] [roll rake edge] [starter] [end band] [terminal] [eave closure] [and] [top fixture] <Insert accessory> units.
6. Flat Shape: Type III, [flat shingle] [flat interlocking] <Insert shape>.
 - a. Accessory Tiles: [Ridge and closed ridge end] [hip and hip starter] [header course] [L-shaped rake edge] [starter] [end band] [and] [terminal] <Insert accessory> units.
7. Size: <Insert length and width dimensions>.
 - a. Provide clay roof tiles of diminishing widths for circular bays or round towers.
8. Finish and Texture: [Matte, smooth] [Matte, striated] [Glazed, smooth] <Insert finish and texture>.
9. Color: [Terra cotta] [Brown] [Red] [Blended red] [Buff] <Insert description>.

10. Product Data: Verify materials were fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
11. Product Data: Verify materials were fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, multiply the distance by 0.25 to determine the distance to Project site.

2.4 UNDERLAYMENT MATERIALS

- A. Felt: **[ASTM D226/D226M Type II, asphalt saturated][ASTM D4869/D4869M Type IV, asphalt saturated][ASTM D2626/D2626M, asphalt saturated and coated, mineral-granule surfaced on weather (top) side]**, unperforated.
- B. Asphalt Roll-Roofing: ASTM D6380/D6380M, Class M, Type II, asphalt-saturated and -coated organic felt; mineral-granule surfaced on weather (top) side.
- C. Synthetic Underlayment: UV-resistant polypropylene, polyolefin, or polyethylene polymer fabric with surface coatings or treatments to improve traction underfoot and abrasion resistance; recommended, in writing, by manufacturer for use under roof tile; and evaluated and documented to be suitable for use as a roof underlayment under applicable codes by a testing and inspecting agency acceptable to authorities having jurisdiction.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Drexel Metals Corp.]**
 - b. **[G.A.P. Roofing, Inc.]**
 - c. **[GAF]**
 - d. **[Owens Corning]**
 - e. **[SDP Advanced Polymer Products Inc.]**
 - f. **[SystemComponents Corporation]**
 - g. **[Tamko Building Products LLC]**
 - h. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Drexel Metals Corp.]**
 - b. **[G.A.P. Roofing, Inc.]**
 - c. **[GAF]**
 - d. **[Owens Corning]**
 - e. **[SDP Advanced Polymer Products Inc.]**
 - f. **[SystemComponents Corporation]**
 - g. **[Tamko Building Products LLC]**
 - h. **<Insert manufacturer's name>**
- D. Polymer-Modified Bitumen Sheet: Styrene-butadiene-styrene- (SBS) modified asphalt, glass-fiber-mat-reinforced sheet; minimum **[55-mil (1.4-mm)][40-mil (1.0-mm)]<Insert dimension>** nominal thickness; recommended in writing by manufacturer and acceptable to authorities having jurisdiction for use as underlayment in tile steep-slope roofing systems; and designed for mechanical fastening or adhesive

attachment using roofing asphalt or cold-applied adhesive.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Atlas Polyiso Roof and Wall Insulation]**
 - b. **[Boral Roofing LLC; Boral USA]**
 - c. **[CertainTeed; SAINT-GOBAIN]**
 - d. **[G.A.P. Roofing, Inc.]**
 - e. **[GMC Roofing & Building Paper Products, Inc.]**
 - f. **[Malarkey Roofing Products]**
 - g. **[Tarco]**
 - h. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Atlas Polyiso Roof and Wall Insulation]**
 - b. **[Boral Roofing LLC; Boral USA]**
 - c. **[CertainTeed; SAINT-GOBAIN]**
 - d. **[G.A.P. Roofing, Inc.]**
 - e. **[GMC Roofing & Building Paper Products, Inc.]**
 - f. **[Malarkey Roofing Products]**
 - g. **[Tarco]**
 - h. **<Insert manufacturer's name>**
 3. **<Insert testing requirements>**.
- E. Self-Adhering, Polymer-Modified Bitumen Sheet: ASTM D1970/D1970M, minimum **[55-mil- (1.4-mm-)][50-mil- (1.3-mm-)][40-mil- (1.0-mm-)]<Insert dimension>** thick sheet; glass-fiber-mat-reinforced, polymer-modified asphalt; with slip-resistant top surface and release backing; cold applied; and recommended in writing by manufacturer for use in tile roofing system required. **[Provide primer for adjoining concrete, masonry, and metal surfaces to receive underlayment.]**
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[ALCO Products LLC]**
 - b. **[Atlas Polyiso Roof and Wall Insulation]**
 - c. **[Carlisle WIP Products; a brand of Carlisle Construction Materials]**
 - d. **[CertainTeed; SAINT-GOBAIN]**
 - e. **[Drexel Metals Corp.]**
 - f. **[GAF]**
 - g. **[GCP Applied Technologies Inc.]**
 - h. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - i. **[IKO Industries Inc.]**
 - j. **[Malarkey Roofing Products]**
 - k. **[SDP Advanced Polymer Products Inc.]**
 - l. **[Tamko Building Products LLC]**
 - m. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. [ALCO Products LLC]
- b. [Atlas Polyiso Roof and Wall Insulation]
- c. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
- d. [CertainTeed; SAINT-GOBAIN]
- e. [Drexel Metals Corp.]
- f. [GAF]
- g. [GCP Applied Technologies Inc.]
- h. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
- i. [IKO Industries Inc.]
- j. [Malarkey Roofing Products]
- k. [SDP Advanced Polymer Products Inc.]
- l. [Tamko Building Products LLC]
- m. **<Insert manufacturer's name>**

3. Top Surface: [Sand][Granule][Textured polymer film][Polyester].

- F. Self-Adhering, Polymer-Modified Bitumen Sheet, High Temperature: ASTM D1970/D1970M, minimum [55-mil- (1.4-mm-)][50-mil- (1.3-mm-)][40-mil- (1.0-mm-)]**<Insert thickness>** thick sheet; glass-fiber-mat-reinforced, polymer-modified asphalt; with slip-resistant top surface and release backing; cold applied; and recommended in writing by manufacturer for use in tile roofing system required.[**Provide primer for adjoining concrete, masonry, and metal surfaces to receive underlayment.**]

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [ALCO Products LLC]
- b. [Atlas Polyiso Roof and Wall Insulation]
- c. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
- d. [CertainTeed; SAINT-GOBAIN]
- e. [Drexel Metals Corp.]
- f. [GCP Applied Technologies Inc.]
- g. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
- h. [Malarkey Roofing Products]
- i. [SDP Advanced Polymer Products Inc.]
- j. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. [ALCO Products LLC]
- b. [Atlas Polyiso Roof and Wall Insulation]
- c. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
- d. [CertainTeed; SAINT-GOBAIN]
- e. [Drexel Metals Corp.]
- f. [GCP Applied Technologies Inc.]
- g. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]

- h. **Waterproofing Inc. brands]**
 - i. **[Malarkey Roofing Products]**
 - j. **[SDP Advanced Polymer Products Inc.]**
 - j. **<Insert manufacturer's name>**
- 3. Thermal Stability: Stable after testing at **240 deg F (116 deg C)** in accordance with ASTM D1970/D1970M.
- 4. Top Surface: **[Granule][Textured polymer film][Polyester]**.

2.5 RIDGE VENTS

- A. Rigid-Plastic Ridge Vent: Manufacturer's standard, rigid section high-density polypropylene or other UV-stabilized plastic ridge vent for use under ridge tiles.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Cor-A-Vent, Inc]**
 - b. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Cor-A-Vent, Inc]**
 - b. **<Insert manufacturer's name>**
 - 3. Minimum Net Free Area: **<Insert area>**.
 - 4. Width: **<Insert dimension>**.
 - 5. Thickness: **<Insert dimension>**.
- B. Flexible Ridge Vent: Manufacturer's standard roll-form ridge vent that protects against driven rain and snow and is recommended in writing by manufacturer for installation with roof tile indicated.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Boral Roofing LLC; Boral USA]**
 - b. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Boral Roofing LLC; Boral USA]**
 - b. **<Insert manufacturer's name>**
 - 3. Width: **<Insert dimension>**.
 - 4. Features: **[Butyl adhesive strips at sides][Corrugated aluminum strips at sides]**.

2.6 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D4586/D4586M Type II, asbestos free.
- B. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied.
- C. Elastomeric Sealant: ASTM C920, Type S, Grade NS, one-part, non-sag, elastomeric polymer sealant of class and use classifications required to seal joints in clay-tile roofing and remain watertight; recommended in writing by manufacturer for applications indicated.
- D. Roofing Asphalt: ASTM D312/D312M Type IV.
- E. Cold-Applied Adhesive: Manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with underlayments.
- F. Mortar: ASTM C270, Type M, **[natural color][with ASTM C979/C979M, pigmented mortar matching the color of clay roof tiles for exposed-to-view mortar, and natural color for concealed-from-view mortar]**.
- G. Foam Adhesive: Two-component, polyurethane expanding adhesive recommended in writing for application by clay-roof-tile manufacturer.
- H. Eave Closure: Manufacturer's standard **[EPDM][copper][stainless steel][galvanized-steel][aluminum, mill finish]<Insert material>** eave closure formed to shape of clay roof tiles.
- I. Wood Nailers: Comply with requirements for pressure-preservative-treated wood in Section 061000 "Rough Carpentry."
- J. Mesh Fabric: **18-by-14 (1.1-by-1.4-mm)** mesh of PVC-coated, glass-fiber thread.

2.7 FASTENERS

- A. Roofing Nails: ASTM F1667, **[hot-dip galvanized-steel, 0.120-inch- (3.05-mm-)][stainless steel, 0.120-inch- (3.05-mm-)][copper, 0.135-inch- (3.43-mm-)][silicon-bronze, 0.120-inch- (3.05-mm-)]** diameter shank, sharp-pointed, conventional roofing nails with barbed shanks; minimum **3/8-inch- (10-mm-)** diameter head; of sufficient length to penetrate **3/4 inch (19 mm)** into substrate or extend at least **1/8 inch (3 mm)** through thickness of the sheathing, whichever is less.
 - 1. Where nails are in contact with sheet metal flashing, use nails made from same metal as flashing.
- B. Underlayment Nails: Aluminum, stainless steel, or hot-dip galvanized-steel wire nails with low-profile metal or plastic caps, **1-inch- (25-mm-)** minimum diameter.
 - 1. Provide with minimum **0.0134-inch- (0.34-mm-)** thick metal cap, **0.010-inch- (0.25-mm-)** thick power-driven metal cap, or **0.035-inch- (0.89-mm-)** thick plastic cap; and with minimum **0.083-inch- (2.11-mm-)** thick ring shank or **0.091-inch- (2.31-mm-)** thick smooth shank of length to penetrate at least **3/4 inch (19 mm)** into roof sheathing or to penetrate through roof sheathing less than **3/4 inch (19 mm)** thick.
- C. Nails for Wood Nailers: ASTM F1667; common or box, steel wire, flat head, and smooth shank.
- D. Wire Ties: **[Copper][Brass][Stainless steel], 0.083-inch- (2.11-mm-)** minimum diameter.

- E. Twisted-Wire-Tie System: Continuously twisted, two-wire unit with loops formed **6 inches (152 mm)** apart, minimum **[0.101-inch- (2.57-mm-) diameter copper wire and 0.064-inch- (1.63-mm-) diameter copper tie wires][0.090-inch- (2.29-mm-) diameter stainless steel wire and 0.063-inch- (1.60-mm-) diameter stainless steel tie wires][0.105-inch- (2.67-mm-) diameter galvanized-steel wire and 0.063-inch- (1.60-mm-) diameter galvanized-steel tie wires]<Insert requirements>**, with matching-metal folding clip anchors.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Frances Fasteners Inc., dba STORM-LOCK Tile Fasteners]**
 - b. **[Wire Works, Inc.]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Frances Fasteners Inc., dba STORM-LOCK Tile Fasteners]**
 - b. **[Wire Works, Inc.]**
 - c. **<Insert manufacturer's name>**
- F. Single-Line, Wire-Tie System: Interconnecting eave-to-ridge system, minimum **[0.101-inch- (2.57-mm-) diameter copper][0.090-inch- (2.29-mm-) diameter stainless steel][0.105-inch- (2.67-mm-) diameter galvanized-steel]<Insert requirements>** wire, preformed to accommodate clay roof tile type and application indicated.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Frances Fasteners Inc., dba STORM-LOCK Tile Fasteners]**
 - b. **[Wire Works, Inc.]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Frances Fasteners Inc., dba STORM-LOCK Tile Fasteners]**
 - b. **[Wire Works, Inc.]**
 - c. **<Insert manufacturer's name>**
- G. Hook Nails: One-piece wind lock and clay-roof-tile fastener system, minimum **[0.135-inch- (3.43-mm-) diameter brass][0.135-inch- (3.43-mm-) diameter copper][0.120-inch- (3.05-mm-) diameter stainless steel][0.120-inch- (3.05-mm-) diameter galvanized-steel]<Insert requirements>** wire, for direct deck nailing.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

-
- a. **[Frances Fasteners Inc., dba STORM-LOCK Tile Fasteners]**
 - b. **[Wire Works, Inc.]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Frances Fasteners Inc., dba STORM-LOCK Tile Fasteners]**
 - b. **[Wire Works, Inc.]**
 - c. **<Insert manufacturer's name>**
- H. Tile Locks: **[Brass][Copper][Stainless steel][Hot-dip galvanized-steel]**, nominal **0.1-inch- (2.5-mm-)** diameter wire device designed to secure butt edges of overlaid clay roof tiles.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Frances Fasteners Inc., dba STORM-LOCK Tile Fasteners]**
 - b. **[Wire Works, Inc.]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Frances Fasteners Inc., dba STORM-LOCK Tile Fasteners]**
 - b. **[Wire Works, Inc.]**
 - c. **<Insert manufacturer's name>**
- I. Storm Clips: **[Brass, minimum 0.048-by-1/2-inch (1.22-by-13-mm)][Stainless steel, minimum 0.048-by-1/2-inch (1.22-by-13-mm)][Hot-dip galvanized-steel, minimum 0.048-by-1/2-inch (1.22-by-13-mm)]<Insert requirements>** strap-type, L-shaped retainer clips designed to secure side edges of clay roof tiles. Provide with two fastener holes in base flange.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Frances Fasteners Inc., dba STORM-LOCK Tile Fasteners]**
 - b. **[Wire Works, Inc.]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Frances Fasteners Inc., dba STORM-LOCK Tile Fasteners]**
 - b. **[Wire Works, Inc.]**
 - c. **<Insert manufacturer's name>**

2.8 SHEET METAL FLASHING AND TRIM

- A. General: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
 1. Sheet Metal: **[Copper][Stainless steel][Zinc-tin alloy coated copper][Anodized aluminum][Aluminum, mill finished]<Insert requirements>**.
- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for design, dimensions, metal, and other characteristics of the item unless otherwise specified in this Section or indicated on Drawings.
 1. Apron Flashings: Fabricate with lower flange extending a minimum of **[4 inches (102 mm)][6 inches (152 mm)]<Insert dimension>** over and **[4 inches (102 mm)]<Insert dimension>** beyond each side of downslope tile roofing and **[6 inches (152 mm)]<Insert dimension>** up the vertical surface.
 2. Step Flashings: Fabricate with a headlap of **4 inches (102 mm)** and a minimum extension of **[4 inches (102 mm)][5 inches (127 mm)]<Insert dimension>** both horizontally and vertically.
 3. Channel Flashings: Fabricate with vertical surface extending a minimum of **[4 inches (102 mm)][5 inches (127 mm)]<Insert dimension>** above the clay roof tile and **[4 inches (102 mm)][6 inches (152 mm)]<Insert dimension>** beneath the tile roofing, with a **[1-inch- (25-mm-)]<Insert dimension>** high vertical return to form a runoff channel.
 4. Rake Pan Flashings: Fabricate with vertical surface extending over fasciae and **[6 inches (152 mm)]<Insert dimension>** beneath the tile roofing, with a **[1-inch- (25-mm-)]<Insert dimension>** high vertical return to form a runoff channel.
 5. Cricket and Backer Flashings: Fabricate with concealed flange extending a minimum of **[24 inches (610 mm)]<Insert dimension>** beneath upslope tile roofing, **[6 inches (152 mm)]<Insert dimension>** beyond each side of **[chimney][skylight]**, and **[6 inches (152 mm)]<Insert dimension>** above the roof plane.
 6. Counterflashings: Fabricate to cover **[4 inches (102 mm)]<Insert dimension>** of base flashing measured vertically; and in lengths required so that no step exceeds **[8 inches (203 mm)]<Insert dimension>** and overall length is no more than **[10 ft. (3 m)]<Insert dimension>**.
 - a. Provide metal **[reglets][receivers]** for installation.
 7. Valley Flashings: Fabricate from metal sheet not less than **[24 inches (610 mm)]<Insert dimension>** wide in lengths not exceeding **[10 ft. (3 m)]<Insert dimension>**, with **[1-inch- (25-mm-)]<Insert dimension>** high, inverted-V profile water diverter at center of valley and equal flange widths of not less than **[11 inches (279 mm)]<Insert dimension>**.
 - a. Hem flange edges for fastening with metal cleats.
 8. Drip Edges: Fabricate in lengths not exceeding **[10 ft. (3 m)]<Insert dimension>**, with minimum **2-inch (51-mm)** roof-deck flange and **1-1/2-inch (38-mm)** fascia flange with **3/8-inch (10-mm)** drip at lower edge.
- C. Sheet Metal Ridge Vent: Fabricate from **16-oz./sq. ft.- (0.55-mm-)** thick copper sheet, terminating each side in V-shaped external baffles with venting holes producing net free ventilation area of **2.65 sq. in./ft. (56 sq. cm/m)**.
- D. Vent-Pipe Flashings: ASTM B749, Type L51121, at least **1/16 inch (1.6 mm)** thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least **4 inches (102 mm)** from pipe onto roof.
- E. **<Insert snow-guard requirements>**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with roofing system Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored and that provisions have been made for flashings and penetrations through roofing.
 - 3. Verify that vent stacks and other penetrations through roofing are installed and securely fastened.
- B. Prepare written report, endorsed by roofing system Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT MATERIALS

- A. Comply with clay-roof-tile and underlayment manufacturers' written installation instructions and with recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems" applicable to products and applications indicated unless more stringent requirements are specified in this Section or indicated on Drawings.
 - 1. Cover **[ridge][hip]** wood nailers with underlayment strips.
- B. Felt: Install parallel with and starting at eaves and fasten with underlayment nails.
 - 1. Single-Layer Installation: Install on roof deck.
 - a. Lap sides a minimum of **[2 inches (51 mm)][4 inches (102 mm)]** over underlying course.
 - b. Lap ends a minimum of **4 inches (102 mm)**.
 - c. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 - 2. Top-Layer Installation: Install as second layer over anchor-layer underlayment, with side laps offset halfway between side laps of underlying anchor layer.
 - a. Lap sides a minimum of **[2 inches (51 mm)][4 inches (102 mm)]** over underlying course.
 - b. Lap ends a minimum of **4 inches (102 mm)**.
 - c. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 - 3. Double-Layer Installation: Install on roof deck.
 - a. Install a **19-inch- (483-mm-)** wide starter course at eaves and completely cover with a **36-inch- (914-mm-)** wide second course.
 - b. Install succeeding **36-inch- (914-mm-)** wide courses lapping previous courses **19 inches (483 mm)** in shingle fashion.
 - c. Lap ends a minimum of **6 inches (152 mm)**.
 - d. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 - e. Apply a continuous layer of asphalt roofing cement over starter course and on felt surface to be concealed by succeeding courses as each felt course is installed. Apply **[over entire**

roof][at locations indicated on Drawings].

4. Install fasteners in a grid pattern of **12 inches (305 mm)** between side laps with **6-inch (152-mm)** spacing at side and end laps.
 5. Install felt over areas protected by self-adhering, polymer-modified bitumen sheet.
 6. Terminate felt **[flush][extended up not less than 4 inches (102 mm)]<Insert requirements>** against sidewalls, curbs, chimneys, and other roof projections.
- C. Asphalt Roll-Roofing: Install parallel with and starting at eaves.
1. Single-Layer Installation: Install on roof deck.
 - a. Lap sides a minimum of **[2 inches (51 mm)][4 inches (102 mm)]** over underlying course.
 - b. Lap ends a minimum of **4 inches (102 mm)**.
 - c. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 - d. Fasten with underlayment nails.
 2. Top-Layer Installation: Install as second layer over anchor-layer underlayment, with side laps offset halfway between side laps of underlying anchor layer.
 - a. Lap sides a minimum of **[2 inches (51 mm)][4 inches (102 mm)]** over underlying course.
 - b. Lap ends a minimum of **4 inches (102 mm)**.
 - c. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 - d. **[Fasten with underlayment nails][Adhere to anchor layer in solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature][Adhere to anchor layer in uniform coating of cold-applied adhesive][Adhere to anchor layer in uniform coating of asphalt roofing cement]**.
 3. Double-Layer Installation: Install on roof deck.
 - a. Install a **19-inch- (483-mm-)** wide starter course at eaves and completely cover with a **36-inch- (914-mm-)** wide second course.
 - b. Install succeeding **36-inch- (914-mm-)** wide courses lapping previous courses **19 inches (483 mm)** in shingle fashion.
 - c. Lap ends a minimum of **6 inches (152 mm)**.
 - d. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 - e. Fasten with underlayment nails.
 - f. Apply a continuous layer of asphalt roofing cement over starter course and on roll-roofing surface to be concealed by succeeding courses as each roll-roofing course is installed. Apply **[over entire roof][at locations indicated on Drawings]**.
 4. Install fasteners in a grid pattern of **12 inches (305 mm)** between side laps with **6-inch (152-mm)** spacing at side and end laps.
 5. Install roll roofing over areas protected by self-adhering, polymer-modified bitumen sheet.
 6. Terminate roll roofing **[flush][extended up not less than 4 inches (102 mm)]<Insert requirements>** against sidewalls, curbs, chimneys, and other roof projections.
- D. Synthetic-Underlayment Top Layer: Install in accordance with manufacturer's written installation instructions and as second layer over anchor-layer underlayment.
1. Completely cover anchor-layer underlayment and install parallel with and starting at the eaves, with side laps offset halfway between side laps of underlying anchor layer.
 2. Lap sides and ends as recommended in writing by manufacturer, but not less than **[2 inches (51 mm)][4 inches (102 mm)]** for side laps and **6 inches (152 mm)** for end laps.
 3. Stagger end laps from anchor-layer end laps and between succeeding top courses at interval recommended in writing by manufacturer, but not less than **72 inches (1829 mm)**.

4. Fasten with underlayment nails.
 5. Install fasteners in a grid pattern of **12 inches (305 mm)** between side laps with **6-inch (152-mm)** spacing at side and end laps.
- E. Polymer-Modified Bitumen Sheet: Install parallel with and starting at eaves.
1. Single- or Anchor-Layer Installation: Install on roof deck.
 - a. Lap sides a minimum of **2 inches (51 mm)**[**4 inches (102 mm)**] over underlying course.
 - b. Lap ends a minimum of **6 inches (152 mm)**.
 - c. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 - d. Fasten with underlayment nails.
 2. Top-Layer Installation: Install as a second layer over anchor-layer underlayment, with side laps offset halfway between side laps of underlying anchor layer.
 - a. Lap sides a minimum of **2 inches (51 mm)**[**4 inches (102 mm)**].
 - b. Lap ends a minimum of **6 inches (152 mm)**.
 - c. Stagger end laps from anchor-layer end laps and between succeeding top-layer courses at least **72 inches (1829 mm)**.
 - d. **[Fasten with underlayment nails][Adhere to anchor layer in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature][Adhere to anchor layer in uniform coating of cold-applied adhesive].**
 3. Double-Layer Installation: Install on roof deck in overlapping layers with a half-width plus **1-inch-(25-mm-)** wide starter course at eaves completely covered by full-width second course.
 - a. Install succeeding courses lapping previous courses by a half-width plus **1 inch (25 mm)** in shingle fashion.
 - b. Lap ends a minimum of **6 inches (152 mm)**.
 - c. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 - d. Fasten with underlayment nails.
 4. Install fasteners in a grid pattern of **12 inches (305 mm)** between side laps with **6-inch (152-mm)** spacing at side and end laps.
 5. Install sheets over areas protected by self-adhering, polymer-modified bitumen sheet.
 6. Terminate sheets **[flush][extended up not less than 4 inches (102 mm)]<Insert requirements>** against sidewalls, curbs, chimneys, and other roof projections.
- F. Self-Adhering, Polymer-Modified Bitumen Sheet: Install, wrinkle free.
1. Comply with low-temperature installation restrictions of underlayment manufacturer.
 2. Install lapped in direction that sheds water.
 3. Lap sides not less than **4 inches (102 mm)**.
 4. Lap ends not less than **6 inches (152 mm)**, staggered **24 inches (610 mm)** between succeeding courses.
 5. Roll laps with roller.
 6. Prime concrete, masonry, and metal surfaces to receive self-adhering, polymer-modified bitumen sheet.
 7. Single-Layer Installation: Install over entire roof deck.
 8. Top-Layer Installation: Install as second layer over anchor-layer underlayment.
 - a. Completely cover anchor-layer underlayment.
 - b. Offset side laps halfway between side laps of underlying anchor layer and offset end laps from those of underlying anchor layer at least **72 inches (1829 mm)**.

9. Water and Ice-Dam Protection Installation: Install on roof deck where indicated [below][on Drawings].
 - a. Eaves: Extend from edges of eaves [24 inches (610 mm)][36 inches (914 mm)]<Insert dimension> beyond interior face of exterior wall.
 - b. Rakes: Extend from edges of rakes [24 inches (610 mm)][36 inches (914 mm)]<Insert dimension> beyond interior face of exterior wall.
 - c. Valleys: Extend from lowest to highest point [18 inches (457 mm)]<Insert dimension> on each side of centerline.
 - d. Hips: Extend [18 inches (457 mm)]<Insert dimension> on each side.
 - e. Ridges: Extend [36 inches (914 mm)]<Insert dimension> on each side[without obstructing continuous ridge vent slot].
 - f. Sidewalls: Extend [18 inches (457 mm)]<Insert dimension> beyond sidewalls and return vertically against sidewalls not less than [4 inches (102 mm)]<Insert dimension>.
 - g. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend [18 inches (457 mm)]<Insert dimension> beyond penetrating elements and return vertically against penetrating elements not less than [4 inches (102 mm)]<Insert dimension>.
 - h. Roof-Slope Transitions: Extend [18 inches (457 mm)]<Insert dimension> on each roof slope.
10. Cover underlayment within seven days.

- G. Valley Underlayment: Install one layer of 36-inch- (914-mm-) wide underlayment centered in valley, running full length of valley, and on top of underlayment on field of roof that is woven through valley. Install all layers of underlayment in and through valley tight with no bridging.

1. Use [same underlayment as installed on field of roof]<Insert requirements>.
2. Lap ends at least 12 inches (305 mm) in direction that sheds water, and seal with asphalt roofing cement.
3. Fasten to roof deck with underlayment nails located as far from valley center as possible and only to extent necessary to hold underlayment in place until installation of valley flashing.
4. Solidly cement valley underlayment to roof-field underlayment that is woven through valley using asphalt roofing cement.

3.3 INSTALLATION OF RIDGE VENTS

- A. Rigid-Plastic Ridge Vents: Install continuous ridge vents over clay roof tiles in accordance with manufacturer's written instructions. Fasten with nails of sufficient length to penetrate substrate.
- B. Flexible Ridge Vent: Install continuous-roll ridge vents over clay roof tiles in accordance with manufacturer's written instructions.

3.4 INSTALLATION OF SHEET METAL FLASHING AND TRIM

- A. Install sheet metal flashings and trim to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
 1. Install in accordance with clay-roof-tile manufacturer's written instructions and recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems."
- B. Apron Flashings: Extend lower flange over and beyond each side of downslope tile roofing and up the vertical surface.
- C. Step Flashings: Install with a headlap of 4 inches (102 mm) and extend both horizontally and vertically.

Install with lower edge of flashing just upslope of, and concealed by, butt of overlying tile. Fasten to roof deck only.

- D. Cricket and Backer Flashings: Install against roof-penetrating elements, extending concealed flange beneath upslope tile roofing and beyond each side.
- E. Channel Flashings: Install over underlayment materials and fasten to roof deck.
- F. Rake Pan Flashings: Install over underlayment materials and fasten to roof deck.
- G. Counterflashings: Coordinate with installation of base flashing and fit tightly to base flashing. Lap joints a minimum of **4 inches (102 mm)** secured in a waterproof manner.
 - 1. Install in reglets or receivers.
- H. Valley Flashings: Install centered in valleys, lapping ends at least **[8 inches (203 mm)]<Insert dimension>** in direction that sheds water. Fasten upper end of each length to roof deck beneath overlap.
 - 1. Secure hemmed flange edges into metal cleats spaced **[12 inches (305 mm)][24 inches (610 mm)]<Insert dimension>** apart and fastened to roof deck.
 - 2. Adhere minimum **[9-inch- (229-mm-)]<Insert dimension>** wide strips of self-adhering, polymer-modified bitumen sheet to metal flanges and to **[underlying self-adhering, polymer-modified bitumen sheet]<Insert requirements>**. Place strips parallel to and over flanges so that they will be just concealed by installed tile.
 - 3. Provide a closure at the end of the inverted-V profile of the valley metal to minimize water and ice infiltration.
- I. Rake Drip Edges: Install over underlayment materials and fasten to roof deck.
- J. Eave Drip Edges: Install below underlayment materials and fasten to roof deck.
- K. Sheet Metal Ridge Vents: Install centered on and mechanically fasten to wood ridge. Adhere each side to clay roof tile with elastomeric sealant.
 - 1. Install fabric mesh over roof-deck air ventilation gaps to prevent insect entry.
- L. Pipe Flashings: Form flashing around pipe penetrations and tile roofing. Fasten and seal to tile roofing.

3.5 INSTALLATION OF WOOD NAILERS

- A. Install wood nailers securely fastened to roof deck at the following locations:
 - 1. Hips.
 - 2. Ridges.
 - 3. Rakes.
- B. Install beveled wood-cant nailers at eaves and securely fasten to roof deck.
- C. Install nominal **1-by-2-inch (25-by-51-mm)** wood-batten nailers horizontally **[over 1/2-inch- (13-mm-) high, pressure-preservative-treated wood lath strips][in 48-inch (1219-mm) lengths with ends separated by 1/2 inch (13 mm)]**, at spacing required by clay-roof-tile manufacturer, and securely fasten to roof deck.

1. Install nominal **1-by-2-inch (25-by-51-mm)** wood counter battens vertically spaced [**24 inches (610 mm)**]**<Insert dimension>** apart and securely fasten to roof deck.

3.6 INSTALLATION OF CLAY ROOF TILES

- A. Install clay roof tiles in accordance with manufacturer's written instructions and recommendations in TRI/WSRCA's "Concrete and Clay Roof Tile Installation Manual" and NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems" unless more stringent requirements are specified in this Section or indicated on Drawings.

1. Install to resist wind forces resulting from design wind speeds indicated on Drawings.
2. Maintain uniform exposure and coursing of clay roof tiles throughout roof.
3. Extend tiles **2 inches (51 mm)** over eave fasciae.
4. Nail Fastening: Drive nails to clear the clay roof tile so the tile hangs from the nail and is not drawn up.
 - a. Install wire through nail holes of cut tiles that cannot be nailed directly to roof deck, and fasten to nails driven into deck.
5. Wire-Tie Fastening: Install wire-tie systems and fasten clay roof tiles in accordance with manufacturer's written instructions.
6. Mortar Setting: Install clay roof tiles in accordance with manufacturer's written instructions and acceptance criteria of authorities having jurisdiction.
7. Foam-Adhesive Setting: Install clay roof tiles in accordance with adhesive and tile manufacturers' written instructions and acceptance criteria of authorities having jurisdiction.
8. Storm Clips: Install to capture edges of longitudinal sides of clay roof tiles and securely fasten to roof deck.
9. Tile Locks: Install to support and lock overlying tile butts to underlying tiles.
10. Cut and fit clay roof tiles neatly around roof vents, pipes, ventilators, and other projections through roof. Fill voids with mortar.
11. Install clay roof tiles with color blend approved by Architect.

- B. Flat-Shingle Clay-Roof-Tile Installation:

1. Maintain **2-inch (51-mm)** headlap between succeeding courses of clay roof tiles.
2. Offset joints by half the clay-roof-tile width in succeeding courses.
3. Extend clay roof tiles **1 inch (25 mm)** over fasciae at rakes.
4. Install ridge tiles in [**V-ridge**][**saddle**][**mitered**] configuration with laps facing away from prevailing wind. Seal laps with [**asphalt roofing cement**][**butyl sealant**][**elastomeric sealant**].
 - a. Close voids where ridge tiles meet clay roof tiles with [**ridge closure**][**mortar struck with face of ridge cover**] tiles.
5. Install hip tiles in [**V-ridge**][**saddle**][**mitered**] configuration. Seal laps with [**asphalt roofing cement**][**butyl sealant**][**elastomeric sealant**].
 - a. Fill voids with mortar where hip tiles meet clay roof tiles, and strike mortar flush with face of hip cover tiles.

- C. Flat Interlocking Clay-Roof-Tile Installation:

1. Provide minimum **3-inch (76-mm)** lap between succeeding courses of clay roof tiles.
2. Offset joints by half the clay-roof-tile width in succeeding courses.
3. Install L-shaped rake tiles.
4. Install ridge tiles in [**V-ridge**][**saddle**][**mitered**] configuration with laps facing away from prevailing

wind. Seal laps with [asphalt roofing cement][butyl sealant][elastomeric sealant].

- a. Close voids where ridge tiles meet clay roof tiles with [ridge closure][mortar struck with face of ridge cover] tiles.

5. Install hip tiles in [V-ridge][saddle][mitered] configuration. Seal laps with [asphalt roofing cement][butyl sealant][elastomeric sealant].

- a. Fill voids with mortar where hip tiles meet clay roof tiles, and strike mortar flush with face of hip cover tiles.

D. Low-Profile, Interlocking Clay-Roof-Tile Installation:

1. Provide minimum **3-inch (76-mm)** lap between succeeding courses of clay roof tiles.
2. Install rake tiles indicated.
3. Install ridge tiles with laps facing away from prevailing wind. Seal laps with [asphalt roofing cement][butyl sealant][elastomeric sealant].

E. High-Profile Clay-Roof-Tile Installation:

1. Install [tile][sheet metal][EPDM] eave closure.
2. Provide minimum **3-inch (76-mm)** lap between succeeding courses of clay roof tiles.
3. Install rake tiles indicated.
4. Install ridge tiles with laps facing away from prevailing wind. Seal laps with [asphalt roofing cement][butyl sealant][elastomeric sealant].

- F. Open Valleys: Cut clay roof tiles at open valleys to form straight lines. **[Maintain uniform width of exposed open valley][Widen exposed portion of open valley 1/8 inch in 12 inches (1:96)]** from highest to lowest point.

1. Drill or notch cut valley tiles and wire-tie to fastener placed clear of valley metal flashings.
2. Do not nail tiles to metal flashings.

- G. Closed Valleys: Cut clay roof tiles at closed valleys to form straight lines, trimming upper concealed corners of tiles. Maintain uniform gap of **[1/2 to 3/4 inch (13 to 19 mm)][3/4 to 1 inch (19 to 25 mm)]**<Insert dimension> on either side of water diverter at valley centerline.

1. Drill or notch cut valley tiles and wire-tie to fastener placed clear of valley metal flashings.
2. Do not nail tiles to metal flashings.

- H. Remove and replace damaged or broken clay roof tiles.

3.7 ROOFING SYSTEM INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing System Installer," has performed roofing and associated Work on the following Project:

1. Owner: <Insert name of Owner>.
2. Owner Address: <Insert address>.
3. Building Name/Type: <Insert information>.
4. Building Address: <Insert address>.
5. Area of the Work: <Insert information>.
6. Warranty Period: [Two][Five]<Insert number> years from date of Substantial Completion.

7. Date of Substantial Completion: _____.
- B. AND WHEREAS Roofing System Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said Work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing System Installer hereby warrants, subject to terms and conditions herein set forth, that, during Warranty Period, Roofing System Installer will, at Roofing System Installer's own cost and expense, make or cause to be made such repairs to or replacements of said Work as are necessary to correct faulty and defective work and as are necessary to maintain said Work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to the Work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding **<Insert mph (m/s)>**;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the Work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When the Work has been damaged by any of foregoing causes, Warranty becomes null and void until such damage has been repaired by Roofing System Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing System Installer is responsible for damage to the Work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of the Work.
 4. During Warranty Period, if Owner allows alteration of the Work by anyone other than Roofing System Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty becomes null and void on date of the alterations, but only to the extent the alterations affect the Work covered by this Warranty. If Owner engages Roofing System Installer to perform the alterations, Warranty does not become null and void unless Roofing System Installer, before starting the alterations, has notified Owner in writing, showing reasonable cause for claim, that the alterations would likely damage or deteriorate the Work, thereby reasonably justifying a limitation or termination of this Warranty.
 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a use or service more severe than originally specified, this Warranty becomes null and void on date of the change, but only to the extent the change affects the Work covered by this Warranty.
 6. Owner to promptly notify Roofing System Installer of observed, known, or suspected leaks, defects, or deterioration and affords reasonable opportunity for Roofing System Installer to inspect the Work and to examine evidence of such leaks, defects, or deterioration.
 7. This Warranty is recognized to be the only warranty of Roofing System Installer on said Work and does not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty does not operate to relieve Roofing System Installer of responsibility for performance of the Work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

07 - Thermal And Moisture Protection



E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 07 32 13 00



SECTION 07 32 16 00 - CONCRETE ROOF TILES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete roof tiles.
2. Underlayment materials.
3. Ridge vents.
4. Sheet metal flashing and trim.

B. Related Requirements:

1. Section 077253 "Snow Guards" for snow guards.

1.2 ALLOWANCES

- A.** See Section 012100 "Allowances" for description of allowances affecting items specified under this Section.

1.3 UNIT PRICES

- A.** See Section 012200 "Unit Prices" for description of unit prices affecting items specified under this Section.

1.4 ALTERNATES

- A.** See Section 012300 "Alternates" for description of alternates affecting items specified under this Section.

1.5 DEFINITIONS

- A.** Roofing Terminology: See ASTM D1079 and glossary in TRI/WSRCA's "Concrete and Clay Roof Tile Installation Manual" for definitions of terms related to roofing Work in this Section.

1.6 PREINSTALLATION MEETINGS

- A.** Preinstallation Conference: Conduct conference **[at Project site][by web conference]<Insert location>**.

1. **<Insert participant requirements>**.

1.7 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For sheet metal flashing and trim.
- C. Samples: For each exposed product and for each color and texture specified, in sizes indicated.
 - 1. Concrete Roof Tiles: Full size, showing full range of color values and blends.
 - 2. Accessory Tiles: Full size, each type.
 - 3. Sheet Metal Flashing: **12 inches (305 mm)** square.
 - 4. Ridge Vents: **12-inch- (305-mm-)** long Sample.
 - 5. Eave Closures: In manufacturer's standard size.
- D. Samples for Initial Selection: For each type of concrete roof tile and accessory tile.
 - 1. Include Samples of accessories involving color selection.
- E. Samples for Verification: For the following products, in sizes indicated:
 - 1. Concrete Roof Tiles: Full size, showing full range of color values and blends.
 - 2. Accessory Tiles: Full size, each type.
 - 3. Sheet Metal Flashing: **12 inches (305 mm)** square.
 - 4. Ridge Vents: **12-inch- (305-mm-)** long Sample.
 - 5. Eave Closures: In manufacturer's standard size.
- F. Sustainable Design Submittals:
 - 1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.

1.8 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of concrete roof tile, based on evaluation of comprehensive tests performed by a qualified testing agency.
- B. Research Reports: From **[an agency acceptable to authorities having jurisdiction][ICC-ES]<Insert evaluation agency>**, indicating that product is suitable for intended use under applicable building codes for the following:
 - 1. **[Mortar][Adhesive]** tile-attachment systems.
 - 2. Wire-tie tile-attachment systems.
 - 3. Polymer-modified bitumen sheet underlayment.
 - 4. Synthetic underlayment.
- C. Qualification Statements: For roofing system Installer.
- D. Sample warranties.

1.9 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system.

- B. Materials warranties.
- C. Roofing system Installer's warranty.

1.10 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Concrete Roof Tiles: **[100 sq. ft. (9.3 sq. m)]<Insert area>** of each type, in unbroken bundles.

1.11 QUALITY ASSURANCE

- A. Roofing System Installer Qualifications: Entity that employs **[a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified concrete tile system installers][a supervisor who is an NRCA ProCertified Roofing Foreman][a supervisor who is an NRCA ProCertified Roofing Foreman and not less than 20 percent of installers who are NRCA ProCertified concrete tile system installers]**.

1.12 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockups for concrete roof tiles including related roofing materials.
 - a. Size: **[48 inches (1219 mm) long by 48 inches (1219 mm) wide]<Insert dimensions>**.
 - b. Include gutter and downspout complying with requirements in **[Section 076200 "Sheet Metal Flashing and Trim."][Section 077100 "Roof Specialties."]**
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.13 DELIVERY, STORAGE, AND HANDLING

- A. Store underlayment rolls in a dry, well-ventilated location protected from weather, sunlight, and moisture in accordance with manufacturer's written instructions.
 - 1. Store on end, on pallets or other raised surfaces. Do not double-stack rolls.
- B. Protect unused underlayment from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.
- C. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

1.14 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with installation only when existing and forecasted weather conditions permit product installation and related work to be performed in accordance with manufacturer's written instructions and warranty requirements.
 - 1. Install self-adhering, polymer-modified bitumen sheet underlayment within the range of ambient and substrate temperatures recommended in writing by manufacturer.

1.15 WARRANTY

- A. Materials Warranty: Manufacturer agrees to repair or replace concrete roof tiles that fail in materials within specified warranty period.
 - 1. Warranty Period: **[50]**<Insert number> years from date of Substantial Completion.
- B. Roofing System Installer's Warranty: Submit roofing system Installer's warranty, on warranty form at end of this Section, signed by roofing system Installer, in which Installer agrees to repair or replace components of concrete-tile roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: **[Two][Five]**<Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of product from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Exterior Fire-Test Exposure: Provide concrete roof tiles and related roofing materials identical to those of assemblies tested for Class A fire resistance in accordance with ASTM E108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
- B. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][32]** or initial SRI not less than **[82][39]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- C. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][25]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- D. Solar Reflectance Index (SRI): Not less than **[78][29]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.

2.3 CONCRETE ROOF TILES

- A. Concrete Roof Tiles: ASTM C1492, molded- or extruded-concrete roof tile units of shape and

configuration indicated, with integral color, and free of surface imperfections. Provide with fastening holes prepunched at factory.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Bartile]**
 - b. **[Boral Roofing LLC; Boral USA]**
 - c. **[Crown Roof Tiles]**
 - d. **[Eagle Roofing Products]**
 - e. **[Vande Hey Raleigh Mfg., Inc]**
 - f. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Bartile]**
 - b. **[Boral Roofing LLC; Boral USA]**
 - c. **[Crown Roof Tiles]**
 - d. **[Eagle Roofing Products]**
 - e. **[Vande Hey Raleigh Mfg., Inc]**
 - f. **<Insert manufacturer's name>**
3. Weight: **[Normal][Medium][Light]**.
4. High-Profile Shape: Type I, **[Spanish or "S"]****[Spanish or "S," interlocking]****<Insert shape>**.
 - a. Accessory Tiles: Type IV, **[ridge][ridge vent][ridge end][hip and hip starter][header course][L-shaped rake edge][roll rake edge][starter][end band][and][terminal]****<Insert accessory>** units.
5. Medium-Profile Shape: Type II, **[French interlocking]****<Insert shape>**.
 - a. Accessory Tiles: Type IV, **[ridge][ridge vent][ridge end][hip and hip starter][header course][L-shaped rake edge][roll rake edge][starter][end band][and][terminal]****<Insert accessory>** units.
6. Low-Profile Shape: Type III, **[flat shingle][flat interlocking]****<Insert shape>**.
 - a. Accessory Tiles: Type IV, **[Ridge and closed ridge end][hip and hip starter][header course][L-shaped rake edge][starter][end band][and][terminal]****<Insert accessory>** units.
7. Size: **<Insert length and width dimensions>**.
8. Finish and Texture: **[Matte, smooth][Matte, striated][Glazed, smooth]****<Insert finish and texture>**.
9. Colors, Blends, and Patterns: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]****<Insert description>**.
10. Product Data: Verify materials were fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.
11. Product Data: Verify materials were fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project

site. If materials are transported by rail or water, multiply the distance by 0.25 to determine the distance to Project site.

2.4 UNDERLAYMENT MATERIALS

- A. Felt: **[ASTM D226/D226M Type II, asphalt saturated][ASTM D4869/D4869M Type IV, asphalt saturated][ASTM D2626/D2626M, asphalt saturated and coated, mineral-granule surfaced on weather (top) side]**, unperforated.
- B. Asphalt Roll-Roofing: ASTM D6380/D6380M, Class M, Type II, asphalt-saturated and -coated organic felt; mineral-granule surfaced on weather (top) side.
- C. Synthetic Underlayment: UV-resistant polypropylene, polyolefin, or polyethylene polymer fabric with surface coatings or treatments to improve traction underfoot and abrasion resistance; recommended, in writing, by manufacturer for use under roof tile; and evaluated and documented to be suitable for use as a roof underlayment under applicable codes by a testing and inspecting agency acceptable to authorities having jurisdiction.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Drexel Metals Corp.]**
 - b. **[G.A.P. Roofing, Inc.]**
 - c. **[GAF]**
 - d. **[Owens Corning]**
 - e. **[SDP Advanced Polymer Products Inc.]**
 - f. **[SystemComponents Corporation]**
 - g. **[Tamko Building Products LLC]**
 - h. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Drexel Metals Corp.]**
 - b. **[G.A.P. Roofing, Inc.]**
 - c. **[GAF]**
 - d. **[Owens Corning]**
 - e. **[SDP Advanced Polymer Products Inc.]**
 - f. **[SystemComponents Corporation]**
 - g. **[Tamko Building Products LLC]**
 - h. **<Insert manufacturer's name>**
- D. Polymer-Modified Bitumen Sheet: Styrene-butadiene-styrene- (SBS) modified asphalt, glass-fiber-mat-reinforced sheet; minimum **[55-mil (1.4-mm)][40-mil (1.0-mm)]<Insert dimension>** nominal thickness; recommended in writing by manufacturer and acceptable to authorities having jurisdiction for use as underlayment in tile steep-slope roofing systems; and designed for mechanical fastening or adhesive attachment using roofing asphalt or cold-applied adhesive.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the**

following]:

- a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [Boral Roofing LLC; Boral USA]
 - c. [CertainTeed; SAINT-GOBAIN]
 - d. [G.A.P. Roofing, Inc.]
 - e. [GMC Roofing & Building Paper Products, Inc.]
 - f. [Malarkey Roofing Products]
 - g. [Tarco]
 - h. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [Boral Roofing LLC; Boral USA]
 - c. [CertainTeed; SAINT-GOBAIN]
 - d. [G.A.P. Roofing, Inc.]
 - e. [GMC Roofing & Building Paper Products, Inc.]
 - f. [Malarkey Roofing Products]
 - g. [Tarco]
 - h. <Insert manufacturer's name>
3. <Insert testing requirements>.
- E. Self-Adhering, Polymer-Modified Bitumen Sheet: ASTM D1970/D1970M, minimum [55-mil- (1.4-mm-)][50-mil- (1.3-mm-)][40-mil- (1.0-mm-)]<Insert dimension> thick sheet; glass-fiber-mat-reinforced, polymer-modified asphalt; with slip-resistant top surface and release backing; cold applied; and recommended in writing by manufacturer for use in tile roofing system required.[Provide primer for adjoining concrete, masonry, and metal surfaces to receive underlayment.]
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- a. [ALCO Products LLC]
 - b. [Atlas Polyiso Roof and Wall Insulation]
 - c. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
 - d. [CertainTeed; SAINT-GOBAIN]
 - e. [Drexel Metals Corp.]
 - f. [GAF]
 - g. [GCP Applied Technologies Inc.]
 - h. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
 - i. [IKO Industries Inc.]
 - j. [Malarkey Roofing Products]
 - k. [SDP Advanced Polymer Products Inc.]
 - l. [Tamko Building Products LLC]
 - m. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [ALCO Products LLC]
- b. [Atlas Polyiso Roof and Wall Insulation]
- c. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
- d. [CertainTeed; SAINT-GOBAIN]
- e. [Drexel Metals Corp.]
- f. [GAF]
- g. [GCP Applied Technologies Inc.]
- h. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
- i. [IKO Industries Inc.]
- j. [Malarkey Roofing Products]
- k. [SDP Advanced Polymer Products Inc.]
- l. [Tamko Building Products LLC]
- m. <Insert manufacturer's name>

3. Top Surface: [Sand][Granule][Textured polymer film][Polyester].

F. Self-Adhering, Polymer-Modified Bitumen Sheet, High Temperature: ASTM D1970/D1970M, minimum [55-mil- (1.4-mm-)][50-mil- (1.3-mm-)][40-mil- (1.0-mm-)]<Insert thickness> thick sheet; glass-fiber-mat-reinforced, polymer-modified asphalt; with slip-resistant top surface and release backing; cold applied; and recommended in writing by manufacturer for use in tile roofing system required. [**Provide primer for adjoining concrete, masonry, and metal surfaces to receive underlayment.**]

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [ALCO Products LLC]
- b. [Atlas Polyiso Roof and Wall Insulation]
- c. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
- d. [CertainTeed; SAINT-GOBAIN]
- e. [Drexel Metals Corp.]
- f. [GCP Applied Technologies Inc.]
- g. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
- h. [Malarkey Roofing Products]
- i. [SDP Advanced Polymer Products Inc.]
- j. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [ALCO Products LLC]
- b. [Atlas Polyiso Roof and Wall Insulation]
- c. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
- d. [CertainTeed; SAINT-GOBAIN]
- e. [Drexel Metals Corp.]
- f. [GCP Applied Technologies Inc.]
- g. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
- h. [Malarkey Roofing Products]
- i. [SDP Advanced Polymer Products Inc.]
- j. <Insert manufacturer's name>

3. Thermal Stability: Stable after testing at **240 deg F (116 deg C)** in accordance with ASTM D1970/D1970M.
4. Top Surface: **[Granule][Textured polymer film][Polyester]**.

2.5 RIDGE VENTS

- A. Rigid-Plastic Ridge Vent: Manufacturer's standard, rigid section high-density polypropylene or other UV-stabilized plastic ridge vent for use under ridge tiles.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Cor-A-Vent, Inc]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Cor-A-Vent, Inc]**
 - b. **<Insert manufacturer's name>**
 3. Minimum Net Free Area: **<Insert area>**.
 4. Width: **<Insert dimension>**.
 5. Thickness: **<Insert dimension>**.
- B. Flexible Ridge Vent: Manufacturer's standard roll-form ridge vent that protects against driven rain and snow and is recommended in writing by manufacturer for installation with roof tile indicated.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Boral Roofing LLC; Boral USA]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Boral Roofing LLC; Boral USA]**
 - b. **<Insert manufacturer's name>**
 3. Width: **<Insert dimension>**.
 4. Features: **[Butyl adhesive strips at sides][Corrugated aluminum strips at sides]**.

2.6 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D4586/D4586M Type II, asbestos free.

- B. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied.
- C. Elastomeric Sealant: ASTM C920, Type S, Grade NS, one-part, non-sag, elastomeric polymer sealant of class and use classifications required to seal joints in concrete-tile roofing and remain watertight; recommended in writing by manufacturer for applications indicated.
- D. Roofing Asphalt: ASTM D312/D312M Type IV.
- E. Cold-Applied Adhesive: Manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with underlayments.
- F. Mortar: ASTM C270, Type M, **[natural color][with ASTM C979/C979M, pigmented mortar matching the color of concrete roof tiles for exposed-to-view mortar, and natural color for concealed-from-view mortar]**.
- G. Foam Adhesive: Two-component, polyurethane expanding adhesive recommended in writing for application by concrete-roof-tile manufacturer.
- H. Eave Closure: Manufacturer's standard **[EPDM][copper][stainless steel][galvanized-steel][aluminum, mill finish]<Insert material>** eave closure formed to shape of concrete roof tiles.
- I. Ridge Closure: Manufacturer's standard EPDM ridge closure, formed to shape of concrete roof tiles.
- J. Wood Nailers: Comply with requirements for pressure-preservative-treated wood in Section 061000 "Rough Carpentry."
- K. Mesh Fabric: **18-by-14 (1.1-by-1.4-mm)** mesh of PVC-coated, glass-fiber thread.

2.7 FASTENERS

- A. Roofing Nails: ASTM F1667, **[hot-dip galvanized-steel, 0.120-inch- (3.05-mm-)] [stainless steel, 0.120-inch- (3.05-mm-)] [copper, 0.135-inch- (3.43-mm-)] [silicon-bronze, 0.120-inch- (3.05-mm-)]** diameter shank, sharp-pointed, conventional roofing nails with barbed shanks; minimum **3/8-inch- (10-mm-)** diameter head; of sufficient length to penetrate **3/4 inch (19 mm)** into substrate or extend at least **1/8 inch (3 mm)** through thickness of the sheathing, whichever is less.
 - 1. Where nails are in contact with sheet metal flashing, use nails made from same metal as flashing.
- B. Underlayment Nails: Aluminum, stainless steel, or hot-dip galvanized-steel wire nails with low-profile metal or plastic caps, **1-inch- (25-mm-)** minimum diameter.
 - 1. Provide with minimum **0.0134-inch- (0.34-mm-)** thick metal cap, **0.010-inch- (0.25-mm-)** thick power-driven metal cap, or **0.035-inch- (0.89-mm-)** thick plastic cap; and with minimum **0.083-inch- (2.11-mm-)** thick ring shank or **0.091-inch- (2.31-mm-)** thick smooth shank of length to penetrate at least **3/4 inch (19 mm)** into roof sheathing or to penetrate through roof sheathing less than **3/4 inch (19 mm)** thick.
- C. Nails for Wood Nailers: ASTM F1667; common or box, steel wire, flat head, and smooth shank.
- D. Wire Ties: **[Copper][Brass][Stainless steel], 0.083-inch- (2.11-mm-)** minimum diameter.
- E. Twisted-Wire-Tie System: Continuously twisted, two-wire unit with loops formed **6 inches (152 mm)**

apart, minimum **[0.101-inch- (2.57-mm-) diameter copper wire and 0.064-inch- (1.63-mm-) diameter copper tie wires][0.090-inch- (2.29-mm-) diameter stainless steel wire and 0.063-inch- (1.60-mm-) diameter stainless steel tie wires][0.105-inch- (2.67-mm-) diameter galvanized-steel wire and 0.063-inch- (1.60-mm-) diameter galvanized-steel tie wires]**<Insert requirements>, with matching-metal folding clip anchors.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Frances Fasteners Inc., dba STORM-LOCK Tile Fasteners]**
 - b. **[Wire Works, Inc.]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Frances Fasteners Inc., dba STORM-LOCK Tile Fasteners]**
 - b. **[Wire Works, Inc.]**
 - c. **<Insert manufacturer's name>**
- F. Hook Nails: One-piece wind lock and concrete-roof-tile fastener system, minimum **[0.135-inch- (3.43-mm-) diameter brass][0.135-inch- (3.43-mm-) diameter copper][0.120-inch- (3.05-mm-) diameter stainless steel][0.120-inch- (3.05-mm-) diameter galvanized-steel]**<Insert requirements> wire, for direct deck nailing.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Frances Fasteners Inc., dba STORM-LOCK Tile Fasteners]**
 - b. **[Wire Works, Inc.]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Frances Fasteners Inc., dba STORM-LOCK Tile Fasteners]**
 - b. **[Wire Works, Inc.]**
 - c. **<Insert manufacturer's name>**
- G. Tile Locks: **[Brass][Copper][Stainless steel][Hot-dip galvanized-steel]**, nominal **0.1-inch- (2.5-mm-) diameter wire device designed to secure butt edges of overlaid concrete roof tiles.**
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Frances Fasteners Inc., dba STORM-LOCK Tile Fasteners]**
 - b. **[Wire Works, Inc.]**
 - c. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Frances Fasteners Inc., dba STORM-LOCK Tile Fasteners]**
- b. **[Wire Works, Inc.]**
- c. **<Insert manufacturer's name>**

- H. Storm Clips: **[Brass, minimum 0.048-by-1/2-inch (1.22-by-13-mm)][Stainless steel, minimum 0.048-by-1/2-inch (1.22-by-13-mm)][Hot-dip galvanized-steel, minimum 0.048-by-1/2-inch (1.22-by-13-mm)]<Insert requirements>** strap-type, L-shaped retainer clips designed to secure side edges of concrete roof tiles. Provide with two fastener holes in base flange.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. **[Frances Fasteners Inc., dba STORM-LOCK Tile Fasteners]**
- b. **[Wire Works, Inc.]**
- c. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Frances Fasteners Inc., dba STORM-LOCK Tile Fasteners]**
- b. **[Wire Works, Inc.]**
- c. **<Insert manufacturer's name>**

2.8 SHEET METAL FLASHING AND TRIM

- A. General: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."

1. Sheet Metal: **[Copper][Stainless steel][Zinc-tin alloy coated copper][Anodized aluminum][Aluminum, mill finished]<Insert requirements>**.

- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for design, dimensions, metal, and other characteristics of the item unless otherwise specified in this Section or indicated on Drawings.

1. Apron Flashings: Fabricate with lower flange extending a minimum of **[4 inches (102 mm)][6 inches (152 mm)]<Insert dimension>** over and **[4 inches (102 mm)]<Insert dimension>** beyond each side of downslope tile roofing and **[6 inches (152 mm)]<Insert dimension>** up the vertical surface.
2. Step Flashings: Fabricate with a headlap of **4 inches (102 mm)** and a minimum extension of **[4 inches (102 mm)][5 inches (127 mm)]<Insert dimension>** both horizontally and vertically.
3. Channel Flashings: Fabricate with vertical surface extending a minimum of **[4 inches (102 mm)][5 inches (127 mm)]<Insert dimension>** above the concrete roof tile and **[4 inches (102 mm)][6 inches (152 mm)]<Insert dimension>** beneath the tile roofing, with a **[1-inch- (25-mm-)]<Insert dimension>** high vertical return to form a runoff channel.
4. Rake Pan Flashings: Fabricate with vertical surface extending over fasciae and **[6 inches (152 mm)]<Insert dimension>** beneath the tile roofing, with a **[1-inch- (25-mm-)]<Insert dimension>** high vertical return to form a runoff channel.

5. Cricket and Backer Flashings: Fabricate with concealed flange extending a minimum of [24 inches (610 mm)]<Insert dimension> beneath upslope tile roofing, [6 inches (152 mm)]<Insert dimension> beyond each side of [chimney][skylight], and [6 inches (152 mm)]<Insert dimension> above the roof plane.
6. Counterflashings: Fabricate to cover [4 inches (102 mm)]<Insert dimension> of base flashing measured vertically; and in lengths required so that no step exceeds [8 inches (203 mm)]<Insert dimension> and overall length is no more than [10 ft. (3 m)]<Insert dimension>.
 - a. Provide metal [reglets][receivers] for installation.
7. Valley Flashings: Fabricate from metal sheet not less than [24 inches (610 mm)]<Insert dimension> wide in lengths not exceeding [10 ft. (3 m)]<Insert dimension>, with [1-inch- (25-mm-)]<Insert dimension> high, inverted-V profile water diverter at center of valley and equal flange widths of not less than [11 inches (279 mm)]<Insert dimension>.
 - a. Hem flange edges for fastening with metal cleats.
8. Drip Edges: Fabricate in lengths not exceeding [10 ft. (3 m)]<Insert dimension>, with minimum 2-inch (51-mm) roof-deck flange and 1-1/2-inch (38-mm) fascia flange with 3/8-inch (10-mm) drip at lower edge.
- C. Sheet Metal Ridge Vent: Fabricate from 16-oz./sq. ft.- (0.55-mm-) thick copper sheet, terminating each side in V-shaped external baffles with venting holes producing net free ventilation area of 2.65 sq. in./ft. (56 sq. cm/m).
- D. Vent-Pipe Flashings: ASTM B749, Type L51121, at least 1/16 inch (1.6 mm) thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof and extending at least 4 inches (102 mm) from pipe onto roof.
- E. <Insert snow-guard requirements>.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with roofing system Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored and that provisions have been made for flashings and penetrations through roofing.
 3. Verify that vent stacks and other penetrations through roofing are installed and securely fastened.
- B. Prepare written report, endorsed by roofing system Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT MATERIALS

- A. Comply with concrete-roof-tile and underlayment manufacturers' written installation instructions and with

recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems" applicable to products and applications indicated unless more stringent requirements are specified in this Section or indicated on Drawings.

1. Cover **[ridge][hip]** wood nailers with underlayment strips.

B. Felt: Install parallel with and starting at eaves and fasten with underlayment nails.

1. Single-Layer Installation: Install on roof deck.
 - a. Lap sides a minimum of **[2 inches (51 mm)][4 inches (102 mm)]** over underlying course.
 - b. Lap ends a minimum of **4 inches (102 mm)**.
 - c. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
2. Top-Layer Installation: Install as second layer over anchor-layer underlayment, with side laps offset halfway between side laps of underlying anchor layer.
 - a. Lap sides a minimum of **[2 inches (51 mm)][4 inches (102 mm)]** over underlying course.
 - b. Lap ends a minimum of **4 inches (102 mm)**.
 - c. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
3. Double-Layer Installation: Install on roof deck.
 - a. Install a **19-inch- (483-mm-)** wide starter course at eaves and completely cover with a **36-inch- (914-mm-)** wide second course.
 - b. Install succeeding **36-inch- (914-mm-)** wide courses lapping previous courses **19 inches (483 mm)** in shingle fashion.
 - c. Lap ends a minimum of **6 inches (152 mm)**.
 - d. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 - e. Apply a continuous layer of asphalt roofing cement over starter course and on felt surface to be concealed by succeeding courses as each felt course is installed. Apply **[over entire roof][at locations indicated on Drawings]**.
4. Install fasteners in a grid pattern of **12 inches (305 mm)** between side laps with **6-inch (152-mm)** spacing at side and end laps.
5. Install felt over areas protected by self-adhering, polymer-modified bitumen sheet.
6. Terminate felt **[flush][extended up not less than 4 inches (102 mm)]<Insert requirements>** against sidewalls, curbs, chimneys, and other roof projections.

C. Asphalt Roll-Roofing: Install parallel with and starting at eaves.

1. Single-Layer Installation: Install on roof deck.
 - a. Lap sides a minimum of **[2 inches (51 mm)][4 inches (102 mm)]** over underlying course.
 - b. Lap ends a minimum of **4 inches (102 mm)**.
 - c. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 - d. Fasten with underlayment nails.
2. Top-Layer Installation: Install as second layer over anchor-layer underlayment, with side laps offset halfway between side laps of underlying anchor layer.
 - a. Lap sides a minimum of **[2 inches (51 mm)][4 inches (102 mm)]** over underlying course.
 - b. Lap ends a minimum of **4 inches (102 mm)**.
 - c. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 - d. **[Fasten with underlayment nails][Adhere to anchor layer in solid mopping of hot**

roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature][Adhere to anchor layer in uniform coating of cold-applied adhesive][Adhere to anchor layer in uniform coating of asphalt roofing cement].

3. Double-Layer Installation: Install on roof deck.
 - a. Install a **19-inch- (483-mm-)** wide starter course at eaves and completely cover with a **36-inch- (914-mm-)** wide second course.
 - b. Install succeeding **36-inch- (914-mm-)** wide courses lapping previous courses **19 inches (483 mm)** in shingle fashion.
 - c. Lap ends a minimum of **6 inches (152 mm)**.
 - d. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 - e. Fasten with underlayment nails.
 - f. Apply a continuous layer of asphalt roofing cement over starter course and on roll-surface to be concealed by succeeding courses as each roll-roofing course is installed. Apply **[over entire roof][at locations indicated on Drawings]**.
4. Install fasteners in a grid pattern of **12 inches (305 mm)** between side laps with **6-inch (152-mm)** spacing at side and end laps.
5. Install roll roofing over areas protected by self-adhering, polymer-modified bitumen sheet.
6. Terminate roll roofing **[flush][extended up not less than 4 inches (102 mm)]<Insert requirements>** against sidewalls, curbs, chimneys, and other roof projections.
- D. Synthetic-Underlayment Top Layer: Install in accordance with manufacturer's written installation instructions and as second layer over anchor-layer underlayment.
 1. Completely cover anchor-layer underlayment and install parallel with and starting at the eaves, with side laps offset halfway between side laps of underlying anchor layer.
 2. Lap sides and ends as recommended in writing by manufacturer, but not less than **[2 inches (51 mm)][4 inches (102 mm)]** for side laps and **6 inches (152 mm)** for end laps.
 3. Stagger end laps from anchor-layer end laps and between succeeding top courses at interval recommended in writing by manufacturer, but not less than **72 inches (1829 mm)**.
 4. Fasten with underlayment nails.
 5. Install fasteners in a grid pattern of **12 inches (305 mm)** between side laps with **6-inch (152-mm)** spacing at side and end laps.
- E. Polymer-Modified Bitumen Sheet: Install parallel with and starting at eaves.
 1. Single- or Anchor-Layer Installation: Install on roof deck.
 - a. Lap sides a minimum of **[2 inches (51 mm)][4 inches (102 mm)]** over underlying course.
 - b. Lap ends a minimum of **6 inches (152 mm)**.
 - c. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 - d. Fasten with underlayment nails.
 2. Top-Layer Installation: Install as a second layer over anchor-layer underlayment, with side laps offset halfway between side laps of underlying anchor layer.
 - a. Lap sides a minimum of **[2 inches (51 mm)][4 inches (102 mm)]**.
 - b. Lap ends a minimum of **6 inches (152 mm)**.
 - c. Stagger end laps from anchor-layer end laps and between succeeding top-layer courses at least **72 inches (1829 mm)**.
 - d. **[Fasten with underlayment nails][Adhere to anchor layer in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature][Adhere to anchor layer in uniform coating of cold-applied adhesive]**.

3. Double-Layer Installation: Install on roof deck in overlapping layers with a half-width plus **1-inch- (25-mm-)** wide starter course at eaves completely covered by full-width second course.
 - a. Install succeeding courses lapping previous courses by a half-width plus **1 inch (25 mm)** in shingle fashion.
 - b. Lap ends a minimum of **6 inches (152 mm)**.
 - c. Stagger end laps between succeeding courses at least **72 inches (1829 mm)**.
 - d. Fasten with underlayment nails.
4. Install fasteners in a grid pattern of **12 inches (305 mm)** between side laps with **6-inch (152-mm)** spacing at side and end laps.
5. Install sheets over areas protected by self-adhering, polymer-modified bitumen sheet.
6. Terminate sheets **[flush][extended up not less than 4 inches (102 mm)]<Insert requirements>** against sidewalls, curbs, chimneys, and other roof projections.

F. Self-Adhering, Polymer-Modified Bitumen Sheet: Install, wrinkle free.

1. Comply with low-temperature installation restrictions of underlayment manufacturer.
2. Install lapped in direction that sheds water.
3. Lap sides not less than **4 inches (102 mm)**.
4. Lap ends not less than **6 inches (152 mm)**, staggered **24 inches (610 mm)** between succeeding courses.
5. Roll laps with roller.
6. Prime concrete, masonry, and metal surfaces to receive self-adhering, polymer-modified bitumen sheet.
7. Single-Layer Installation: Install over entire roof deck.
8. Top-Layer Installation: Install as second layer over anchor-layer underlayment.
 - a. Completely cover anchor-layer underlayment.
 - b. Offset side laps halfway between side laps of underlying anchor layer and offset end laps from those of underlying anchor layer at least **72 inches (1829 mm)**.
9. Water and Ice-Dam Protection Installation: Install on roof deck where indicated **[below][on Drawings]**.
 - a. Eaves: Extend from edges of eaves **[24 inches (610 mm)][36 inches (914 mm)]<Insert dimension>** beyond interior face of exterior wall.
 - b. Rakes: Extend from edges of rakes **[24 inches (610 mm)][36 inches (914 mm)]<Insert dimension>** beyond interior face of exterior wall.
 - c. Valleys: Extend from lowest to highest point **[18 inches (457 mm)]<Insert dimension>** on each side of centerline.
 - d. Hips: Extend **[18 inches (457 mm)]<Insert dimension>** on each side.
 - e. Ridges: Extend **[36 inches (914 mm)]<Insert dimension>** on each side **[without obstructing continuous ridge vent slot]**.
 - f. Sidewalls: Extend **[18 inches (457 mm)]<Insert dimension>** beyond sidewalls and return vertically against sidewalls not less than **[4 inches (102 mm)]<Insert dimension>**.
 - g. Dormers, Chimneys, Skylights, and Other Roof-Penetrating Elements: Extend **[18 inches (457 mm)]<Insert dimension>** beyond penetrating elements and return vertically against penetrating elements not less than **[4 inches (102 mm)]<Insert dimension>**.
 - h. Roof-Slope Transitions: Extend **[18 inches (457 mm)]<Insert dimension>** on each roof slope.
10. Cover underlayment within seven days.

G. Valley Underlayment: Install one layer of **36-inch- (914-mm-)** wide underlayment centered in valley,

running full length of valley, and on top of underlayment on field of roof that is woven through valley. Install all layers of underlayment in and through valley tight with no bridging.

1. Use [same underlayment as installed on field of roof]<Insert requirements>.
2. Lap ends at least **12 inches (305 mm)** in direction that sheds water, and seal with asphalt roofing cement.
3. Fasten to roof deck with underlayment nails located as far from valley center as possible and only to extent necessary to hold underlayment in place until installation of valley flashing.
4. Solidly cement valley underlayment to roof-field underlayment that is woven through valley using asphalt roofing cement.

3.3 INSTALLATION OF RIDGE VENTS

- A. Rigid-Plastic Ridge Vents: Install continuous ridge vents over concrete roof tiles in accordance with manufacturer's written instructions. Fasten with nails of sufficient length to penetrate substrate.
- B. Flexible Ridge Vent: Install continuous-roll ridge vents over concrete roof tiles in accordance with manufacturer's written instructions.

3.4 INSTALLATION OF SHEET METAL FLASHING AND TRIM

- A. Install sheet metal flashings and trim to comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
 1. Install metal flashings in accordance with concrete-roof-tile manufacturer's written instructions and recommendations in NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems."
- B. Apron Flashings: Extend lower flange over and beyond each side of downslope tile roofing and up the vertical surface.
- C. Step Flashings: Install with a headlap of **4 inches (102 mm)** and extend both horizontally and vertically. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying tile. Fasten to roof deck only.
- D. Cricket and Backer Flashings: Install against roof-penetrating elements, extending concealed flange beneath upslope tile roofing and beyond each side.
- E. Channel Flashings: Install over underlayment materials and fasten to roof deck.
- F. Rake Pan Flashings: Install over underlayment materials and fasten to roof deck.
- G. Counterflashings: Coordinate with installation of base flashing and fit tightly to base flashing. Lap joints a minimum of **4 inches (102 mm)** secured in a waterproof manner.
 1. Install in reglets or receivers.
- H. Valley Flashings: Install centered in valleys, lapping ends at least [**8 inches (203 mm)**]<Insert dimension> in direction that sheds water. Fasten upper end of each length to roof deck beneath overlap.
 1. Secure hemmed flange edges into metal cleats spaced [**12 inches (305 mm)**][**24 inches (610 mm)**]<Insert dimension> apart and fastened to roof deck.
 2. Adhere minimum [**9-inch- (229-mm-)**]<Insert dimension> wide strips of self-adhering, polymer-

modified bitumen sheet to metal flanges and to **[underlying self-adhering, polymer-modified bitumen sheet]**<Insert requirements>. Place strips parallel to and over flanges so that they will be just concealed by installed tile.

3. Provide a closure at the end of the inverted-V profile of the valley metal to minimize water and ice infiltration.

- I. Rake Drip Edges: Install over underlayment materials and fasten to roof deck.
- J. Eave Drip Edges: Install below underlayment materials and fasten to roof deck.
- K. Sheet Metal Ridge Vents: Install centered on and mechanically fasten to wood ridge. Adhere each side to concrete roof tile with elastomeric sealant.
 1. Install fabric mesh over roof-deck air ventilation gaps to prevent insect entry.
- L. Pipe Flashings: Form flashing around pipe penetrations and tile roofing. Fasten and seal to tile roofing.

3.5 INSTALLATION OF WOOD NAILERS

- A. Install wood nailers securely fastened to roof deck at the following locations:
 1. Hips.
 2. Ridges.
 3. Rakes.
- B. Install beveled wood-cant nailers at eaves and securely fasten to roof deck.
- C. Install nominal **1-by-2-inch (25-by-51-mm)** wood-batten nailers horizontally [**over 1/2-inch- (13-mm-) high, pressure-preservative-treated wood lath strips**][**in 48-inch (1219-mm) lengths with ends separated by 1/2 inch (13 mm)**], at spacing required by concrete-roof-tile manufacturer, and securely fasten to roof deck.
 1. Install nominal **1-by-2-inch (25-by-51-mm)** wood counter battens vertically spaced [**24 inches (610 mm)**]<Insert dimension> apart and securely fasten to roof deck.

3.6 INSTALLATION OF CONCRETE ROOF TILES

- A. Install concrete roof tiles in accordance with manufacturer's written instructions and recommendations in TRI/WSRCA's "Concrete and Clay Roof Tile Installation Manual" and NRCA's "The NRCA Roofing Manual: Steep-Slope Roof Systems" unless more stringent requirements are specified in this Section or indicated on Drawings.
 1. Install tiles to resist wind forces resulting from design wind speeds indicated on Drawings.
 2. Maintain uniform exposure and coursing of concrete roof tiles throughout roof.
 3. Extend tiles **2 inches (51 mm)** over eave fasciae.
 4. Nail Fastening: Drive nails to clear the concrete roof tile so the tile hangs from the nail and is not drawn up.
 - a. Install wire through nail holes of cut tiles that cannot be nailed directly to roof deck, and fasten to nails driven into deck.
 5. Wire-Tie Fastening: Install wire-tie systems and fasten concrete roof tiles in accordance with

- manufacturer's written instructions.
6. Mortar Setting: Install concrete roof tiles in accordance with manufacturer's written instructions and acceptance criteria of authorities having jurisdiction.
 7. Foam-Adhesive Setting: Install concrete roof tiles in accordance with adhesive and tile manufacturers' written instructions and acceptance criteria of authorities having jurisdiction.
 8. Storm Clips: Install to capture edges of longitudinal sides of concrete roof tiles and securely fasten to roof deck.
 9. Tile Locks: Install to support and lock overlying tile butts to underlying tiles.
 10. Cut and fit concrete roof tiles neatly around roof vents, pipes, ventilators, and other projections through roof. Fill voids with mortar.
 11. Install concrete roof tiles with color blend approved by Architect.
- B. Low-Profile, Flat-Shingle Concrete-Roof-Tile Installation:
1. Maintain **2-inch (51-mm)** headlap between succeeding courses of concrete roof tiles.
 2. Offset joints by half the concrete-roof-tile width in succeeding courses.
 3. Extend concrete roof tiles **1 inch (25 mm)** over fasciae at rakes.
 4. Install ridge tiles in **[V-ridge][saddle][mitered]** configuration with laps facing away from prevailing wind. Seal laps with **[asphalt roofing cement][butyl sealant][elastomeric sealant]**.
 - a. Close voids where ridge tiles meet concrete roof tiles with **[ridge closure][mortar struck with face of ridge cover]** tiles.
 5. Install hip tiles in **[V-ridge][saddle][mitered]** configuration. Seal laps with **[asphalt roofing cement][butyl sealant][elastomeric sealant]**.
 - a. Fill voids with mortar where hip tiles meet concrete roof tiles, and strike mortar flush with face of hip cover tiles.
- C. Low-Profile, Flat Interlocking Concrete-Roof-Tile Installation:
1. Provide minimum **3-inch (76-mm)** lap between succeeding courses of concrete roof tiles.
 2. Offset joints by half the concrete-roof-tile width in succeeding courses.
 3. Install L-shaped rake tiles.
 4. Install ridge tiles in **[V-ridge][saddle][mitered]** configuration with laps facing away from prevailing wind. Seal laps with **[asphalt roofing cement][butyl sealant][elastomeric sealant]**.
 - a. Close voids where ridge tiles meet concrete roof tiles with **[ridge closure][mortar struck with face of ridge cover]** tiles.
 5. Install hip tiles in **[V-ridge][saddle][mitered]** configuration. Seal laps with **[asphalt roofing cement][butyl sealant][elastomeric sealant]**.
 - a. Fill voids with mortar where hip tiles meet concrete roof tiles, and strike mortar flush with face of hip cover tiles.
- D. Medium-Profile, Interlocking Concrete-Roof-Tile Installation:
1. Provide minimum **3-inch (76-mm)** lap between succeeding courses of concrete roof tiles.
 2. Install rake tiles indicated.
 3. Install ridge tiles with laps facing away from prevailing wind. Seal laps with **[asphalt roofing cement][butyl sealant][elastomeric sealant]**.
- E. High-Profile Concrete-Roof-Tile Installation:
1. Install **[tile][sheet metal][EPDM]** eave closure.

2. Provide minimum **3-inch (76-mm)** lap between succeeding courses of concrete roof tiles.
3. Install rake tiles indicated.
4. Install ridge tiles with laps facing away from prevailing wind. Seal laps with **[asphalt roofing cement][butyl sealant][elastomeric sealant]**.

F. Open Valleys: Cut concrete roof tiles at open valleys to form straight lines. **[Maintain uniform width of exposed open valley][Widen exposed portion of open valley 1/8 inch in 12 inches (1:96)]** from highest to lowest point.

1. Drill or notch cut valley tiles and wire-tie to fastener placed clear of valley metal flashings.
2. Do not nail tiles to metal flashings.

G. Closed Valleys: Cut concrete roof tiles at closed valleys to form straight lines, trimming upper concealed corners of tiles. Maintain uniform gap of **[1/2 to 3/4 inch (13 to 19 mm)][3/4 to 1 inch (19 to 25 mm)]**<Insert dimension> on either side of water diverter at valley centerline.

1. Drill or notch cut valley tiles and wire-tie to fastener placed clear of valley metal flashings.
2. Do not nail tiles to metal flashings.

H. Remove and replace damaged or broken concrete roof tiles.

3.7 ROOFING SYSTEM INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing System Installer," has performed roofing and associated Work on the following Project:

1. Owner: <Insert name of Owner>.
2. Owner Address: <Insert address>.
3. Building Name/Type: <Insert information>.
4. Building Address: <Insert address>.
5. Area of the Work: <Insert information>.
6. Warranty Period: **[Two][Five]**<Insert number> years from date of Substantial Completion.
7. Date of Substantial Completion: _____.

B. AND WHEREAS Roofing System Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said Work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing System Installer hereby warrants, subject to terms and conditions herein set forth, that, during Warranty Period, Roofing System Installer will, at Roofing System Installer's own cost and expense, make or cause to be made such repairs to or replacements of said Work as are necessary to correct faulty and defective work and as are necessary to maintain said Work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to the work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding <Insert mph (m/s)>;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;

- e. faulty construction of copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the Work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
- 2. When the Work has been damaged by any of foregoing causes, Warranty becomes null and void until such damage has been repaired by Roofing System Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 - 3. Roofing System Installer is responsible for damage to the Work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of the Work.
 - 4. During Warranty Period, if Owner allows alteration of the Work by anyone other than Roofing System Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty becomes null and void on date of the alterations, but only to the extent the alterations affect the Work covered by this Warranty. If Owner engages Roofing System Installer to perform the alterations, Warranty does not become null and void unless Roofing System Installer, before starting the alterations, has notified Owner in writing, showing reasonable cause for claim, that the alterations would likely damage or deteriorate the Work, thereby reasonably justifying a limitation or termination of this Warranty.
 - 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a use or service more severe than originally specified, this Warranty becomes null and void on date of the change, but only to the extent the change affects the Work covered by this Warranty.
 - 6. Owner to promptly notify Roofing System Installer of observed, known, or suspected leaks, defects, or deterioration and affords reasonable opportunity for Roofing System Installer to inspect the Work and to examine evidence of such leaks, defects, or deterioration.
 - 7. This Warranty is recognized to be the only warranty of Roofing System Installer on said Work and does not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty does not operate to relieve Roofing System Installer of responsibility for performance of the Work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

- 1. Authorized Signature: _____.
- 2. Name: _____.
- 3. Title: _____.

END OF SECTION 07 32 16 00



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07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 34 00 00	07 31 13 00	Asphalt Shingles
07 34 00 00	07 31 16 00	Metal Shingles
07 34 00 00	07 31 26 00	Slate Shingles
07 34 00 00	07 31 29 00	Wood Shingles And Shakes
07 34 00 00	07 32 13 00	Clay Roof Tiles



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SECTION 07 41 13 00 - FORMED METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Corrugated-profile, exposed-fastener metal roof panels.
2. Tapered-rib-profile, exposed-fastener metal roof panels.
3. Vee-rib-profile, exposed-fastener metal roof panels.
4. Box-rib-profile, exposed-fastener metal roof panels.
5. Deep-box-rib-profile, exposed-fastener metal roof panels.
6. Horizontal-seam (Bermuda-type) metal roof panels.
7. Substrate board.
8. Vapor retarder.
9. Roof insulation.
10. Cover board.
11. Underlayment.

B. Related Requirements:

1. Section 074293 "Soffit Panels" for metal panels used in horizontal soffit applications.
2. Section 077253 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface, allowing it to melt and drain off slowly.

1.2 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal roof panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal roof panel Installer, metal roof panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal roof panels, including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal roof panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review structural loading limitations of supporting structure during and after roofing.
6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other

- construction that affect metal roof panels.
7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
8. Review temporary protection requirements for metal roof panel systems during and after installation.
9. Review procedures for repair of metal roof panels damaged after installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 1. Include fabrication and installation layouts of metal roof panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than **1-1/2 inches per 12 inches (1:10)**.
- C. Samples for Initial Selection: Manufacturer's standard color charts, showing full range of available colors for each type of exposed finish.
 1. Include similar Samples of trim and accessories involving color selection.
- D. Samples for Verification: Actual sample of finished products for each type of exposed finish for metal roof panels, clips, fasteners, closures, and other metal panel accessories.
 1. Size: **[Manufacturers' standard size]<Insert size>**.
- E. Sustainable Design Submittals:
 1. Recycled Content: Provide manufacturer documentation for recycled content, indicating postconsumer and preconsumer recycled content.
 2. Verify adhesives and sealants comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Other Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Nonmembrane Roof Sealants: 300 g/L.
 - j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - k. Sealant Primers for Porous Substrates: 775 g/L.
 3. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.

1.5 INFORMATIONAL SUBMITTALS

- A. Certificates for portable roll-forming equipment.
- B. Product Test Reports: For formed metal roof panels, for tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Qualification Statements: For roof installers.
- E. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal roof panels.

1.7 QUALITY ASSURANCE

- A. Roof Installer Qualifications: Entity that employs **[a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified Metal Panel Roof Systems Installers][a supervisor who is an NRCA ProCertified Roofing Foreman][a supervisor who is an NRCA ProCertified Roofing Foreman and not less than 20 percent of installers who are NRCA ProCertified Metal Panel Roof Systems Installers]**.
- B. Portable Roll-Forming Equipment Certification: UL-certified, portable roll-forming equipment capable of producing metal roof panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of Work.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof area and eave[, **including fascia,][and soffit]** as shown on Drawings; approximately **[48 inches (1200 mm)][12 ft. (3.5 m)]<Insert dimension>** square by full thickness, including attachments, underlayment, and accessories.
 - 2. Build mockups for typical roof area only, including accessories.
 - a. Size: **[12 ft. (3.5 m) long by 6 ft. (1.75 m)]<Insert dimension>**.
 - b. **[Each type of exposed seam and seam termination]<Insert mockup item>**.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations in by Change Order.
 - 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.

- B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal roof panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness, with positive slope for drainage of water. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal roof panels during installation.
- E. Copper Roof Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal roof panels to be performed in accordance with manufacturers' written installation instructions and warranty requirements.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal roof panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: **[20][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal roof panel systems capable of withstanding the effects of the following loads when tested in accordance with ASTM E1592:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: **[As indicated on Drawings]<Insert loads>**.

3. Deflection Limits: For wind loads, no greater than [1/180][1/240]<Insert deflection> of the span.
 4. <Insert other performance requirements>.
- B. Air Infiltration: Air leakage of not more than [0.04 cfm/sq. ft. (0.2 L/s per sq. m)][0.06 cfm/sq. ft. (0.3 L/s per sq. m)]<Insert value> when tested in accordance with ASTM E1680[or ASTM E283/E283M] at the following test-pressure difference:
1. Test-Pressure Difference: [1.57 lbf/sq. ft. (75 Pa)][6.24 lbf/sq. ft. (300 Pa)].
- C. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E1646[or ASTM E331] at the following test-pressure difference:
1. Test-Pressure Difference: [2.86 lbf/sq. ft. (137 Pa)][6.24 lbf/sq. ft. (300 Pa)].
- D. Watertightness: No water penetration when tested in accordance with ASTM E2140 for hydrostatic-head resistance.
- E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
1. Uplift Rating: [UL 30][UL 60][UL 90].
- F. FM Approvals Listing: Provide metal roof panels and component materials that comply with requirements in FM Approvals 4471 as part of a metal panel roofing system and that are listed in FM's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.
1. Fire/Windstorm Classification: Class 1A-[60][75][90][105][120]<Insert number>.
 2. Hail Resistance: [MH][SH].
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: [120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature range>.
- H. Energy Performance:
1. Provide metal roof panels meeting one of the following requirements when tested in accordance with CRRC-1:
 - a. Three-year, aged solar reflectance of not less than [0.55]<Insert value> and emissivity of not less than [0.75]<Insert value>.
 - b. Three-year, aged Solar Reflectance Index (SRI) of not less than [64]<Insert value> when calculated in accordance with ASTM E1980.
- 2.2 EXPOSED-FASTENER METAL ROOF PANELS, GENERAL
- A. Provide factory-formed metal roof panels designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners. Include all accessories required for weathertight installation.
- B. Recycled Content: Provide manufacturer documentation for recycled content, indicating postconsumer and preconsumer recycled content.

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- C. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][32]** or initial SRI not less than **[82][39]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- D. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][25]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- E. Solar Reflectance Index (SRI): Not less than **[78][29]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.

2.3 CORRUGATED-PROFILE, EXPOSED-FASTENER METAL ROOF PANELS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

1. **[AEP Span a brand of ASC Profiles LLC, a part of BlueScope]**
2. **[Berridge Manufacturing Company]**
3. **[CENTRIA, a Nucor Brand]**
4. **[Fabral; a brand of Flack Global Metals]**
5. **[Flexospan Steel Buildings, Inc]**
6. **[MBCI; Cornerstone Building Brands]**
7. **[McElroy Metal, Inc]**
8. **[Metal Sales Manufacturing Corporation]**
9. **[Morin - A Kingspan Group Company]**
10. **[Union Corrugating Company; Cornerstone Building Brands]**
11. **<Insert manufacturer's name>**

- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

1. **[AEP Span a brand of ASC Profiles LLC, a part of BlueScope]**
2. **[Berridge Manufacturing Company]**
3. **[CENTRIA, a Nucor Brand]**
4. **[Fabral; a brand of Flack Global Metals]**
5. **[Flexospan Steel Buildings, Inc]**
6. **[MBCI; Cornerstone Building Brands]**
7. **[McElroy Metal, Inc]**
8. **[Metal Sales Manufacturing Corporation]**
9. **[Morin - A Kingspan Group Company]**
10. **[Union Corrugating Company; Cornerstone Building Brands]**
11. **<Insert manufacturer's name>**

- C. Metal Roof Panels: Formed with alternating curved ribs.

1. Structural Support: Over **[solid deck][open framing]**.
2. Material: **[Metallic-coated steel][Aluminum][Stainless steel][Copper]**.
3. Rib Spacing: **[2.67 inches (68 mm)]<Insert dimension>** o.c. across width of panel.
4. Panel Coverage: **[21.3 inches (541 mm)][29.3 inches (744 mm)][34.67 inches (881 mm)][37.3 inches (947 mm)][42.67 inches (1084 mm)][45.3 inches (1151 mm)]<Insert dimension>**.
5. Panel Height: **[0.5 inch (13 mm)][0.875 inch (22 mm)]<Insert dimension>**.
6. Fasteners: Manufacturer's standard screw fasteners.

2.4 TAPERED-RIB-PROFILE, EXPOSED-FASTENER METAL ROOF PANELS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[AEP Span a brand of ASC Profiles LLC, a part of BlueScope]**
 2. **[Architectural Metal Systems]**
 3. **[Berridge Manufacturing Company]**
 4. **[Butler Manufacturing Company; a division of BlueScope Buildings North America, Inc.]**
 5. **[CENTRIA, a Nucor Brand]**
 6. **[Everlast Metals]**
 7. **[Fabral; a brand of Flack Global Metals]**
 8. **[Flexospan Steel Buildings, Inc]**
 9. **[MBCI; Cornerstone Building Brands]**
 10. **[McElroy Metal, Inc]**
 11. **[Metal Sales Manufacturing Corporation]**
 12. **[Morin - A Kingspan Group Company]**
 13. **[PAC-CLAD; Petersen; a Carlisle company]**
 14. **[Union Corrugating Company; Cornerstone Building Brands]**
 15. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[AEP Span a brand of ASC Profiles LLC, a part of BlueScope]**
 2. **[Architectural Metal Systems]**
 3. **[Berridge Manufacturing Company]**
 4. **[Butler Manufacturing Company; a division of BlueScope Buildings North America, Inc.]**
 5. **[CENTRIA, a Nucor Brand]**
 6. **[Everlast Metals]**
 7. **[Fabral; a brand of Flack Global Metals]**
 8. **[Flexospan Steel Buildings, Inc]**
 9. **[MBCI; Cornerstone Building Brands]**
 10. **[McElroy Metal, Inc]**
 11. **[Metal Sales Manufacturing Corporation]**
 12. **[Morin - A Kingspan Group Company]**
 13. **[PAC-CLAD; Petersen; a Carlisle company]**
 14. **[Union Corrugating Company; Cornerstone Building Brands]**
 15. **<Insert manufacturer's name>**
- C. Metal Roof Panels: Formed with raised, trapezoidal ribs spaced at regular intervals.
1. Structural Support: Over **[solid deck][open framing]**.
 2. Material: **[Metallic-coated steel][Aluminum][Stainless steel][Copper]**.
 3. Panel Profile: **[Intermediate stiffening ribs, symmetrically spaced][Flat pan]** between major ribs.
 4. Rib Spacing: **[6 inches (152 mm)][8 inches (203 mm)][9 inches (229 mm)][12 inches (305 mm)]<Insert dimension> o.c.**
 5. Panel Coverage: **[24 inches (610 mm)][36 inches (914 mm)]<Insert dimension>**.
 6. Panel Height: **[0.625 inch (16 mm)][0.75 inch (19 mm)][1 inch (25 mm)][1.25 inches (32 mm)][1.5 inches (38 mm)]<Insert dimension>**.
 7. Fasteners: Manufacturer's standard screw fasteners.

2.5 VEE-RIB-PROFILE, EXPOSED-FASTENER METAL ROOF PANELS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[AEP Span a brand of ASC Profiles LLC, a part of BlueScope]**
 2. **[Berridge Manufacturing Company]**
 3. **[CENTRIA, a Nucor Brand]**
 4. **[Fabral; a brand of Flack Global Metals]**
 5. **[Flexospan Steel Buildings, Inc]**
 6. **[MBCI; Cornerstone Building Brands]**
 7. **[Metal Sales Manufacturing Corporation]**
 8. **[Morin - A Kingspan Group Company]**
 9. **[PAC-CLAD; Petersen; a Carlisle company]**
 10. **[Sentrigard; NB Handy Company]**
 11. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[AEP Span a brand of ASC Profiles LLC, a part of BlueScope]**
 2. **[Berridge Manufacturing Company]**
 3. **[CENTRIA, a Nucor Brand]**
 4. **[Fabral; a brand of Flack Global Metals]**
 5. **[Flexospan Steel Buildings, Inc]**
 6. **[MBCI; Cornerstone Building Brands]**
 7. **[Metal Sales Manufacturing Corporation]**
 8. **[Morin - A Kingspan Group Company]**
 9. **[PAC-CLAD; Petersen; a Carlisle company]**
 10. **[Sentrigard; NB Handy Company]**
 11. **<Insert manufacturer's name>**
- C. Metal Roof Panels: Formed with raised, V-shaped ribs and recesses that are approximately same size, evenly spaced across panel width, and with rib/recess sides angled at approximately 45 degrees.
1. Structural Support: Over **[solid deck][open framing]**.
 2. Material: **[Metallic-coated steel][Aluminum][Stainless steel][Copper]**.
 3. Rib Spacing: **[5.3 inches (135 mm)][7.2 inches (183 mm)][12 inches (305 mm)]<Insert dimension>**.
 4. Panel Coverage: **[30 inches (762 mm)][32 inches (813 mm)][36 inches (914 mm)][40 inches (1016 mm)]<Insert dimension>**.
 5. Panel Height: **[1.375 inches (35 mm)][1.5 inches (38 mm)][1.75 inches (44 mm)][2 inches (50 mm)][3 inches (75 mm)]<Insert dimension>**.

2.6 BOX-RIB-PROFILE, EXPOSED-FASTENER METAL ROOF PANELS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[Berridge Manufacturing Company]**
 2. **[Fabral; a brand of Flack Global Metals]**
 3. **[MBCI; Cornerstone Building Brands]**

4. [Metal Sales & Service, Inc.]
5. [Metal Sales Manufacturing Corporation]
6. <Insert manufacturer's name>

B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [Berridge Manufacturing Company]
2. [Fabral; a brand of Flack Global Metals]
3. [MBCI; Cornerstone Building Brands]
4. [Metal Sales & Service, Inc.]
5. [Metal Sales Manufacturing Corporation]
6. <Insert manufacturer's name>

C. Metal Roof Panels: Formed with raised, box-shaped ribs that are wider than recesses, evenly spaced across panel width, and with rib/recess sides angled 60 degrees or more.

1. Structural Support: Over [solid deck][open framing].
2. Material: [Metallic-coated steel][Aluminum][Stainless steel][Copper].
3. Rib Spacing: [2.67 inches (68 mm)][4 inches (102 mm)][5.3 inches (135 mm)][6 inches (152 mm)]<Insert dimension> o.c.
4. Panel Coverage: [24 inches (610 mm)][28 inches (711 mm)][30 inches (762 mm)][32 inches (813 mm)][36 inches (914 mm)]<Insert dimension>.
5. Panel Height: [0.625 inch (16 mm)][1 inch (25 mm)][1.5 inches (38 mm)][2 inches (50 mm)]<Insert dimension>.

2.7 DEEP-BOX-RIB-PROFILE, EXPOSED-FASTENER METAL ROOF PANELS

A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. [CENTRIA, a Nucor Brand]
2. [Fabral; a brand of Flack Global Metals]
3. [MBCI; Cornerstone Building Brands]
4. [Metal Sales & Service, Inc.]
5. [Metal Sales Manufacturing Corporation]
6. [Morin - A Kingspan Group Company]
7. <Insert manufacturer's name>

B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [CENTRIA, a Nucor Brand]
2. [Fabral; a brand of Flack Global Metals]
3. [MBCI; Cornerstone Building Brands]
4. [Metal Sales & Service, Inc.]
5. [Metal Sales Manufacturing Corporation]
6. [Morin - A Kingspan Group Company]
7. <Insert manufacturer's name>

C. Metal Roof Panels: Formed with raised, box-shaped ribs that are wider than recesses, evenly spaced across panel width, and with rib/recess sides angled more than 60 degrees.

1. Structural Support: Over [solid deck][open framing].

2. Material: **[Metallic-coated steel][Aluminum][Stainless steel][Copper]**.
3. Rib Spacing: **[12 inches (305 mm)]<Insert dimension>** o.c.
4. Panel Coverage: **[24 inches (610 mm)]<Insert dimension>**.
5. Panel Height: **[3 inches (75 mm)][4 inches (102 mm)]<Insert dimension>**.

2.8 HORIZONTAL-SEAM (BERMUDA-TYPE) METAL ROOF PANELS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 1. **[Berridge Manufacturing Company]**
 2. **[Drexel Metals Corp.]**
 3. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 1. **[Berridge Manufacturing Company]**
 2. **[Drexel Metals Corp.]**
 3. **<Insert manufacturer's name>**
- C. Metal Roof Panels: Formed with horizontal seam at panel edges and smooth, flat pan; designed to be installed in sequential installation by engaging lower edge of each panel to upper edge of panel below and mechanically attaching panels to supports using concealed clips located under upper edge of panels.
 1. Structural Support: Over **[solid deck][open framing]**.
 2. Material: **[Metallic-coated steel][Aluminum][Stainless steel][Copper]**.
 3. Exposure: **[9.5 inches (241 mm)][11 inches (279 mm)]<Insert dimension>** nominal.
 4. Seam Height: **[1 inch (25 mm)][1.5 inches (38 mm)]<Insert dimension>**.
 5. Seal: Factory-applied sealant or vinyl weatherseal in seam.
 6. Clips: One piece.
 - a. **0.028-inch- (0.71-mm-) nominal thickness, [zinc-coated (galvanized)][or][aluminum-zinc alloy-coated]** steel sheet.
 - b. **0.025-inch- (0.64-mm-) thick, stainless steel sheet.**

2.9 METAL ROOF PANEL MATERIAL

- A. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with minimum ASTM A653/A653M, **G90 (Z275)** coating designation, or aluminum-zinc alloy-coated steel sheet complying with minimum ASTM A792/A792M, **Class AZ50 (Class AZM150)** coating designation; structural quality. Sheet prepainted by coil-coating process to comply with ASTM A755/A755M.
 1. Nominal Thickness: **[0.022 inch (0.56 mm)][0.028 inch (0.71 mm)][0.034 inch (0.86 mm)][0.040 inch (1.02 mm)][0.052 inch (1.32 mm)]**.
 2. Surface: **[Smooth, flat][Embossed]** texture.
 3. Exterior Finish: **[Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester]<Insert finish>**.
 4. Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>**.

- B. Aluminum Sheet: Coil-coated sheet, ASTM B209/B209M, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
1. Thickness: [0.032 inch (0.81 mm)][0.040 inch (1.02 mm)].
 2. Surface: [Smooth, flat][Embossed] texture.
 3. Exterior Finish: [Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester][Clear anodized][Color anodized]<Insert finish>.
 4. Color: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.
- C. Stainless Steel Sheet: ASTM A240/A240M, [Type 304][Type 316], fully annealed.
1. Nominal Thickness: [0.0188 inch (0.477 mm)][0.0250 inch (0.635 mm)][0.0313 inch (0.795 mm)][0.0375 inch (0.952 mm)][0.0500 inch (1.270 mm)].
 2. Exterior Finish: [Polished][Bright, cold-rolled, unpolished]<Insert finish>.
- D. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 temper.
1. Thickness: [16 oz./sq. ft. (0.55 mm)][20 oz./sq. ft. (0.68 mm)].
 2. Exposed Finish: [Mill][Prepatinated].
 3. Prepatinated Color: [Dark brown][Verdigris]<Insert color>.

2.10 SUBSTRATE BOARD

- A. Glass-Mat Gypsum Roof Substrate Board: ASTM C1177/C1177M, water-resistant gypsum board.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [CertainTeed; SAINT-GOBAIN]
 - b. [Georgia-Pacific Gypsum LLC]
 - c. [Gold Bond Building Products, LLC provided by National Gypsum Company]
 - d. [USG Corporation]
 - e. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [CertainTeed; SAINT-GOBAIN]
 - b. [Georgia-Pacific Gypsum LLC]
 - c. [Gold Bond Building Products, LLC provided by National Gypsum Company]
 - d. [USG Corporation]
 - e. <Insert manufacturer's name>
 3. Thickness: [1/4 inch (6 mm)][1/2 inch (13 mm)][Type X, 5/8 inch (16 mm)].
 4. Surface Finish: [Factory primed][Unprimed].
- B. Fiber-Reinforced Gypsum Roof Board: ASTM C1278/C1278M, cellulosic-fiber-reinforced, water-resistant gypsum board.
1. Thickness: [1/4 inch (6 mm)][3/8 inch (10 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)].

- C. Perlite Board: ASTM C728, seal coated.
 - 1. Thickness: **[3/4 inch (19 mm)][1 inch (25 mm)]**.
- D. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions for fastening substrate board to roof deck.

2.11 VAPOR RETARDER

- A. Rubberized-Asphalt-Sheet Vapor Retarder, Self-Adhering: ASTM D1970/D1970M polyethylene film laminated to layer of rubberized asphalt adhesive, minimum **40-mil (1.0-mm)** total thickness; maximum permeance rating of **0.1 perm (6 ng/Pa x s x sq. m)**; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
- B. Butyl Rubber Sheet Vapor Retarder, Self-Adhering: Polyethylene film laminated to layer of butyl rubber adhesive, minimum **30-mil (0.76-mm)** total thickness; maximum permeance rating of **0.1 perm (6 ng/Pa x s x sq. m)**; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
- C. Laminated Sheet Vapor Retarder: Two layers, fire-retardant polyethylene laminate, reinforced with cord grid.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Reef Industries, Inc.]**
 - b. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Reef Industries, Inc.]**
 - b. **<Insert manufacturer's name>**
 - 3. Permeance Rating: Not more than **0.062 perm (3.556 ng/Pa x s x sq. m)** when tested in accordance with ASTM E96/E96M.
 - 4. Flame-Spread Index: Not more than 5 when tested in accordance with ASTM E84.
 - 5. Smoke-Developed Index: Not more than 35 when tested in accordance with ASTM E84.
 - 6. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.12 ROOF INSULATION

- A. Insulation Over Solid Deck:
 - 1. Polyisocyanurate Board Insulation: ASTM C1289, Type II, **[Class 1 felt facer][Class 2 coated glass-fiber facer][Class 3 uncoated glass-fiber facer]** on both major surfaces.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the**

following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- 1) [Atlas Polyiso Roof and Wall Insulation]
- 2) [Carlisle Syntec Systems]
- 3) [CertainTeed; SAINT-GOBAIN]
- 4) [Elevate; Holcim Building Envelope]
- 5) [GAF]
- 6) [Hunter Panels; a Carlisle company]
- 7) [IKO Industries Inc.]
- 8) [Insulfoam; a Carlisle Company]
- 9) [Johns Manville; a Berkshire Hathaway company]
- 10) [Kingspan Insulation LLC]
- 11) [Polyglass U.S.A., Inc.]
- 12) [Rmax, A Business Unit of Sika Corporation]
- 13) <Insert manufacturer's name>

- b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- 1) [Atlas Polyiso Roof and Wall Insulation]
- 2) [Carlisle Syntec Systems]
- 3) [CertainTeed; SAINT-GOBAIN]
- 4) [Elevate; Holcim Building Envelope]
- 5) [GAF]
- 6) [Hunter Panels; a Carlisle company]
- 7) [IKO Industries Inc.]
- 8) [Insulfoam; a Carlisle Company]
- 9) [Johns Manville; a Berkshire Hathaway company]
- 10) [Kingspan Insulation LLC]
- 11) [Polyglass U.S.A., Inc.]
- 12) [Rmax, A Business Unit of Sika Corporation]
- 13) <Insert manufacturer's name>

- c. Compressive Strength: [Grade 2, 20 psi (138 kPa)][Grade 3, 25 psi (172 kPa)].
d. Size: [48 by 48 inches (1219 by 1219 mm)][48 by 96 inches (1219 by 2438 mm)].
e. Thickness:

- 1) Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.
- 2) Upper Layer: <Insert thickness>.

2. Composite Polyisocyanurate Board Insulation: ASTM C1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber-mat facer on the other surface.

- a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- 1) [Atlas Polyiso Roof and Wall Insulation]
- 2) [CertainTeed; SAINT-GOBAIN]
- 3) [Elevate; Holcim Building Envelope]
- 4) [GAF]

- 5) [Hunter Panels; a Carlisle company]
- 6) [Insulfoam; a Carlisle Company]
- 7) [Johns Manville; a Berkshire Hathaway company]
- 8) <Insert manufacturer's name>

b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- 1) [Atlas Polyiso Roof and Wall Insulation]
- 2) [CertainTeed; SAINT-GOBAIN]
- 3) [Elevate; Holcim Building Envelope]
- 4) [GAF]
- 5) [Hunter Panels; a Carlisle company]
- 6) [Insulfoam; a Carlisle Company]
- 7) [Johns Manville; a Berkshire Hathaway company]
- 8) <Insert manufacturer's name>

- c. Facer: [Type IV cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch (13 mm) thick][Type V oriented strand board facer, 7/16 inch (11 mm) thick][Type VII glass-mat-faced gypsum board facer, 1/4 inch (6 mm) thick]<Insert material>.
- d. Size: [48 by 48 inches (1219 by 1219 mm)][48 by 96 inches (1219 by 2438 mm)].
- e. Thickness: <Insert thickness>.

B. Insulation Over Open Framing:

1. Mineral-Fiber-Blanket Insulation: ASTM C665, type indicated below; consisting of fibers manufactured from glass, slag wool, or rock wool.
 - a. Nonreflective Faced: Type II (blankets with nonreflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
 - b. Reflective Faced: Type III (blankets with reflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
 - c. Unfaced: Type I (blankets without membrane covering), passing ASTM E136 for combustion characteristics.

2.13 COVER BOARD

- A. Cellulosic-Fiber Cover Board: ASTM C208, Type II, Grade 2, high-density cellulosic-fiber insulation board, having a minimum compressive strength of **40 psi (276 kPa)**.
 1. Thickness: [1/2 inch (13 mm)][1 inch (25 mm)]<Insert thickness>.
 2. Surface Finish: [Primed one side][Primed two sides with non-asphaltic primer][Integral coating, six sides][Unprimed]<Insert finish>.
- B. Oriented Strand Board: DOC PS 2, Exposure 1, **7/16 inch (11 mm)** thick.
- C. Fiber-Reinforced Cementitious Cover Board: ASTM C1325, fiber-mat-reinforced cementitious board.
 1. Thickness: [**7/16 inch (11 mm)**][1/2 inch (13 mm)][5/8 inch (16 mm)].
- D. High-Density Polyisocyanurate Cover Board: ASTM C1289 Type II, Class 4, Grade 1, **1/2 inch (13 mm)**

thick, with a minimum compressive strength of **80 psi (551 kPa)**.

2.14 UNDERLAYMENT

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of **30 mils (0.76 mm)** thick, specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer when recommended by underlayment manufacturer.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[ATAS International, Inc.]**
 - b. **[Carlisle WIP Products; a brand of Carlisle Construction Materials]**
 - c. **[GCP Applied Technologies Inc.]**
 - d. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - e. **[Owens Corning]**
 - f. **[Polyglass U.S.A., Inc.]**
 - g. **[Protecto Wrap Company]**
 - h. **[SDP Advanced Polymer Products Inc.]**
 - i. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ATAS International, Inc.]**
 - b. **[Carlisle WIP Products; a brand of Carlisle Construction Materials]**
 - c. **[GCP Applied Technologies Inc.]**
 - d. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - e. **[Owens Corning]**
 - f. **[Polyglass U.S.A., Inc.]**
 - g. **[Protecto Wrap Company]**
 - h. **[SDP Advanced Polymer Products Inc.]**
 - i. **<Insert manufacturer's name>**
 3. Thermal Stability: Stable after testing at **220 deg F (111 deg C)**; ASTM D1970/D1970M.
 4. Low-Temperature Flexibility: Passes after testing at **minus 20 deg F (minus 29 deg C)**; ASTM D1970/D1970M.
- B. Felt Underlayment: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felts.
- C. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.15 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645; cold-formed, metallic-coated steel sheet, minimum ASTM A653/A653M, **G90 (Z275)** hot-dip galvanized coating designation or ASTM A792/A792M, **Class AZ50 (Class AZM150)** aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal roof

panel system.

- B. Roof Panel Accessories: Provide components required for a complete, weathertight roof panel system, including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
 - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum **1-inch- (25-mm-)** thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal roof panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.
- D. Gutters: Formed from same material as metal roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum **96-inch- (2400-mm-)** long sections, of size and metal thickness in accordance with manufacturer's recommendations. Furnish gutter supports spaced a maximum of **36 inches (914 mm)** o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match **[metal roof panels][roof fascia and rake trim]**.
- E. Downspouts: Formed from same material as metal roof panels. Fabricate in **10-foot- (3-m-)** long sections, complete with formed elbows and offsets, of size and metal thickness in accordance with manufacturer's recommendations. Finish downspouts to match gutters.
- F. Roof Curbs: Fabricated from same material as metal roof panels, **[0.048-inch- (1.2-mm-)]<Insert dimension>** nominal thickness; with bottom of skirt profiled to match metal roof panel profiles and with welded top box and integral full-length cricket. Fabricate curb subframing of **0.060-inch- (1.52-mm-)** nominal thickness, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads of size and height indicated. Finish roof curbs to match metal roof panels.
 - 1. Insulate roof curb with **1-inch- (25-mm-)** thick, rigid insulation.
- G. Roof Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- H. Roof Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape **1/2 inch (13 mm)** wide and **1/8 inch (3 mm)** thick.
 - 2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
 - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.16 FABRICATION

- A. Fabricate and finish metal roof panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal roof panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate in accordance with equipment manufacturer's written instructions and to comply with details shown.
- C. Provide roof panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal roof panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with manufacturer's recommendations.
 - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal roof panel manufacturer.
 - a. Size: As recommended by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

2.17 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.
- C. Steel Roof Panels and Accessories:
 - 1. Two-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
 - 2. Three-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed

metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].

3. Mica Fluoropolymer: Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
4. Metallic Fluoropolymer: Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
5. FEVE Fluoropolymer: Two-coat fluoropolymer finish containing 100 percent FEVE in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
6. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than **0.2 mil (0.005 mm)** for primer and **0.8 mil (0.02 mm)** for topcoat.
7. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of **0.5 mil (0.013 mm)**.

D. Aluminum Roof Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
2. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
3. Mica Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
4. Metallic Fluoropolymer: AAMA 2605. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
5. FEVE Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish containing 100 percent FEVE resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
6. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than **0.2 mil (0.005 mm)** for primer and **0.8 mil (0.02 mm)** for topcoat.
7. Exposed Anodized Finish:
 - a. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**][**AA-M12C22A31, Class II, 0.010 mm**] or thicker.
 - b. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**][**AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.

E. Stainless Steel Roof Panels and Accessories:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finish: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.

- b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - c. Directional Satin Finish: ASTM A480/A480M No. 4.
- 3. Bright, Cold-Rolled, Unpolished Finish: ASTM A480/A480M No. 2B.
- F. Copper Roof Panels and Accessories:
 - 1. Prepatination: Factory prepatinate in accordance with ASTM B882 to convert the copper surface to an inorganic crystalline structure with the appearance and durability of naturally formed patina.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the Work.
 - 1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
 - 2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C754 and metal roof panel manufacturer's written recommendations.

3.3 INSTALLATION OF SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than **24 inches (610 mm)** in adjacent rows.
 - 1. At steel roof decks, install substrate board at right angle to flutes of deck.
 - a. Locate end joints over crests of steel roof deck.
 - 2. Tightly butt substrate boards together.
 - 3. Cut substrate board to fit tightly around penetrations and projections, and to fit tightly to intersecting sloping roof decks.

4. Fasten substrate board in accordance with roofing system manufacturers' written installation instructions.

3.4 INSTALLATION OF VAPOR RETARDER

- A. Install vapor retarder in a single layer over roof area in accordance with manufacturer's written installation instructions, side and end lapping each sheet a minimum of **2 and 6 inches (50 and 152 mm)**, respectively.
 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 2. Continuously seal side and end laps with **[tape][adhesive]**.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.5 INSTALLATION OF ROOF INSULATION

- A. General: Install insulation concurrently with metal roof panel installation, in thickness indicated to cover entire surface, in accordance with manufacturer's written installation instructions.
 1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
 2. Tape joints and ruptures in vapor retarder and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- B. Blanket Roof Insulation: Comply with the following installation method:
 1. Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal roof panels fastened to secondary framing.
 2. Between-Purlin Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Hold in place with bands and crossbands below insulation.

3.6 INSTALLATION OF COVER BOARD

- A. Install cover boards over insulation in accordance with manufacturer's written installation instructions. Install with long joints in continuous straight lines, with end joints staggered between rows. Offset joints of insulation below a minimum of **6 inches (152 mm)** in each direction.

3.7 INSTALLATION OF UNDERLAYMENT

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated **[below][on Drawings]**, wrinkle free, in shingle fashion to shed water, and with end laps of not less than **6 inches (152 mm)** staggered **24 inches (610 mm)** between courses. Overlap side edges not less than **3-1/2 inches (90 mm)**. **[Extend underlayment into gutter trough.]** Roll laps with roller. Cover underlayment within 14 days.
 1. Apply over the entire roof surface.

2. Apply over the roof area indicated below:
 - a. Roof perimeter for a distance up from eaves of [24 inches (610 mm)][36 inches (914 mm)]<Insert dimension> beyond interior wall line.
 - b. Valleys, from lowest point to highest point, for a distance on each side of [18 inches (460 mm)]<Insert dimension>. Overlap ends of sheets not less than 6 inches (152 mm).
 - c. Rake edges for a distance of [18 inches (460 mm)]<Insert dimension>.
 - d. Hips and ridges for a distance on each side of [12 inches (305 mm)]<Insert dimension>.
 - e. Roof-to-wall intersections for a distance from wall of [18 inches (460 mm)]<Insert dimension>.
 - f. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of [18 inches (460 mm)]<Insert dimension>.
- B. Felt Underlayment: Apply at locations indicated [below][on Drawings], in shingle fashion to shed water, and with lapped joints of not less than 2 inches (50 mm).
 1. Apply over the entire roof surface.
 2. Apply on roof not covered by self-adhering sheet underlayment. Lap over edges of self-adhering sheet underlayment not less than 3 inches (75 mm), in shingle fashion to shed water.
- C. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.
- D. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.8 INSTALLATION OF FORMED METAL ROOF PANELS

- A. Install metal roof panels in accordance with manufacturer's written instructions in orientation, sizes, and locations indicated. Anchor metal roof panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 1. Shim or otherwise plumb substrates receiving metal roof panels.
 2. Flash and seal metal roof panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that are concealed by metal roof panels are installed.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal roof panel Work proceeds.
 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of metal roof panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
 1. Steel Roof Panels: Use stainless steel fasteners for surfaces exposed to exterior; use galvanized-steel fasteners for surfaces exposed to interior.
 2. Aluminum Roof Panels: Use aluminum or stainless steel fasteners for surfaces exposed to exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to interior.
 3. Stainless Steel Roof Panels: Use stainless steel fasteners.
 4. Copper Roof Panels: Use copper, stainless steel, or hardware-bronze fasteners.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal roof panel manufacturer.

- D. Exposed-Fastener, Metal Roof Panels: Fasten metal roof panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal roof panels.
 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
 5. Flash and seal panels with weather closures at perimeter of all openings.
 6. Watertight Installation:
 - a. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal roof panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
 - b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - c. At panel splices, nest panels with minimum **6-inch (152-mm)** end lap, sealed with sealant and fastened together by interlocking clamping plates.
- E. Horizontal-Seam (Bermuda-Type) Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each horizontal-seam joint at location and spacing, and with fasteners recommended by manufacturer. Start at eave and work upward toward ridge.
1. Install clips to supports with self-drilling fasteners.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal roof panel system, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturer; or, if not indicated, provide types recommended in writing by metal roof panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements and manufacturer's written installation instructions. Provide concealed fasteners where possible and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that are without buckling and tool marks, and that are true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 ft. (3 m)**, with no joints allowed within **24 inches (610 mm)** of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with mastic sealant (concealed within joints).
- H. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than **36 inches (914 mm)** o.c., using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- I. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely **1 inch (25 mm)** away from walls; locate fasteners at top and bottom and at approximately **60 inches (1524 mm)** o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

- J. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.
- K. Pipe and Conduit Penetrations: Fasten and seal to metal roof panels as recommended by manufacturer.

3.9 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal roof panel units within installed tolerance of **1/4 inch in 20 ft. (6 mm in 6 m)** on slope and location lines and within **1/8-inch (3-mm)** offset of adjoining faces and of alignment of matching profiles.

3.10 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal roof panel installation, including accessories. Report results in writing.
- B. Remove and replace applications where tests and inspections indicate that they do not comply with specified requirements.
- C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.11 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 41 13 00



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SECTION 07 41 13 00A - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum plate wall panels.

B. Related Requirements:

1. Section 014339 "Mockups" for integrated exterior mockup requirements.
2. Section 061600 "Sheathing" for structural wall sheathing.
3. Section 072100 "Thermal Insulation" for insulation.
4. Section 072500 "Weather Barriers" for weather-resistive barriers and sealing penetrations in barriers resulting from installation of support system.
5. Section 072726 "Fluid-Applied Membrane Air Barriers" for air barriers and sealing penetrations in barriers resulting from installation of wall panel support system.

1.2 DEFINITIONS

- A. Wall Panel Assembly: Assembly consisting of wall panels, support systems, cavities, [**continuous insulation, girts,**] weather barriers, air barriers, and sheathing substrate that has been shown to comply with assembly testing and performance requirements.

1.3 COORDINATION

- A. Coordinate installation of wall panels and support system with insulation, weather barriers, air barriers, flashings, and other adjoining construction to ensure proper sequencing.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference [at Project site][by web conference]<Insert location> .

1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.

7. Review temporary protection requirements for metal panel assembly during and after installation.
8. Review procedures for repair of field-cut metal panels or metal panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
- B. Shop Drawings:
 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
 2. Accessories: Include details of flashing, trim, and anchorage, at a scale of not less than **1-1/2 inches per 12 inches (1:10)**.
- C. Samples for Initial Selection: Manufacturer's standard color charts, showing full range of available colors for each type of exposed finish.
 1. Include Samples of trim and accessories involving color selection.
- D. Samples for Verification: Actual sample of finished products for each type of exposed finish.
 1. Size: **[Manufacturer's standard size]<Insert size>** .
- E. Delegated Design Submittals: For wall panel assembly, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. Sustainable Design Submittals:
 1. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.
 2. Environmental Product Declaration (EPD): For each product.
 3. Health Product Declaration (HPD): For each product.
 4. Environmental Product Declaration (EPD): For each product.
 5. Health Product Declaration (HPD): For each product.
 6. Environmental Product Declaration (EPD): For each product.
 7. Environmental Product Declaration (EPD): For each product.
 8. Environmental Product Declaration (EPD): For each product.
 9. Third-Party Certifications: For each product.
 10. Third-Party-Certified Life-Cycle Assessment: For each product.

1.6 INFORMATIONAL SUBMITTALS

- A. Wall Panel Assembly Test Reports: Certified test reports showing system compliance with specific performance or third-party listing documenting compliance in accordance with the IBC.
- B. Field Quality Control Reports: For specified tests and inspections.
- C. Qualification Statements: For **[Installer][testing agency][and delegated design engineer]** .

- D. Sample Warranties: For specified special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal plate wall panels.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Testing Agency Qualifications: An agency acceptable to authorities having jurisdiction.
- C. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in **[state]<Insert jurisdiction>** where Project is located and who is experienced in providing engineering services of the type indicated.

1.9 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical metal wall panel assembly **[as indicated on Drawings]<Insert size>** , including **[corner,][soffits,]** supports, attachments, flashing and trim, and accessories.
 - 2. Water-Spray Test: Conduct water-spray test on mockup of metal wall panel assembly, testing for water penetration in accordance with AAMA 501.2.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package panels for protection during transportation and handling.
- B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store panels to ensure dryness, with positive slope for drainage of water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal wall panels during installation.

1.11 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.12 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal wall panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: **[20][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal plate wall assembly, including support systems.
- B. Structural Performance: Provide metal wall panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E330/E330M:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: **[As indicated on Drawings]<Insert loads>** .
 - 3. Deflection Limits: For wind loads, no greater than **[1/180][1/240]<Insert deflection>** of the span.
- C. Air Infiltration: Not more than **0.06 cfm/sq. ft. (0.3 L/s per sq. m)** when tested in accordance with ASTM E283/E283M at the following test-pressure difference:
 - 1. Test-Pressure Difference: **[1.57 lbf/sq. ft. (75 Pa)][6.24 lbf/sq. ft. (300 Pa)]** .
- D. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: **[2.86 lbf/sq. ft. (137 Pa)][6.24 lbf/sq. ft. (300 Pa)]** .
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature change>** .

- F. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL on its "Product iQ" website or from the listings of another qualified testing agency.

2.2 METAL PLATE WALL PANELS

- A. Aluminum Plate Wall Panels : Factory-formed, wall panel fabricated into profile for installation method indicated.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Alfred, LLC]**
 - b. **[Alply Insulated Panels LLC]**
 - c. **[American Metalcraft Inc.]**
 - d. **[Architectural Specialty Products, Inc]**
 - e. **[Carter Architectural Panels, Inc.]**
 - f. **[Castle Metal Products]**
 - g. **[DAMS Incorporated; D. Architectural Metal Solutions Incorporated]**
 - h. **[Fabral; a brand of Flack Global Metals]**
 - i. **[Fairview Architectural]**
 - j. **[Firestone Metal Products]**
 - k. **[Metal Sales & Service, Inc.]**
 - l. **[Protean Construction Products, Inc]**
 - m. **[SAF (Southern Aluminum Finishing Company, Inc.)]**
 - n. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Alfred, LLC]**
 - b. **[Alply Insulated Panels LLC]**
 - c. **[American Metalcraft Inc.]**
 - d. **[Architectural Specialty Products, Inc]**
 - e. **[Carter Architectural Panels, Inc.]**
 - f. **[Castle Metal Products]**
 - g. **[DAMS Incorporated; D. Architectural Metal Solutions Incorporated]**
 - h. **[Fabral; a brand of Flack Global Metals]**
 - i. **[Fairview Architectural]**
 - j. **[Firestone Metal Products]**
 - k. **[Metal Sales & Service, Inc.]**
 - l. **[Protean Construction Products, Inc]**
 - m. **[SAF (Southern Aluminum Finishing Company, Inc.)]**
 - n. **<Insert manufacturer's name>**
 3. Type of Panel: **[Flat][Profiled]<Insert type>** tension-leveled, smooth aluminum sheet, ASTM B209/B209M.
 4. Nominal Thickness: **[0.120 inch (3.05 mm)][0.125 inch (3.18 mm)][0.1875 inch (4.76 mm)][0.190 inch (4.82 mm)]** thick.
 5. Panel Depth: **[2 inches (51 mm)][As indicated on Drawings]<Insert dimension>** .

6. Exterior Finish: [Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Clear anodized][Color anodized]<Insert finish> .
7. Color: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color> .

- B. Attachment Assembly: [Manufacturer's standard][Flange attachment][Clip][Subgirt and spline][Track support][Rail support][Rainscreen-principle system]<Insert attachment> .

2.3 ACCESSORIES

- A. Structural Performance: Provide support system for metal wall panels capable of withstanding and transferring design loads to building structure within limits and under conditions indicated.
- B. Metal Subframing and Furring: ASTM C955, cold-formed, metallic-coated steel members, ASTM A653/A653M, **G90 (Z275)** hot-dip galvanized coating designation or ASTM A792/A792M, **Class AZ50 (Class AZM150)** aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- C. Wall Panel Assembly Accessories, General: Provide components required for a complete, weathertight wall panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
 1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended in writing by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum **1-inch- (25-mm-)** thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- D. Flashing and Trim: Provide flashing and trim formed from same material as metal wall panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.
- E. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- F. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer. Provide sealant types that are compatible with panel materials, are nonstaining, and do not damage panel finish.

2.4 FABRICATION

- A. Fabricate and finish metal wall panels and accessories at the factory, by panel manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

- B. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with panel manufacturer's written instructions that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with manufacturer's written instructions.
 - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended in writing by metal wall panel manufacturer for application, but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Aluminum Panels and Accessories:
 - 1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**] .
 - 2. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**] .
 - 3. Mica Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**] .
 - 4. Metallic Fluoropolymer: AAMA 2605. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**] .
 - 5. FEVE Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish containing 100 percent FEVE resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**] .
 - 6. Exposed Anodized Finish:

- a. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**][**AA-M12C22A31, Class II, 0.010 mm**] or thicker.
- b. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**][**AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of the Work.
 - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install steel subframing, furring, and other miscellaneous support system members and anchorages in accordance with metal wall panel manufacturer's written instructions.

3.3 INSTALLATION OF METAL PLATE WALL PANELS, GENERAL

- A. Install in accordance with metal wall panel manufacturer's written instructions in orientation, sizes, and locations indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal panels.
 - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - 8. Provide watertight escutcheons for pipe- and conduit-penetrating panels.

- B. Fasteners: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

3.4 INSTALLATION OF ALUMINUM PLATE WALL PANELS

- A. Install assembly required to support metal plate wall panels and to provide a complete watertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
 - 1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
 - 2. Attach metal plate wall panels to supports at locations, spacings, and with fasteners recommended in writing by manufacturer to achieve performance requirements specified.
 - a. Wet-Seal Systems: Seal horizontal and vertical joints between adjacent metal plate wall panels with sealant backing and sealant. Install sealant backing and sealant in accordance with requirements specified in Section 079200 "Joint Sealants."
- B. Rainscreen Principle Installation: Install using manufacturer's standard assembly with vertical channel that provides support and secondary drainage assembly, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended in writing by manufacturer. Attach metal plate wall panels by inserting horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.
 - 1. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
 - 2. Do not apply sealants to joints unless otherwise indicated.
- C. Install accessories with positive anchorage to building and watertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal panel system including copings, corners, seam covers, sealants, gaskets, fillers, closure strips, and similar items.
- D. Flashing and Trim: Comply with performance requirements and panel manufacturer's written installation instructions. Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
 - 1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 ft. (3 m)** with no joints allowed within **24 inches (605 mm)** of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with mastic sealant (concealed within joints).

3.5 INSTALLATION TOLERANCES

- A. Shim and align metal plate wall panel units within installed tolerance of **1/4 inch in 20 ft. (6 mm in 6 m)**,

non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
- B. Water-Spray Test: After installation, test area of wall panel assembly **[as indicated on Drawings][as directed by Architect]<Insert area>** for water penetration in accordance with AAMA 501.2.
 - 1. After testing, repair leaks, repeat tests, and make further repairs until wall panel assembly installation is watertight.
 - a. Cost of retesting is Contractor's responsibility.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.
 - 1. After testing, repair leaks, repeat tests, and make further repairs until wall panel assembly installation is watertight.
 - a. Cost of retesting is Contractor's responsibility.
- D. Remove and replace metal wall panel assembly where tests and inspections indicate that it does not comply with specified requirements.
- E. Additional tests and inspections, at Contractor's expense, will be required to determine if replaced or additional work complies with specified requirements.
- F. Prepare test and inspection reports.

3.7 CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of panel installation, clean finished surfaces as recommended in writing by metal wall panel manufacturer.
- B. After installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

3.8 PROTECTION

- A. Maintain metal wall panels in a clean condition during the remainder of construction.
- B. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 41 13 00A

SECTION 07 41 13 00B - BATTEN-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Narrow-profile, snap-on-batten-seam metal roof panels.
2. Wide-profile, snap-on-batten-seam metal roof panels.
3. Tee-top, seamed-batten metal roof panels.
4. Substrate board.
5. Vapor retarder.
6. Roof insulation.
7. Cover board.
8. Underlayment.

1.2 COORDINATION

- A.** Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B.** Coordinate metal roof panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal roof panel Installer, metal roof panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal roof panels, including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal roof panel installation, including manufacturer's written installation instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review structural loading limitations of supporting structure during and after roofing.
6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal roof panels.
7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
8. Review temporary protection requirements for metal roof panel systems during and after installation.
9. Review procedures for repair of metal roof panels damaged after installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal roof panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than **1-1/2 inches per 12 inches**.
- C. Samples for Initial Selection: Manufacturer's standard color charts, showing full range of available colors for each type of exposed finish.
 - 1. Include similar Samples of trim and accessories involving color selection.
- D. Samples for Verification: Actual sample of finished products for each type of exposed finish for metal roof panels, clips, fasteners, closures, and other metal panel accessories.
 - 1. Size: **[Manufacturers' standard size]<Insert size>**.
- E. Sustainable Design Submittals:

1.5 INFORMATIONAL SUBMITTALS

- A. Certificates for portable roll-forming equipment.
- B. Product Test Reports: For batten-seam metal roof panels, for tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Qualification Statements: For roof installers.
- E. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal roof panels.

1.7 QUALITY ASSURANCE

- A. Roof Installer Qualifications: Entity that employs **[a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified Metal Panel Roof Systems Installers][a supervisor who is an NRCA ProCertified Roofing Foreman][a supervisor who is an NRCA ProCertified Roofing Foreman and not less than 20 percent of installers who are NRCA ProCertified Metal Panel Roof Systems Installers]**.

- B. Portable Roll-Forming Equipment Certification: UL-certified, portable roll-forming equipment capable of producing metal roof panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of Work.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof area and eave[, **including fascia,**][**and soffit**] as shown on Drawings; approximately **[48 inches]****[12 ft.]<Insert dimension>** square by full thickness, including attachments, underlayment, and accessories.
 - 2. Build mockups for typical roof area only, including accessories.
 - a. Size: **[12 ft. long by 6 ft.]<Insert dimension>**.
 - b. **[Each type of exposed seam and seam termination]<Insert mockup item>**.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal roof panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness, with positive slope for drainage of water. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal roof panels during installation.
- E. Copper Roof Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal roof panels to be performed in accordance with manufacturers' written installation instructions and warranty requirements.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal roof panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
2. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Finish Warranty Period: **[20][10]<Insert number>** years from date of Substantial Completion.
- C. Special Weathertightness Warranty: Manufacturer agrees to repair or replace batten-seam metal roof panel systems that fail to remain weathertight, including leaks, within specified warranty period.
 1. Warranty Period: **[20]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal roof panel systems capable of withstanding the effects of the following loads when tested in accordance with ASTM E1592:
 1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: **[As indicated on Drawings]<Insert loads>**.
 3. Deflection Limits: For wind loads, no greater than **[1/180][1/240]<Insert deflection>** of the span.
 4. **<Insert other performance requirements>**.
- B. Air Infiltration: Air leakage of not more than **0.06 cfm/sq. ft.** when tested in accordance with ASTM E1680 **[or ASTM E283/E283M]** at the following test-pressure difference:
 1. Test-Pressure Difference: **[1.57 lbf/sq. ft.][6.24 lbf/sq. ft.]**.
- C. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E1646 **[or ASTM E331]** at the following test-pressure difference:
 1. Test-Pressure Difference: **[2.86 lbf/sq. ft.][6.24 lbf/sq. ft.]**.
- D. Watertightness: No water penetration when tested in accordance with ASTM E2140 for hydrostatic-head resistance.
- E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 1. Uplift Rating: **[UL 30][UL 60][UL 90]**.
- F. FM Approvals Listing: Provide metal roof panels and component materials that comply with

requirements in FM Approvals 4471 as part of a metal panel roofing system and that are listed in FM Approvals' "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.

1. Fire/Windstorm Classification: Class 1A-[60][75][90][105][120]<Insert number>.
2. Hail Resistance: [MH][SH].

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: [120 deg F, ambient; 180 deg F, material surfaces]<Insert temperature range>.

H. Energy Performance:

1. Provide metal roof panels meeting one of the following requirements when tested in accordance with CRRC-1:
 - a. Three-year, aged solar reflectance of not less than [0.55]<Insert value> and emissivity of not less than [0.75]<Insert value>.
 - b. Three-year, aged Solar Reflectance Index (SRI) of not less than [64]<Insert value> when calculated in accordance with ASTM E1980.

2.2 BATTEN-SEAM METAL ROOF PANELS, GENERAL

- A. Provide factory-formed metal roof panels designed to be installed by mechanically attaching panels to supports using concealed clips and covering vertical side edges of adjacent panels with batten caps. Include all accessories required for weathertight installation.
- B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.

2.3 NARROW-PROFILE, SNAP-ON-BATTEN-SEAM METAL ROOF PANELS

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. [AEP Span a brand of ASC Profiles LLC, a part of BlueScope]
2. [Architectural Building Components]
3. [ATAS International, Inc.]
4. [Berridge Manufacturing Company]
5. [CENTRIA, a Nucor Brand]
6. [Drexel Metals Corp.]
7. [Fabral; a brand of Flack Global Metals]
8. [Fashion, Inc]
9. [Garland Company, Inc. (The)]
10. [Innovative Metals Company, Inc]
11. [MBCI; Cornerstone Building Brands]
12. [McElroy Metal, Inc]
13. [Merchant & Evans Inc.]
14. [Metal Sales & Service, Inc.]
15. [Metal Sales Manufacturing Corporation]
16. [PAC-CLAD; Petersen; a Carlisle company]
17. [Ultra Seam Incorporated]

18. <Insert manufacturer's name>

B. Metal Roof Panels: Formed with vertical ribs at panel edges; designed for independent installation by mechanically attaching panels to supports using concealed clips located between panels and installing narrow profile caps over panel joints.

1. Structural Support: Over **[solid deck][open framing]**.
2. Material: **[Metallic-coated steel][Aluminum][Stainless steel][Copper]**.
3. Panel Profile: **[Intermediate stiffening ribs symmetrically spaced between ribs][Flat pan][Striated pan][Curved][Tapered]<Insert profile>**.
4. Panel Coverage:
[12 inches][14 inches][16 inches][18 inches][20 inches][22 inches][24 inches]<Insert dimension>.
5. Panel Height: **[1.0 inch][1.5 inches][1.75 inches]<Insert dimension>**.
6. Batten Cap: Manufacturer's standard. Same material, finish, and color as roof panels.
 - a. Height: **[1.5 inches][1.75 inches]<Insert dimension>**.
 - b. Width: **[3/8 inch][1/2 inch]<Insert dimension>**.
7. Clips: **[One-piece fixed][Two-piece floating]** to accommodate thermal movement.
 - a. Steel Clips: **[0.028-inch-][0.064-inch-]** nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
 - b. Stainless Steel Clips: **[0.0250-inch-][0.0625-inch-]** thick, stainless steel sheet.
 - c. Clip Spacing: **[24 inches][36 inches][As indicated on approved Shop Drawings]<Insert spacing>**.

2.4 WIDE-PROFILE, SNAP-ON-BATTEN-SEAM METAL ROOF PANELS

A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

1. **[Advanced Architectural Frames]**
2. **[Advanced Architectural Products]**
3. **[AEP Span a brand of ASC Profiles LLC, a part of BlueScope]**
4. **[ATAS International, Inc.]**
5. **[Berridge Manufacturing Company]**
6. **[CENTRIA, a Nucor Brand]**
7. **[Dimensional Metals, Inc.]**
8. **[Drexel Metals Corp.]**
9. **[Fabral; a brand of Flack Global Metals]**
10. **[Fashion, Inc]**
11. **[Garland Company, Inc. (The)]**
12. **[Innovative Metals Company, Inc]**
13. **[McElroy Metal, Inc]**
14. **[Merchant & Evans Inc.]**
15. **[Metal Sales Manufacturing Corporation]**
16. **[PAC-CLAD; Petersen; a Carlisle company]**
17. **[Ultra Seam Incorporated]**
18. **<Insert manufacturer's name>**

B. Metal Roof Panels: Formed with vertical ribs at panel edges; designed for independent installation by mechanically attaching panels to supports using concealed clips located between panels, and installing

wide profile caps over panel joints.

1. Structural Support: Over **[solid deck][open framing]**.
2. Material: **[Metallic-coated steel][Aluminum][Stainless steel][Copper]**.
3. Panel Profile: **[Intermediate stiffening ribs symmetrically spaced between ribs][Flat pan][Striated pan][Curved][Tapered]<Insert profile>**.
4. Panel Coverage:
[12 inches][14 inches][16 inches][18 inches][20 inches][22 inches][24 inches]<Insert dimension>.
5. Panel Height: **[1.0 inch][1.5 inches]<Insert dimension>**.
6. Batten Cap: Manufacturer's standard. Same material, finish, and color as roof panels.
 - a. Height: **[1.5 inches][2 inches]<Insert dimension>**.
 - b. Width: **[1.5 inches][2 inches]<Insert dimension>**.
7. Clips: **[One-piece fixed][Two-piece floating]** to accommodate thermal movement.
 - a. Steel Clips: **[0.028-inch-][0.064-inch-]** nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
 - b. Stainless Steel Clips: **[0.0250-inch-][0.0625-inch-]** thick, stainless steel sheet.
 - c. Clip Spacing: **[24 inches][36 inches][As indicated on approved Shop Drawings]<Insert spacing>**.

2.5 TEE-TOP, SEAMED-BATTEN METAL ROOF PANELS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 1. **[Berridge Manufacturing Company]**
 2. **[CENTRIA, a Nucor Brand]**
 3. **[Englert, Inc.]**
 4. **[Fabral; a brand of Flack Global Metals]**
 5. **[Garland Company, Inc. (The)]**
 6. **[Innovative Metals Company, Inc]**
 7. **[PAC-CLAD; Petersen; a Carlisle company]**
 8. **<Insert manufacturer's name>**
- B. Metal Roof Panels: Formed with vertical ribs at panel edges; designed for independent installation by mechanically attaching panels to supports using concealed clips located between panels, and mechanically seaming panel rib tops together to form tee-shaped joint.
 1. Structural Support: Over **[solid deck][open framing]**.
 2. Material: **[Metallic-coated steel][Aluminum][Stainless steel][Copper]**.
 3. Panel Profile: **[Intermediate stiffening ribs symmetrically spaced between ribs][Flat pan][Striated pan][Curved][Tapered]<Insert profile>**.
 4. Panel Coverage:
[12 inches][14 inches][16 inches][18 inches][20 inches][22 inches][24 inches]<Insert dimension>.
 5. Panel Height: **[1.0 inch][1.5 inches][1.75 inches]<Insert dimension>**.
 6. Batten Cap: Manufacturer's standard. Same material, finish, and color as roof panels.
 - a. Height: **[2.0 inches][3.0 inches]<Insert dimension>**.
 - b. Width: **[1.5 inches][1.75 inches]<Insert dimension>**.

7. Clips: Two-piece floating to accommodate thermal movement.
 - a. Steel Clips: [0.028-inch-][0.064-inch-] nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
 - b. Stainless Steel Clips: [0.0250-inch-][0.0625-inch-] thick, stainless steel sheet.
 - c. Clip Spacing: [24 inches][36 inches][As indicated on approved Shop Drawings]<Insert spacing>.

2.6 METAL ROOF PANEL MATERIAL

- A. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with minimum ASTM A653/A653M, **G90** coating designation, or aluminum-zinc alloy-coated steel sheet complying with minimum ASTM A792/A792M, **Class AZ50** coating designation; structural quality. Sheet prepainted by the coil-coating process to comply with ASTM A755/A755M.
 1. Nominal Thickness: [0.022 inch][0.028 inch][0.034 inch][0.040 inch][0.052 inch].
 2. Surface: [Smooth, flat][Embossed] texture.
 3. Exterior Finish: [Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester]<Insert finish>.
 4. Color: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.
- B. Aluminum Sheet: Coil-coated sheet, ASTM B209/B209M, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 1. Thickness: [0.032 inch][0.040 inch].
 2. Surface: [Smooth, flat][Embossed] texture.
 3. Exterior Finish: [Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester][Clear anodized][Color anodized]<Insert finish>.
 4. Color: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.
- C. Stainless Steel Sheet: ASTM A240/A240M, [Type 304][Type 316], fully annealed.
 1. Nominal Thickness: [0.0188 inch][0.0250 inch][0.0313 inch][0.0375 inch][0.0500 inch].
 2. Exterior Finish: [Polished][Bright, cold-rolled, unpolished]<Insert finish>.
- D. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 temper.
 1. Thickness: [16 oz./sq. ft.][20 oz./sq. ft.] thick.
 2. Exposed Finish: [Mill][Prepatinated].
 3. Prepatinated Color: [Dark brown][Verdigris]<Insert color>.

2.7 SUBSTRATE BOARD

- A. Glass-Mat Gypsum Roof Substrate Board: ASTM C1177/C1177M, water-resistant gypsum board.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
2. Thickness: **[1/4 inch][1/2 inch][Type X, 5/8 inch]**.
3. Surface Finish: **[Factory primed][Unprimed]**.
- B. Fiber-Reinforced Gypsum Roof Board: ASTM C1278/C1278M, cellulosic-fiber reinforced, water-resistant gypsum board.
 1. Thickness: **[1/4 inch][3/8 inch][1/2 inch][5/8 inch]**.
- C. Perlite Board: ASTM C728, seal coated.
 1. Thickness: **[3/4 inch][1 inch]**.
- D. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions for fastening substrate board to roof deck.

2.8 VAPOR RETARDER

- A. Rubberized-Asphalt-Sheet Vapor Retarder, Self-Adhering: ASTM D1970/D1970M polyethylene film laminated to layer of rubberized asphalt adhesive, minimum **40-mil** total thickness; maximum permeance rating of **0.1 perm**; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
- B. Butyl Rubber Sheet Vapor Retarder, Self-Adhering: Polyethylene film laminated to layer of butyl rubber adhesive, minimum **30-mil** total thickness; maximum permeance rating of **0.1 perm**; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
- C. Laminated Sheet Vapor Retarder: Two layers, fire-retardant polyethylene laminate, reinforced with cord grid.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Reef Industries, Inc.]**
 - b. **<Insert manufacturer's name>**
 2. Permeance Rating: Not more than **0.062 perm** when tested in accordance with ASTM E96/E96M.
 3. Flame-Spread Index: Not more than 5 when tested in accordance with ASTM E84.
 4. Smoke-Developed Index: Not more than 35 when tested in accordance with ASTM E84.
 5. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.9 ROOF INSULATION

- A. Insulation over Solid Deck:

1. Polyisocyanurate Board Insulation: ASTM C1289, Type II, [Class 1 felt facer][Class 2 coated glass-fiber facer][Class 3 uncoated glass-fiber facer] on both major surfaces.
 - a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - 1) [Atlas Polyiso Roof and Wall Insulation]
 - 2) [Carlisle Syntec Systems]
 - 3) [CertainTeed; SAINT-GOBAIN]
 - 4) [Elevate; Holcim Building Envelope]
 - 5) [GAF]
 - 6) [Hunter Panels; a Carlisle company]
 - 7) [IKO Industries Inc.]
 - 8) [Insulfoam; a Carlisle Company]
 - 9) [Johns Manville; a Berkshire Hathaway company]
 - 10) [Kingspan Insulation LLC]
 - 11) [Polyglass U.S.A., Inc.]
 - 12) [Rmax, A Business Unit of Sika Corporation]
 - 13) <Insert manufacturer's name>
 - b. Compressive Strength: [Grade 2, 20 psi][Grade 3, 25 psi].
 - c. Size: [48 by 48 inches][48 by 96 inches].
 - d. Thickness:
 - 1) Base Layer: [1-1/2 inches]<Insert thickness>.
 - 2) Upper Layer: <Insert thickness>.
2. Composite Polyisocyanurate Board Insulation: ASTM C1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other surface.
 - a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - 1) [Atlas Polyiso Roof and Wall Insulation]
 - 2) [Carlisle Syntec Systems]
 - 3) [CertainTeed; SAINT-GOBAIN]
 - 4) [Elevate; Holcim Building Envelope]
 - 5) [GAF]
 - 6) [Hunter Panels; a Carlisle company]
 - 7) [Insulfoam; a Carlisle Company]
 - 8) [Johns Manville; a Berkshire Hathaway company]
 - 9) <Insert manufacturer's name>
 - b. Facer: [Type IV cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch thick][Type V oriented strand board facer, 7/16 inch thick][Type VII glass-mat-faced gypsum board facer, 1/4 inch thick]<Insert material>.
 - c. Size: [48 by 48 inches][48 by 96 inches].
 - d. Thickness: <Insert thickness>.

B. Insulation over Open Framing:

1. Mineral-Fiber-Blanket Insulation: ASTM C665, type indicated below; consisting of fibers manufactured from glass, slag wool, or rock wool.
 - a. Nonreflective Faced: Type II (blankets with nonreflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
 - b. Reflective Faced: Type III (blankets with reflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
 - c. Unfaced: Type I (blankets without membrane covering), passing ASTM E136 for combustion characteristics.

2.10 COVER BOARD

- A. Cellulosic-Fiber Cover Board: ASTM C208, Type II, Grade 2, high-density cellulosic-fiber insulation board, having a minimum compressive strength of **40 psi**.
 1. Thickness: **[1/2 inch][1 inch]<Insert thickness>**.
 2. Surface Finish: **[Primed one side][Primed two sides with non-asphaltic primer][Integral coating, six sides][Unprimed]<Insert finish>**.
- B. Oriented Strand Board: DOC PS 2, Exposure 1, **7/16 inch** thick.
- C. Fiber-Reinforced Cementitious Cover Board: ASTM C1325, fiber-mat-reinforced cementitious board.
 1. Thickness: **[7/16 inch][1/2 inch][5/8 inch]**.
- D. High-Density Polyisocyanurate Cover Board: ASTM C1289 Type II, Class 4, Grade 1, **1/2 inch** thick, with a minimum compressive strength of **80 psi**.

2.11 UNDERLAYMENT

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of **30 mils** thick, specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer when recommended by underlayment manufacturer.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ATAS International, Inc.]**
 - b. **[Carlisle WIP Products; a brand of Carlisle Construction Materials]**
 - c. **[GCP Applied Technologies Inc.]**
 - d. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - e. **[Owens Corning]**
 - f. **[Polyglass U.S.A., Inc.]**
 - g. **[Protecto Wrap Company]**
 - h. **[SDP Advanced Polymer Products Inc.]**
 - i. **<Insert manufacturer's name>**
 2. Thermal Stability: Stable after testing at **220 deg F**; ASTM D1970/D1970M.
 3. Low-Temperature Flexibility: Passes after testing at **minus 20 deg F**; ASTM D1970/D1970M.

- B. Felt Underlayment: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felts.
- C. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.12 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645; cold-formed, metallic-coated steel sheet, minimum ASTM A653/A653M, **G90** hot-dip galvanized coating designation or ASTM A792/A792M, **Class AZ50** aluminum-zinc-alloy coating designation. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Roof Panel Accessories: Provide components required for a complete, weathertight metal roof panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
 - 2. Backing Plates: Provide metal backing plates at roof panel end splices, fabricated from material recommended by manufacturer.
 - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum **1-inch**- thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal roof panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.
- D. Gutters: Formed from same material as metal roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum **96-inch**- long sections, of size and metal thickness in accordance with manufacturer's recommendations. Furnish gutter supports spaced a maximum of **36 inches** o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match **[metal roof panels][roof fascia and rake trim]**.
- E. Downspouts: Formed from same material as metal roof panels. Fabricate in **10-ft.**- long sections, complete with formed elbows and offsets, of size and metal thickness in accordance with manufacturer's recommendations. Finish downspouts to match gutters.
- F. Roof Curbs: Fabricated from same material as roof panels, **[0.048-inch]<Insert dimension>** nominal thickness; with bottom of skirt profiled to match metal roof panel profiles and with welded top box and integral full-length cricket. Fabricate curb subframing of **0.060-inch**- nominal thickness, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads of size and height indicated. Finish roof curbs to match metal roof panels.
 - 1. Insulate roof curb with **1-inch**- thick, rigid insulation.
- G. Roof Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- H. Roof Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with metal roof panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.13 FABRICATION

- A. Fabricate and finish metal roof panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal roof panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate in accordance with equipment manufacturer's written instructions and to comply with details shown.
- C. Provide roof panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal roof panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations that apply to design, dimensions, metal, and other characteristics of item indicated.
 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with manufacturer's recommendations.
 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal roof panel manufacturer.
 - a. Size: As recommended by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

2.14 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Roof Panels and Accessories:

1. Two-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
2. Three-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
3. Mica Fluoropolymer: Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
4. Metallic Fluoropolymer: Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
5. FEVE Fluoropolymer: Two-coat fluoropolymer finish containing 100 percent FEVE resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
6. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than **0.2 mil** for primer and **0.8 mil** for topcoat.
7. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of **0.5 mil**.

D. Aluminum Roof Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
2. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
3. Mica Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
4. Metallic Fluoropolymer: AAMA 2605. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
5. FEVE Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish containing 100 percent FEVE resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
6. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than **0.2 mil** for primer and **0.8 mil** for topcoat.
7. Exposed Anodized Finish:
 - a. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**][**AA-M12C22A31, Class II, 0.010 mm**] or thicker.
 - b. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**][**AA-**

M12C22A32/A34, Class II, 0.010 mm] or thicker.

E. Stainless Steel Roof Panels and Accessories:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - c. Directional Satin Finish: ASTM A480/A480M No. 4.
3. Bright, Cold-Rolled, Unpolished Finish: ASTM A480/A480M No. 2B.

F. Copper Roof Panels and Accessories:

1. Prepatination: Factory prepatinate in accordance with ASTM B882 to convert the copper surface to an inorganic crystalline structure with the appearance and durability of naturally formed patina.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the Work.
1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
 2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C754 and metal roof panel manufacturer's written recommendations.

3.3 INSTALLATION OF SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than **24 inches** in adjacent rows.

1. At steel roof decks, install substrate board at right angle to flutes of deck.
 - a. Locate end joints over crests of steel roof deck.
2. Tightly butt substrate boards together.
3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
4. Fasten substrate board in accordance with metal roof panel system manufacturers' written installation instructions.

3.4 INSTALLATION OF VAPOR RETARDER

- A. Install vapor retarder in a single layer over roof area in accordance with manufacturer's written installation instructions, side and end lapping each sheet a minimum of **2 and 6 inches**, respectively.
 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 2. Continuously seal side and end laps with **[tape][adhesive]**.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.5 INSTALLATION OF ROOF INSULATION

- A. General: Install insulation concurrently with metal roof panel installation, in thickness indicated to cover entire surface, in accordance with manufacturer's written installation instructions.
 1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
 2. Tape joints and ruptures in vapor retarder and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
- B. Blanket Roof Insulation: Comply with the following installation method:
 1. Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal roof panels fastened to secondary framing.
 2. Between-Purlin Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Hold in place with bands and crossbands below insulation.

3.6 INSTALLATION OF COVER BOARD

- A. Install cover board over insulation in accordance with manufacturer's written installation instructions. Install with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of **6 inches** in each direction.

3.7 INSTALLATION OF UNDERLAYMENT

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated **[below][on**

Drawings], wrinkle free, in shingle fashion to shed water, and with end laps of not less than **6 inches** staggered **24 inches** between courses. Overlap side edges not less than **3-1/2 inches**.**[Extend underlayment into gutter trough.]** Roll laps with roller. Cover underlayment within 14 days.

1. Apply over the entire roof surface.
2. Apply over the roof area indicated below:
 - a. Roof perimeter for a distance up from eaves of **[24 inches][36 inches]<Insert dimension>** beyond interior wall line.
 - b. Valleys, from lowest point to highest point, for a distance on each side of **[18 inches]<Insert dimension>**. Overlap ends of sheets not less than **6 inches**.
 - c. Rake edges for a distance of **[18 inches]<Insert dimension>**.
 - d. Hips and ridges for a distance on each side of **[12 inches]<Insert dimension>**.
 - e. Roof-to-wall intersections for a distance from wall of **[18 inches]<Insert dimension>**.
 - f. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of **[18 inches]<Insert dimension>**.

B. Felt Underlayment: Apply at locations indicated **[below][on Drawings]**, in shingle fashion to shed water, and with lapped joints of not less than **2 inches**.

1. Apply over the entire roof surface.
2. Apply on roof not covered by self-adhering sheet underlayment. Lap over edges of self-adhering sheet underlayment not less than **3 inches**, in shingle fashion to shed water.

C. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.

D. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.8 INSTALLATION OF BATTEN-SEAM METAL ROOF PANELS

A. Install metal roof panels in accordance with manufacturer's written instructions and approved Shop Drawings in orientation, sizes, and locations indicated on Drawings. Anchor metal roof panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal roof panels.
2. Flash and seal metal roof panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal roof panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal roof panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal roof panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Roof Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
2. Aluminum Roof Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
3. Stainless Steel Roof Panels: Use stainless steel fasteners.

4. Copper Roof Panels: Use copper, stainless steel, or hardware-bronze fasteners.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal roof panel manufacturer.
- D. Batten-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each batten-seam joint at location, spacing, and with fasteners recommended by manufacturer.
 1. Install clips to supports with self-drilling fasteners.
 2. Apply caps to metal roof panel seams, fully engaged to provide weathertight joints.
 3. Watertight Installation:
 - a. Apply a continuous ribbon of sealant or tape to seal joints of metal roof panels, using sealant or tape as recommend by manufacturer as needed to make panels watertight.
 - b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - c. At panel splices, nest panels with minimum **6-inch** end lap, sealed with sealant and fastened together by interlocking clamping plates.
- E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
 1. Install components required for a complete metal roof panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturer; or, if not indicated, provide types recommended by metal roof panel manufacturer.
- F. Flashing and Trim: Comply with performance requirements and manufacturer's written installation instructions. Provide concealed fasteners where possible and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
 1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 ft.** with no joints allowed within **24 inches** of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than **1 inch** deep, filled with mastic sealant (concealed within joints).
- G. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than **36 inches** o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- H. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely **1 inch** away from walls; locate fasteners at top and bottom and at approximately **60 inches** o.c. in between.
 1. Provide elbows at base of downspouts to direct water away from building.
 2. Connect downspouts to underground drainage system indicated.
- I. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.
- J. Pipe and Conduit Penetrations: Fasten and seal to metal roof panels as recommended by manufacturer.



3.9 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of **1/4 inch in 20 ft.** on slope and location lines as indicated and within **1/8-inch** offset of adjoining faces and of alignment of matching profiles.

3.10 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal roof panel installation, including accessories. Report results in writing.
- B. Remove and replace metal roof panels where tests and inspections indicate that they do not comply with specified requirements.
- C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.11 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 41 13 00B



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07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 41 13 00	07 61 00 00	Sheet Metal Roofing



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SECTION 07 42 13 19 - INSULATED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Foamed-insulation-core metal wall panels.
2. Laminated-insulation-core metal wall panels.
3. Honeycomb-core metal wall panels.

B. Related Requirements:

1. Section 074293 "Soffit Panels" for metal panels used in horizontal soffit applications.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal panel assembly during and after installation.
8. Review procedures for repair of metal panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Foamed-insulation-core metal wall panels.
2. Laminated-insulation-core metal wall panels.
3. Honeycomb-core metal wall panels.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

C. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Data: For insulation, indicating that R-values comply with tables in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air Conditioning."
3. Environmental Product Declaration: For each product.
4. Health Product Declaration: For each product.
5. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
6. Environmental Product Declaration: For each product.
7. Environmental Product Declaration: For each product.
8. Environmental Product Declaration: For each product.
9. Third-Party Certifications: For each product.
10. Third-Party Certified Life Cycle Assessment: For each product.

D. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than **1-1/2 inches per 12 inches (1:10)**.

E. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

F. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below.

1. Metal Panels: **12 inches (305 mm)** long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical metal panel assembly **[as shown on Drawings]**<Insert size>, including **[corner,][soffits,]** supports, attachments, and accessories.
 - 2. Water-Spray Test: Conduct water-spray test of metal panel assembly mockup, testing for water penetration in accordance with AAMA 501.2.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: **[Two]**<Insert number> years from date of Substantial Completion.

- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Finish Warranty Period: [20][10]<Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert value> percent.
- B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E72:
1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: [As indicated on Drawings]<Insert loads>.
 3. Deflection Limits: For wind loads, no greater than [1/180][1/240]<Insert deflection> of the span.
 4. <Insert serviceability requirements>.
- C. Air Infiltration: Air leakage of not more than **0.06 cfm/sq. ft. (0.3 L/s per sq. m)** when tested in accordance with ASTM E283 at the following test-pressure difference:
1. Test-Pressure Difference: [1.57 lbf/sq. ft. (75 Pa)][6.24 lbf/sq. ft. (300 Pa)].
- D. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E331 at the following test-pressure difference:
1. Test-Pressure Difference: [2.86 lbf/sq. ft. (137 Pa)][6.24 lbf/sq. ft. (300 Pa)].
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): [120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature range>.
- F. Fire-Test-Response Characteristics: Provide metal wall panels and system components with the following fire-test-response characteristics, as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per

- ASTM E119.
2. Intermediate-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which wall panel is a part, complies with NFPA 285 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies.
3. Radiant Heat Exposure: No ignition when tested in accordance with NFPA 268.
4. Potential Heat: Acceptable level when tested in accordance with NFPA 259.
5. Surface-Burning Characteristics: Provide wall panels with a flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E84.

2.2 FOAMED-INSULATION-CORE METAL WALL PANELS

- A. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and insulation core foamed in place during fabrication, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
 1. Insulation Core: Modified isocyanurate or polyurethane foam using a non-CFC blowing agent, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.
 - a. Closed-Cell Content: 90 percent when tested in accordance with ASTM D6226.
 - b. Density: **2.0 to 2.6 lb/cu. ft. (32 to 42 kg/cu. m)** when tested in accordance with ASTM D1622.
 - c. Compressive Strength: Minimum **20 psi (140 kPa)** when tested in accordance with ASTM D1621.
 - d. Shear Strength: **26 psi (179 kPa)** when tested in accordance with ASTM C273/C273M.
- B. Exposed-Fastener, Foamed-Insulation-Core Metal Wall Panels : Formed with a raised, trapezoidal major rib at panel edge and two intermediate stiffening ribs symmetrically spaced between major rib and panel edge; designed for lapping side edges of adjacent panels and mechanically attaching to supports using exposed fasteners in side laps.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[CENTRIA, a Nucor Brand]**
 - b. **[MBCI; Cornerstone Building Brands]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CENTRIA, a Nucor Brand]**
 - b. **[MBCI; Cornerstone Building Brands]**
 - c. **<Insert manufacturer's name>**
 3. Metallic-Coated Steel Sheet: Facings of zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, **G90 (Z275)** coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, **Class AZ50 (Class AZM150)** coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Nominal Thickness: **[0.022 inch (0.56 mm)][0.028 inch (0.71 mm)][0.034 inch (0.86 mm)]**.
 - b. Exterior Finish: **[Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized**

polyester]<Insert finish>.

- 1) Color: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.

c. Interior Finish: [Siliconized polyester]<Insert finish>.

- 1) Color: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.

4. Backer Board: On back side of exterior facing.
5. Snap-on Batten: Same material, finish, and color as exterior facings of wall panels.
6. Panel Coverage: [36 inches (914 mm)]<Insert dimension> nominal.
7. Panel Thickness: [3.0 inches (76 mm)][4.0 inches (102 mm)][5.0 inches (127 mm)]<Insert dimension>.
8. Thermal-Resistance Value (R-Value): <Insert R-value> in accordance with ASTM C1363.

C. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels : Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [CENTRIA, a Nucor Brand]
 - b. [Kingspan Insulated Panels, Inc.]
 - c. [MBCI; Cornerstone Building Brands]
 - d. [Metl-Span; a Nucor Brand]
 - e. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [CENTRIA, a Nucor Brand]
 - b. [Kingspan Insulated Panels, Inc.]
 - c. [MBCI; Cornerstone Building Brands]
 - d. [Metl-Span; a Nucor Brand]
 - e. <Insert manufacturer's name>
3. Metallic-Coated Steel Sheet: Facings of zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, **G90 (Z275)** coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, **Class AZ50 (Class AZM150)** coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Nominal Thickness: [0.022 inch (0.56 mm)][0.028 inch (0.71 mm)][0.034 inch (0.86 mm)].
 - b. Exterior Finish: [Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester]<Insert finish>.
 - 1) Color: [As indicated by manufacturer's designations][Match Architect's

samples][As selected by Architect from manufacturer's full range]<Insert color>.

c. Interior Finish: **[Siliconized polyester]<Insert finish>.**

1) Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.**

4. Backer Board: On back side of exterior facing.
5. Snap-on Batten: Same material, finish, and color as exterior facings of wall panels.
6. Panel Coverage: **[36 inches (914 mm)][40 inches (1016 mm)]<Insert dimension> nominal.**
7. Panel Thickness: **[1.0 inch (25 mm)][1.5 inches (38 mm)][2.0 inches (51 mm)][2.5 inches (64 mm)][3.0 inches (76 mm)][4.0 inches (102 mm)][5.0 inches (127 mm)]<Insert dimension>.**
8. Thermal-Resistance Value (R-Value): **<Insert R-value>** in accordance with ASTM C1363.

2.3 LAMINATED-INSULATION-CORE METAL WALL PANELS

A. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and core material laminated or otherwise securely bonded to facing sheets during fabrication without use of contact adhesives, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.

B. Wrapped-Edge, Laminated-Insulation-Core Metal Wall Panels : Formed with flush exterior panel facing wrapped over panel edges; designed for independent installation by mechanically attaching **[panels to supports using staggered, concealed side clips engaging panel edges][through extended panel edges to supports using concealed fasteners]**; with **[sealant][gasketed]** joints.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[CENTRIA, a Nucor Brand]**
 - b. **[Kingspan Insulated Panels, Inc.]**
 - c. **[Protean Construction Products, Inc]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CENTRIA, a Nucor Brand]**
 - b. **[Kingspan Insulated Panels, Inc.]**
 - c. **[Protean Construction Products, Inc]**
 - d. **<Insert manufacturer's name>**
3. Metallic-Coated Steel Sheet: Facings of zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, **G90 (Z275)** coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, **Class AZ50 (Class AZM150)** coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Nominal Thickness: **[0.028 inch (0.71 mm)][0.034 inch (0.86 mm)][0.040 inch (1.02 mm)][0.052 inch (1.32 mm)].**
 - b. Exterior Finish: **[Two-coat fluoropolymer][Three-coat fluoropolymer][Mica**

fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester]<Insert finish>.

- 1) Color: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.
- c. Interior Finish: [Siliconized polyester]<Insert finish>.
 - 1) Color: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.
4. Aluminum Sheet: Fabricate panel with exterior and interior facings of same material and thickness. Provide facings of aluminum coil-coated sheet, **ASTM B209 (ASTM B209M)**, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - a. Thickness: [0.032 inch (0.81 mm)][0.040 inch (1.02 mm)][0.050 inch (1.27 mm)][0.063 inch (1.60 mm)][0.080 inch (2.03 mm)].
 - b. Surface: [Smooth, flat][Embossed] finish.
 - c. Exterior Finish: [Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester][Clear anodized][Color anodized]<Insert finish>.
 - 1) Color: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.
 - d. Interior Finish: [Siliconized polyester]<Insert finish>.
 - 1) Color: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.
5. Core Material: [Manufacturers' standard.][Board insulation of the following type:]
 - a. Polyisocyanurate Insulation: Closed cell, modified polyisocyanurate foam using a non-CFC blowing agent, board type, with a maximum flame-spread index of 25 and a smoke-developed index of 450.
 - 1) Closed-Cell Content: 90 percent when tested in accordance with ASTM D6226.
 - b. Extruded-Polystyrene Board Insulation: ASTM C578, Type IV, **1.60-lb/cu. ft. (26-kg/cu. m)** minimum density, unless otherwise indicated; with a maximum flame-spread index of 25 and a smoke-developed index of 450.
 - c. Molded-Polystyrene Board Insulation: ASTM C578, [Type I, **0.9 lb/cu. ft. (14 kg/cu. m)**][Type II, **1.35 lb/cu. ft. (22 kg/cu. m)**, **Class 2 or 3, Grade 3**], with a maximum flame-spread index of 25 and a smoke-developed index of 450.
6. Backer Board: [0.125-inch- (3-mm-)][0.250-inch- (6-mm-)] thick hardboard behind exterior facing for increased impact resistance.
7. Clips: Manufacturer's standard one piece, formed from [zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet][stainless steel].
8. Gaskets: Extruded, dry seal silicone.

9. Sealant: Manufacturer's standard silicone.
 10. Panel Thickness: [1.0 inch (25 mm)][2.0 inches (51 mm)][3.0 inches (76 mm)][4.0 inches (102 mm)][5.0 inches (127 mm)][6.0 inches (152 mm)]<Insert dimension>.
 11. Thermal-Resistance Value (R-Value): <Insert R-value> in accordance with ASTM C1363.
- C. Shiplap-Edge, Laminated-Insulation-Core Metal Wall Panels : Formed with flush exterior panel facing and with shiplap edges; designed for sequential installation by mechanically attaching panels to supports using concealed clips and fasteners; with factory-applied [sealant][gaskets] in side laps.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Alply Insulated Panels LLC]
 - b. [Kingspan Insulated Panels, Inc.]
 - c. [Protean Construction Products, Inc]
 - d. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Alply Insulated Panels LLC]
 - b. [Kingspan Insulated Panels, Inc.]
 - c. [Protean Construction Products, Inc]
 - d. <Insert manufacturer's name>
 3. Metallic-Coated Steel Sheet: Facings of zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, **G90 (Z275)** coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, **Class AZ50 (Class AZM150)** coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Nominal Thickness: [0.028 inch (0.71 mm)][0.034 inch (0.86 mm)][0.040 inch (1.02 mm)].
 - b. Exterior Finish: [Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester]<Insert finish>.
 - 1) Color: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.
 - c. Interior Finish: [Siliconized polyester]<Insert finish>.
 - 1) Color: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.
 4. Aluminum Sheet: Fabricate panel with exterior and interior facings of same material and thickness. Provide facings of aluminum coil-coated sheet, **ASTM B209 (ASTM B209M)**, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - a. Thickness: [0.032 inch (0.81 mm)][0.040 inch (1.02 mm)][0.050 inch (1.27 mm)][0.063 inch (1.60 mm)].
 - b. Surface: [Smooth, flat][Embossed] finish.

- c. Exterior Finish: **[Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester][Clear anodized][Color anodized]<Insert finish>**.
 - 1) Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>**.
 - d. Interior Finish: **[Siliconized polyester]<Insert finish>**.
 - 1) Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>**.
5. Core Material: **[Manufacturers' standard.][Board insulation of the following type:]**
- a. Polyisocyanurate Insulation: Closed cell, modified polyisocyanurate foam using a non-CFC blowing agent, board type, with a maximum flame-spread index of 25 and a smoke-developed index of 450.
 - 1) Closed-Cell Content: 90 percent when tested in accordance with ASTM D6226.
 - b. Extruded-Polystyrene Board Insulation: ASTM C578, Type IV, **1.60-lb/cu. ft. (26-kg/cu. m)** minimum density unless otherwise indicated; with a maximum flame-spread index of 25 and a smoke-developed index of 450.
 - c. Molded-Polystyrene Board Insulation: ASTM C578, **[Type I, 0.9 lb/cu. ft. (14 kg/cu. m)][Type II, 1.35 lb/cu. ft. (22 kg/cu. m), Class 2 or 3, Grade 3]**, with a maximum flame-spread index of 25 and a smoke-developed index of 450.
6. Backer Board: **[0.125-inch- (3-mm-)][0.250-inch- (6-mm-)]** thick hardboard behind exterior facing for increased impact resistance.
 7. Clips: Manufacturer's standard one piece, formed from **[zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet][stainless steel]**.
 8. Gaskets: Extruded, dry seal silicone.
 9. Sealant: Manufacturer's standard silicone.
 10. Panel Thickness: **[1.0 inch (25 mm)][2.0 inches (51 mm)][3.0 inches (76 mm)][4.0 inches (102 mm)][5.0 inches (127 mm)][6.0 inches (152 mm)]<Insert dimension>**.
 11. Thermal-Resistance Value (R-Value): **<Insert R-value>** in accordance with ASTM C1363.
- D. Framed-Edge, Laminated-Insulation-Core Metal Wall Panels : Formed with flush exterior panel facing and integral, extruded edge members; designed for independent installation by mechanically attaching panels to supports through edge framing using concealed fasteners; with gasketed joints.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Alply Insulated Panels LLC]**
 - b. **[Protean Construction Products, Inc]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Alply Insulated Panels LLC]**
 - b. **[Protean Construction Products, Inc]**
 - c. **<Insert manufacturer's name>**
3. Metallic-Coated Steel Sheet: Facings of zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, **G90 (Z275)** coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, **Class AZ50 (Class AZM150)** coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Nominal Thickness: **[0.028 inch (0.71 mm)][0.034 inch (0.86 mm)][0.040 inch (1.02 mm)]**.
 - b. Exterior Finish: **[Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester]<Insert finish>**.
 - 1) Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>**.
 - c. Interior Finish: **[Siliconized polyester]<Insert finish>**.
 - 1) Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>**.
4. Aluminum Sheet: Fabricate panel with exterior and interior facings of same material and thickness. Provide facings of aluminum coil-coated sheet, **ASTM B209 (ASTM B209M)**, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - a. Thickness: **[0.032 inch (0.81 mm)][0.040 inch (1.02 mm)][0.050 inch (1.27 mm)][0.063 inch (1.60 mm)][0.080 inch (2.03 mm)]**.
 - b. Surface: **[Smooth, flat][Embossed]** finish.
 - c. Exterior Finish: **[Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester][Clear anodized][Color anodized]<Insert finish>**.
 - 1) Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>**.
 - d. Interior Finish: **[Siliconized polyester]<Insert finish>**.
 - 1) Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>**.
5. Core Material: **[Manufacturers' standard.][Board insulation of the following type:]**
 - a. Polyisocyanurate Insulation: Closed cell, modified polyisocyanurate foam using a non-CFC blowing agent, board type, with a maximum flame-spread index of 25 and a smoke-developed index of 450.
 - 1) Closed-Cell Content: 90 percent when tested in accordance with ASTM D6226.
 - b. Extruded-Polystyrene Board Insulation: ASTM C578, Type IV, **1.60-lb/cu. ft. (26-kg/cu. m)** minimum density unless otherwise indicated; with a maximum flame-spread index of 25

- and a smoke-developed index of 450.
- c. Molded-Polystyrene Board Insulation: ASTM C578, **[Type I, 0.9 lb/cu. ft. (14 kg/cu. m)][Type II, 1.35 lb/cu. ft. (22 kg/cu. m), Class 2 or 3, Grade 3]**, with maximum flame-spread index of 25 and smoke-developed index of 450.
 6. Backer Board: **[0.125-inch- (3-mm-)][0.250-inch- (6-mm-)]** thick hardboard behind exterior facing for increased impact resistance.
 7. Edge Members: Extruded aluminum, not less than **0.063-inch (1.60-mm)** wall thickness.
 8. Gaskets: Extruded, dry seal silicone.
 9. Panel Thickness: **[1.0 inch (25 mm)][2.0 inches (51 mm)][3.0 inches (76 mm)][4.0 inches (102 mm)][5.0 inches (127 mm)][6.0 inches (152 mm)]<Insert dimension>**.
 10. Thermal-Resistance Value (R-Value): **<Insert R-value>** in accordance with ASTM C1363.

2.4 HONEYCOMB-CORE METAL WALL PANELS

- A. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and honeycomb-core material laminated or otherwise securely bonded to facing sheets during fabrication without use of contact adhesives or pinch rollers, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
- B. Wrapped-Edge, Honeycomb-Core Metal Wall Panels : Formed with flush exterior panel facing wrapped over panel edges; designed for independent installation by mechanically attaching **[panels to supports using staggered, concealed side clips engaging panel edges][through extended panel edges to supports using concealed fasteners]**; with **[sealant][gasketed]** joints.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Firestone Metal Products]**
 - b. **[Protean Construction Products, Inc]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Firestone Metal Products]**
 - b. **[Protean Construction Products, Inc]**
 - c. **<Insert manufacturer's name>**
 3. Metallic-Coated Steel Sheet: Facings of zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, **G90 (Z275)** coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, **Class AZ50 (Class AZM150)** coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Nominal Thickness: **[0.028 inch (0.71 mm)][0.034 inch (0.86 mm)][0.040 inch (1.02 mm)]**.
 - b. Exterior Finish: **[Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester]<Insert finish>**.
 - 1) Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert**

color>.

- c. Interior Finish: **[Siliconized polyester]<Insert finish>.**
 - 1) Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.**
4. Aluminum Sheet: Fabricate panel with exterior and interior facings of same material and thickness. Provide facings of aluminum coil-coated sheet, **ASTM B209 (ASTM B209M)**, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - a. Thickness: **[0.032 inch (0.81 mm)][0.040 inch (1.02 mm)][0.050 inch (1.27 mm)][0.063 inch (1.60 mm)].**
 - b. Surface: **[Smooth, flat][Embossed]** finish.
 - c. Exterior Finish: **[Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester][Clear anodized][Color anodized]<Insert finish>.**
 - 1) Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.**
 - d. Interior Finish: **[Siliconized polyester]<Insert finish>.**
 - 1) Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.**
5. Kraft-Paper Honeycomb Core: Manufacturer's standard phenolic-resin impregnated paper, with not less than 15 percent resin content by weight and chemically treated for fire resistance; with maximum **1/2-inch (13-mm)** cell size.
6. Aluminum Honeycomb Core: Manufacturer's standard **0.003-inch- (0.08-mm-)** thick, commercial-grade aluminum with maximum **3/4-inch (19-mm)** cell size.
7. Clips: Manufacturer's standard one piece, formed from **[zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet][stainless steel]**.
8. Gaskets: Extruded, dry seal silicone.
9. Sealant: Manufacturer's standard silicone.
10. Panel Thickness: **[0.25 inch (6 mm)][1.0 inch (25 mm)][2.0 inches (51 mm)][3.0 inches (76 mm)][4.0 inches (102 mm)]<Insert dimension>.**
- C. Shiplap-Edge, Honeycomb-Core Metal Wall Panels : Formed with flush exterior panel facing and with shiplap edges; designed for sequential installation by mechanically attaching panels to supports using concealed clips and fasteners; with factory-applied **[sealant][gaskets]** in side laps.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Kingspan Insulated Panels, Inc.]**
 - b. **[Protean Construction Products, Inc]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert**

manufacturer's name; product name or designation> or comparable product by one of the following:

- a. **[Kingspan Insulated Panels, Inc.]**
 - b. **[Protean Construction Products, Inc]**
 - c. **<Insert manufacturer's name>**
3. Metallic-Coated Steel Sheet: Facings of zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, **G90 (Z275)** coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, **Class AZ50 (Class AZM150)** coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
- a. Nominal Thickness: **[0.028 inch (0.71 mm)][0.034 inch (0.86 mm)][0.040 inch (1.02 mm)]**.
 - b. Exterior Finish: **[Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester]<Insert finish>**.
 - 1) Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>**.
 - c. Interior Finish: **[Siliconized polyester]<Insert finish>**.
 - 1) Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>**.
4. Aluminum Sheet: Fabricate panel with exterior and interior facings of same material and thickness. Provide facings of aluminum coil-coated sheet, **ASTM B209 (ASTM B209M)**, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
- a. Thickness: **[0.032 inch (0.81 mm)][0.040 inch (1.02 mm)][0.050 inch (1.27 mm)][0.063 inch (1.60 mm)]**.
 - b. Surface: **[Smooth, flat][Embossed]** finish.
 - c. Exterior Finish: **[Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester][Clear anodized][Color anodized]<Insert finish>**.
 - 1) Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>**.
 - d. Interior Finish: **[Siliconized polyester]<Insert finish>**.
 - 1) Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>**.
5. Kraft-Paper Honeycomb Core: Manufacturer's standard phenolic-resin-impregnated paper, with not less than 15 percent resin content by weight and chemically treated for fire resistance; with maximum **1/2-inch (13-mm)** cell size.
6. Aluminum Honeycomb Core: Manufacturer's standard **0.003-inch- (0.08-mm-)** thick, commercial-grade aluminum with maximum **3/4-inch (19-mm)** cell size.
7. Clips: Manufacturer's standard one piece, formed from **[zinc-coated (galvanized) steel or**

polyester][Clear anodized][Color anodized]<Insert finish>.

- 1) Color: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.

d. Interior Finish: [Siliconized polyester]<Insert finish>.

- 1) Color: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.

5. Kraft-Paper Honeycomb Core: Manufacturer's standard phenolic-resin-impregnated paper, with not less than 15 percent resin content by weight and chemically treated for fire resistance; with maximum **1/2-inch (13-mm)** cell size.
6. Aluminum Honeycomb Core: Manufacturer's standard **0.003-inch- (0.08-mm-)** thick, commercial-grade aluminum with maximum **3/4-inch (19-mm)** cell size.
7. Edge Members: Extruded aluminum, not less than **0.063-inch (1.6-mm)** wall thickness.
8. Gaskets: Extruded, dry seal silicone.
9. Panel Thickness: [**1.0 inch (25 mm)**][**2.0 inches (51 mm)**][**3.0 inches (76 mm)**]<Insert dimension>.

2.5 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, **G90 (Z275 hot-dip galvanized)** coating designation or ASTM A792/A792M, **Class AZ50 (Class AZM150)** aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum **1-inch- (25-mm-)** thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Backer Board: Hardboard complying with ANSI A135.4, Class 1 tempered, [**1/8 inch (3 mm)**][**1/4 inch (6 mm)**] thick unless otherwise indicated.
- D. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- E. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- F. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel

materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape **1/2 inch (13 mm)** wide and **1/8 inch (3 mm)** thick.
2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.6 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- D. Honeycomb-Core Metal Wall Panels: Fabricate panels using manufacturer's standard thermosetting structural adhesive in a lamination process that bonds panel under minimum **10-psi (69-kPa)** pressure. Use of contact adhesives with pinch-roll process is unacceptable.
 1. Panel Bow Tolerance: Not more than 0.5 percent of panel width or length.
- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.7 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if

they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
3. Mica Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
4. Metallic Fluoropolymer: AAMA 621. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
5. FEVE Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
6. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than **0.2 mil (0.005 mm)** for primer and **0.8 mil (0.02 mm)** for topcoat.
7. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of **0.5 mil (0.013 mm)**.

D. Aluminum Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
3. Mica Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
4. Metallic Fluoropolymer: AAMA 2605. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
5. FEVE Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
6. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than **0.2 mil (0.005 mm)** for primer and **0.8 mil (0.02 mm)** for topcoat.
7. Exposed Anodized Finish:
 - a. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**][**AA-M12C22A31, Class II, 0.010 mm**] or thicker.
 - b. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**][**AA-**

M12C22A32/A34, Class II, 0.010 mm] or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C754 and metal panel manufacturer's written recommendations.

3.3 INSTALLATION OF METAL PANELS

- A. General: Install metal panels in accordance with manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal panels.
 - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:

1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
 2. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal wall panel manufacturer.
1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.4 INSTALLATION OF INSULATION-CORE METAL WALL PANELS

- A. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.
1. Fasten foamed-insulation-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.
 2. Apply panels and associated items true to line for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
 3. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
 4. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 5. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
 6. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.
 7. Apply snap-on battens to exposed-fastener, insulated-core metal wall panel seams to conceal fasteners.
- B. Foamed-Insulation-Core Metal Wall Panels: Fasten metal wall panels to supports with concealed clips at each joint at location and spacing and with fasteners recommended by manufacturer. Fully engage tongue and groove of adjacent panels.
1. Install clips to supports with self-tapping fasteners.
- C. Laminated-Insulation-Core Metal Wall Panels:
1. Wrapped-Edge Panels:
 - a. Mechanically attach wall panels to supports using staggered, concealed side clips engaging wrapped panel edges. Install clips to supports with self-tapping fasteners. Seal joints with **[backer rod and sealant][manufacturer's standard gaskets]**.
 - b. Mechanically attach wall panels through extended edge of panels to supports using self-tapping fasteners. Seal joints with **[backer rod and sealant][manufacturer's standard gaskets]**.

2. Shiplap-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging tongue-and-groove panel edges. Install clips to supports with self-tapping fasteners.
 - a. Horizontal Joints: **[Maintain reveal joint of consistent width][Seal joints with backer rod and sealant][Seal joints with manufacturer's standard gaskets].**
 - b. Vertical Joints: **[Maintain reveal joint of consistent width][Seal joints with backer rod and sealant][Seal joints with manufacturer's standard gaskets].**
 3. Framed-Edge Panels: Mechanically attach wall panels through integral, extruded edge members to supports using self-tapping fasteners. Seal joints with manufacturer's standard gaskets.
- D. Honeycomb-Core Metal Wall Panels:
1. Wrapped-Edge Panels:
 - a. Mechanically attach wall panels to supports using staggered, concealed side clips engaging wrapped panel edges. Install clips to supports with self-tapping fasteners. Seal joints with **[backer rod and sealant][manufacturer's standard gaskets].**
 - b. Mechanically attach wall panels through extended edge of panels to supports using self-tapping fasteners. Seal joints with **[backer rod and sealant][manufacturer's standard gaskets].**
 2. Shiplap-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging tongue-and-groove panel edges. Install clips to supports with self-tapping fasteners.
 - a. Horizontal Joints: **[Maintain reveal joint of consistent width][Seal joints with backer rod and sealant][Seal joints with manufacturer's standard gaskets].**
 - b. Vertical Joints: **[Maintain reveal joint of consistent width][Seal joints with backer rod and sealant][Seal joints with manufacturer's standard gaskets].**
 3. Framed-Edge Panels: Mechanically attach wall panels through integral, extruded edge members to supports using self-tapping fasteners. Seal joints with manufacturer's standard gaskets.
- E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.
- F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 feet (3 m)** with no joints allowed within **24 inches (610 mm)** of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1

inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
- B. Water-Spray Test: After installation, test area of assembly **[shown on Drawings][as directed by Architect]**<Insert area> for water penetration in accordance with AAMA 501.2.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.
- D. Metal wall panels will be considered defective if they do not pass test and inspections.
- E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 13 19



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 42 13 19	08 80 00 00	Glazing



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SECTION 07 42 13 23 - COMPOSITE WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal composite material (MCM) wall panels.
2. Pressure-equalized rainscreen (PER) MCM system.
3. Drained and back-ventilated rainscreen (DBVR) MCM system.
4. Dry-seal barrier MCM system.
5. Wet-seal barrier MCM system.

B. Related Requirements:

1. Section 014339 "Mockups" for integrated exterior mockup requirements.
2. Section 061600 "Sheathing" for structural wall sheathing.
3. Section 072100 "Thermal Insulation" for insulation.
4. Section 072500 "Weather Barriers" for weather-resistive barriers and sealing penetrations in barriers resulting from installation of wall panel support system.
5. Section 072726 "Fluid-Applied Membrane Air Barriers" for air barriers and sealing penetrations in barriers resulting from installation of wall panel support system.

1.2 DEFINITIONS

- A. DBVR: Drained and back-ventilated rainscreen. Wall assemblies with minimum **3/8-inch- (10-mm)** wide cavity designed to drain incidental water entering the cavity and promote drying by vents through the bottom and top of the assembly.
- B. MCM: Metal composite material. Cladding material formed by joining two thin metal skins to PE or fire-retardant core and bonded under precise temperature, pressure, and tension.
- C. PER: Pressure-equalized rainscreen. Wall assemblies in which the cavity is compartmentalized to control air pressure difference.
- D. Wall Panel Assembly: Assembly consisting of wall panels, support systems, cavities, [**continuous insulation, girts,**] weather barriers, air barriers, and sheathing substrate that have been shown to comply with assembly testing and performance requirements.

1.3 COORDINATION

- A. Coordinate installation of wall panels and support system with insulation, weather barriers, air barriers, flashings, and other adjoining construction to ensure proper sequencing.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference [at Project site][by web conference]<Insert location> .

1. Meet with Owner, Architect, Owner's insurer if applicable, MCM system Installer, MCM system manufacturer's representative, and installers whose work interfaces with or affects MCM panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to MCM system installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect MCM system.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for system assembly during and after installation.
8. Review procedures for repair of field-cut panels or panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
10. Review NFPA 285 requirements for wall assembly.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of specified product.
- B. Shop Drawings:
 1. Include fabrication and installation layouts of MCM panels, details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, accessories, and special details.
 2. Accessories: Include details of flashing, trim, and anchorage, at a scale of not less than **1-1/2 inches per 12 inches (1:10)**.
- C. Samples for Initial Selection: Manufacturer's standard color charts, showing full range of available colors for each type of exposed finish.
 1. Include Samples of trim and accessories involving color selection.
- D. Samples for Verification: Actual sample of finished products for each type of exposed finish.
 1. Size: **[Manufacturer's standard size]<Insert size>** .
- E. Delegated Design Submittals: For wall panel assembly, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. Sustainable Design Submittals:
 1. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.
 2. Environmental Product Declaration (EPD): For each product.
 3. Health Product Declaration (HPD): For each product.
 4. Environmental Product Declaration (EPD): For each product.
 5. Health Product Declaration (HPD): For each product.
 6. Environmental Product Declaration (EPD): For each product.
 7. Environmental Product Declaration (EPD): For each product.
 8. Environmental Product Declaration (EPD): For each product.

9. Third-Party Certifications: For each product.
10. Third-Party-Certified Life-Cycle Assessment: For each product.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each specified **[MCM panel][MCM system]** , for tests performed by **[a qualified testing agency][manufacturer and witnessed by a qualified testing agency]** .
 1. MCM Panel Manufacturer's Material Test Reports: Certified test reports showing compliance with specific performance or third-party listing documenting compliance in accordance with the IBC.
 2. Wall Panel Assembly Test Reports: Certified test reports showing system compliance with specific performance or third-party listing documenting compliance in accordance with the IBC.
 - a. PER System: Tested to AAMA 508.
 - b. DBVR System: Tested to AAMA 509.
 - c. Dry- or Wet-Seal System: Tested to AAMA 501.1.
- B. Research Reports: For specified MCM systems, from **[an agency acceptable to authorities having jurisdiction][ICC-ES]<Insert evaluation agency>** showing compliance with **<Insert requirement>** .
- C. Preconstruction Test Reports: For specified MCM system.
- D. Field Quality Control Reports: For specified tests and inspections.
- E. Qualification Statements: For **[fabricator][Installer][testing agency][and delegated design engineer]** .
- F. Sample Warranties: For specified special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For MCM wall panels.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: **[Approved by MCM panel manufacturer][Certified MCM fabricator by the MCA]** .
- B. Installer: **[Fabricator of MCM system][Entity that employs installers and supervisors who are trained and approved by MCM system manufacturer]** .
- C. Testing Agency Qualifications: An agency acceptable to authorities having jurisdiction.
- D. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in **[state]<Insert jurisdiction>** where Project is located and who is experienced in providing engineering services of the type indicated.

1.9 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockup of typical metal wall panel assembly **[as indicated on Drawings]<Insert size>** , including **[corner,][soffits,]** supports, attachments, flashing and trim, and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: **[Owner will engage][Engage]** a qualified testing agency to perform preconstruction testing on **<Insert product>[field mockups][laboratory mockups]** .
1. Provide test specimens and assemblies representative of proposed materials and construction.
 2. Build laboratory mockups at testing agency facility; use personnel, materials, and methods of construction that will be used at Project site.
 3. Notify Architect **[seven]<Insert number>** days in advance of dates and times when laboratory mockups will be tested.
- B. Preconstruction Testing: Performed by a qualified testing agency on manufacturer's standard assemblies.
1. Water-Spray Test: Conduct water-spray test **[of mockup]** of MCM system, testing for water penetration in accordance with AAMA 501.2.
 2. Seismic Performance: Conduct seismic test **[of mockup]** of MCM system, testing for seismic performance in accordance with AAMA 501.4.
 3. PER MCM System: Conduct all tests to determine wall performance and pressure equalization in accordance with AAMA 508.
 4. DBVR MCM System: Conduct all tests to determine wall performance and provide a "V/W" classification in accordance with AAMA 509.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, MCM panels, and other manufactured items so as not to be damaged or deformed. Package MCM panels for protection during transportation and handling.
- B. Unload, store, and erect MCM panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack MCM panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store panels to ensure dryness, with positive slope for drainage of water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on MCM panels during installation.
- E. Copper MCM Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.12 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of MCM panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.13 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of MCM panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: **[Two][Five][10]<Insert number>** years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer agrees to repair finish or replace MCM panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Anodized Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D 4214.
 - c. Cracking, peeling, or chipping.
 - 3. Finish Warranty Period: **[20][10]<Insert number>** years from date of Substantial Completion.
- C. MCM System Warranty: **[System manufacturer][Fabricator]** agrees to repair or replace components of MCM system that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: **[One][Two][Five]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design MCM wall panel assembly, including support systems.
- B. Seismic Performance: No failure or deterioration of MCM system when laterally racked to **3/4 inch (19 mm)** in both directions and repeated for three cycles in accordance with AAMA 501.4. System must pass the static water test as described in ASTM E331 following the seismic racking.
- C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- D. Structural Performance: Provide MCM systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E330/E330M:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: **[As indicated on Drawings]<Insert loads>** .

3. Deflection Limits: For wind loads, no greater than **[1/180][1/240]<Insert deflection>** of the span.
 - E. Air Infiltration: Not more than **0.06 cfm/sq. ft. (0.3 L/s per sq. m)** when tested in accordance with ASTM E283/E283M at the following test-pressure difference:
 1. Test-Pressure Difference: **[1.57 lbf/sq. ft. (75 Pa)][6.24 lbf/sq. ft. (300 Pa)]** .
 - F. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E331 at the following test-pressure difference:
 1. Test-Pressure Difference: **[2.86 lbf/sq. ft. (137 Pa)][6.24 lbf/sq. ft. (300 Pa)]** .
 - G. Water Penetration under Dynamic Pressure: No water penetration when tested in accordance with AAMA 501.1 at the following test pressure:
 1. Test Pressure: **[6.24 psf (300 Pa)][12 psf (580 Pa)][15 psf (720 Pa)]<Insert pressure>** .
 - H. Pressure Cycling: Provide PER MCM system with a pass rating in accordance with AAMA 508.
 1. Lag between the cavity and the cyclic wind pressure to not exceed 0.08 seconds.
 2. Maximum differential between the cavity and the cyclic wind pressure to not exceed 50 percent of the maximum test pressure.
 - I. Provide DBVR MCM system **[with V-axis classification number greater than or equal to W-axis classification number]<Insert V-axis, W-axis>** in accordance with AAMA 509.
 - J. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 1. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature change>** .
 - K. Fire-Resistance Ratings: Comply with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Indicate design designations from UL on its "Product iQ" website or from listings of another qualified testing agency.
 - L. Fire Propagation Characteristics: MCM system to pass NFPA 285 testing as part of an approved wall assembly.
- ### 2.2 METAL COMPOSITE MATERIAL (MCM) WALL PANELS
- A. Metal Composite Material (MCM) Wall Panels : Provide MCM panels fabricated from two metal facings bonded to a solid, extruded thermoplastic core.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Alcotex Inc.]**
 - b. **[Alfrex, LLC]**
 - c. **[ALPOLIC]**

- d. [ALUCOBOND; 3A Composites USA, Inc]
 - e. [Alucoil North America]
 - f. [Arconic Architectural Products, LLC]
 - g. [Carter Architectural Panels, Inc.]
 - h. [Castle Metal Products]
 - i. [Fairview Architectural]
 - j. [StacBond]
 - k. [VM Building Solutions USA]
 - l. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Alcotex Inc.]
 - b. [Alfred, LLC]
 - c. [ALPOLIC]
 - d. [ALUCOBOND; 3A Composites USA, Inc]
 - e. [Alucoil North America]
 - f. [Arconic Architectural Products, LLC]
 - g. [Carter Architectural Panels, Inc.]
 - h. [Castle Metal Products]
 - i. [Fairview Architectural]
 - j. [StacBond]
 - k. [VM Building Solutions USA]
 - l. <Insert manufacturer's name>
 3. Core: [FR][PE] .
 4. Panel Thickness: [0.118 inch (3 mm)][0.157 inch (4 mm)][0.236 inch (6 mm)][As indicated on Drawings] .
 5. Bond Strength: 22.5 in-lb/in. (100 N x mm/mm) when tested for bond integrity in accordance with ASTM D1781.
 6. Fire Performance: Flame-spread index less than [25][75] and smoke-developed index less than 450, in accordance with ASTM E84 or UL 723.
 7. Perforated Panels: [Geometric][Slotted]<Insert pattern> , maximum [45][65] percent open. [Locations as indicated on Drawings.]
- B. MCM Panel Materials:
1. Aluminum-Faced Panels : ASTM B209/B209M [alloy as standard with manufacturer, temper as required to suit finish and forming operations][Alloy 3003, Temper H14][Alloy 5005, Temper H14]<Insert alloy, temper> with [0.020-inch- (0.50-mm-)][0.032-inch- (0.81-mm-)] thick, aluminum sheet facings.
 - a. Exterior Finish: [Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Clear anodized][Color anodized]<Insert finish> .
 - 1) Color: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color> .
 2. Copper-Faced Panels : ASTM B370 with [12 oz./sq. ft. (0.41 mm thick)][14 oz./sq. ft. (0.48 mm thick)] , copper sheet facings.
 - a. Exterior Finish: [Mill][Prepatinated]<Insert finish> .

3. Steel-Faced Panels :
 - a. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, **G90 (Z275)** coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, **Class AZ50 (Class AZM150)** coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - 1) Exterior Finish: **[Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer]<Insert finish>** .
 - a) Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>** .
 - b. Stainless Steel: ASTM A240/A240M, **[Type 304][Type 316]** with **0.016-inch- (0.41-mm-)** thick, steel sheet facings.
 - c. Weathering Steel: **[ASTM A242/242M][ASTM A588/588M][ASTM A606/606M]** with **0.016-inch- (0.41-mm-)** thick, steel sheet facings.
4. Titanium-Faced Panels : ASTM B265 with **0.016-inch- (0.41-mm-)** thick, titanium sheet facings.
 - a. Exterior Finish: **[Mill][Reflective polished]<Insert finish>** .
5. Zinc-Faced Panels : ASTM B69 with **0.020-inch- (0.50-mm-)** thick, zinc sheet facings.
 - a. Exterior Finish: **[Mill][Prepatinated]<Insert finish>** .

2.3 METAL COMPOSITE MATERIAL (MCM) WALL PANEL SYSTEMS

- A. MCM Wall Panel Systems, General: Provide complete MCM assemblies including, but not limited to, panels, support structure, attachment hardware, flashings, and accessories **[by a single manufacturer]** in compliance with testing and performance requirements indicated.
- B. System Panel Depth: **[1 inch (25 mm)][1-1/2 inches (38 mm)][1-3/4 inches (44 mm)][2 inches (51 mm)][As indicated by manufacturer's designations][As indicated on Drawings]<Insert depth>** .
- C. Support Structure and Attachment Assembly Components: **[Manufacturer's standard][Clips][Tracks][Channels]<Insert method>** formed from **[extruded aluminum][material compatible with panel facing]** .
- D. Labeling: Comply with labeling requirement of applicable building code.
- E. Pressure-Equalized Rainscreen (PER) MCM System : **[Factory-formed and -assembled,]** MCM panels formed into profile for PER system installation, drained at horizontal joints and at base of wall. Include panels, support system components, **[panel stiffeners,]** attachment hardware, flashings, and accessories required for compartmentalized, air-pressure-controlled rainscreen system.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- a. [Carter Architectural Panels, Inc.]
 - b. [Fairview Architectural]
 - c. [NorthClad Rainscreen Solutions]
 - d. [SAF (Southern Aluminum Finishing Company, Inc.)]
 - e. [Sobotec]
 - f. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Carter Architectural Panels, Inc.]
 - b. [Fairview Architectural]
 - c. [NorthClad Rainscreen Solutions]
 - d. [SAF (Southern Aluminum Finishing Company, Inc.)]
 - e. [Sobotec]
 - f. <Insert manufacturer's name>
- F. Drained and Back-Ventilated Rainscreen (DBVR) MCM System : [**Factory-formed and -assembled,** MCM panels for DBVR installation, drained at horizontal joints and at base of wall. Include attachment assembly components, [**panel stiffeners,** attachment hardware, flashings, and accessories required for back-ventilated rainscreen system.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [Citadel Architectural Products, Inc.; a Carlisle Company]
 - b. [Fairview Architectural]
 - c. [NorthClad Rainscreen Solutions]
 - d. [NOW Specialties, Inc.]
 - e. [Protean Construction Products, Inc]
 - f. [SAF (Southern Aluminum Finishing Company, Inc.)]
 - g. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Citadel Architectural Products, Inc.; a Carlisle Company]
 - b. [Fairview Architectural]
 - c. [NorthClad Rainscreen Solutions]
 - d. [NOW Specialties, Inc.]
 - e. [Protean Construction Products, Inc]
 - f. [SAF (Southern Aluminum Finishing Company, Inc.)]
 - g. <Insert manufacturer's name>
- G. Dry-Seal Barrier MCM System : [**Factory-formed and -assembled,** MCM panels formed into profile for dry-seal, gasketed barrier system installation. Include attachment assembly components, [**panel stiffeners,** joint gaskets, attachment hardware, flashings, and accessories required for weathertight system.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the

following] :

- a. [Carter Architectural Panels, Inc.]
- b. [Citadel Architectural Products, Inc.; a Carlisle Company]
- c. [Coated Metals Group]
- d. [East Coast Metal Systems]
- e. [Fairfield Metal, LLC]
- f. [MillerClapperton]
- g. [NOW Specialties, Inc.]
- h. [Sobotec]
- i. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Carter Architectural Panels, Inc.]
- b. [Citadel Architectural Products, Inc.; a Carlisle Company]
- c. [Coated Metals Group]
- d. [East Coast Metal Systems]
- e. [Fairfield Metal, LLC]
- f. [MillerClapperton]
- g. [NOW Specialties, Inc.]
- h. [Sobotec]
- i. <Insert manufacturer's name>

- H. Wet-Seal Barrier MCM System : [**Factory-formed and -assembled,**] MCM panels formed into profile for wet-seal barrier system installation. Include attachment assembly components, [**panel stiffeners,**] joint sealants, attachment hardware, flashings, and accessories required for weathertight system.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :

- a. [Carter Architectural Panels, Inc.]
- b. [Citadel Architectural Products, Inc.; a Carlisle Company]
- c. [East Coast Metal Systems]
- d. [Fairfield Metal, LLC]
- e. [MillerClapperton]
- f. [NOW Specialties, Inc.]
- g. [Protean Construction Products, Inc.]
- h. [SAF (Southern Aluminum Finishing Company, Inc.)]
- i. [Sobotec]
- j. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Carter Architectural Panels, Inc.]
- b. [Citadel Architectural Products, Inc.; a Carlisle Company]
- c. [East Coast Metal Systems]
- d. [Fairfield Metal, LLC]
- e. [MillerClapperton]

- f. [NOW Specialties, Inc.]
- g. [Protean Construction Products, Inc]
- h. [SAF (Southern Aluminum Finishing Company, Inc.)]
- i. [Sobotec]
- j. <Insert manufacturer's name>

2.4 ACCESSORIES

- A. Structural Performance: Provide support system for MCM panels capable of withstanding and transferring design loads to building structure within limits and under conditions indicated.
- B. Metal Subframing and Furring: ASTM C955 cold-formed, metallic-coated steel members, ASTM A653/A653M, **G90 (Z275)** hot-dip galvanized coating designation or ASTM A792/A792M, **Class AZ50 (Class AZM150)** aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of MCM system.
- C. Low Thermally-Conductive Cladding Support System: Provide [**manufacturer's standard**] fiberglass or fiberglass-reinforced-plastic support components designed to minimize thermal bridging.
- D. Wall Panel Assembly Accessories, General: Provide components required for a complete MCM system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of MCM panels unless otherwise indicated.
- E. Flashing and Trim: Provide flashing and trim formed from same material as MCM panels as required to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, [**parapet caps,**] soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent MCM panels.
- F. Panel Fasteners: Self-tapping screws designed to withstand design loads. Use gasketed or approved coated fasteners between dissimilar metals.
 - 1. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
 - 2. Copper Panels: Use copper, stainless steel, or hardware-bronze fasteners.
 - 3. Steel, Titanium, or Zinc Panels: Use stainless steel fasteners.
 - 4. Provide exposed fasteners with heads matching color of MCM panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- G. Dry-Seal MCM System Gaskets: ASTM C509 or ASTM C864 as required to seal joints in MCM panels and remain weathertight, and as recommended in writing by MCM manufacturer.
- H. Wet-Seal MCM System Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in MCM panels and remain weathertight; and as recommended in writing by MCM system manufacturer.

2.5 FABRICATION

- A. Fabricate and finish MCM panels at the factory, by panel manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Shop-fabricate MCM systems and accessories by fabricator's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with requirements of MCM panel manufacturer, of indicated system profiles, and with dimensional and

structural requirements.

1. Fabricate panels to dimensions indicated on Drawings based on an assumed design temperature of **70 deg F (21 deg C)**. Allow for ambient temperature range at time of fabrication.
2. Formed MCM panel lines, breaks, and angles to be sharp and straight, with surfaces free from warp or buckle.
3. Fabricate panels with sharply cut edges and no displacement of face sheet or protrusion of core.
4. Fabricated Panel Tolerances: Shop-fabricate panels to sizes and joint configurations indicated on Drawings.
 - a. Width: Plus or minus **0.079 inch (2 mm)** at **70 deg F (21 deg C)**.
 - b. Length: Plus or minus **0.079 inch (2 mm)** at **70 deg F (21 deg C)**.
 - c. Squareness: Plus or minus **0.079 inch (2 mm)** at **70 deg F (21 deg C)**.
5. Fabricate MCM panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
6. Attach routed-and-turned panel flanges to **[perimeter extrusions][panel clips]** with manufacturer's standard **[fasteners][structural silicone adhesive]** .

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with MCM manufacturer's written instructions that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams.
4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with manufacturer's written instructions.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal manufacturer.
 - a. Size: As recommended in writing by metal manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Coil-Coated Metal Finish:
 1. PVDF Fluoropolymer: AAMA 2605, **[two-coat][three-coat][two-coat, with suspended mica flakes,][three-coat, with suspended metallic flakes,]** fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat **[and clear topcoat]** . Prepare, pretreat, and

- apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**] .
2. FEVE Fluoropolymer: AAMA 2605, [one-coat][two-coat][three-coat][two-coat, with suspended mica flakes,][three-coat, with suspended metallic flakes,] fluoropolymer finish containing 100 percent FEVE resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**] .
 - D. Anodized Aluminum Finish: [Clear][Color] in accordance with AAMA 611, [AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm] or thicker.
 - E. Copper Finish: [Mill][Factory prepatinated in accordance with ASTM B882 with the appearance and durability of naturally formed patina]<Insert finish> .
 - F. Steel Finish, Stainless: Grind and polish surfaces to produce uniform finish in accordance with ASTM A480/480M, free of cross scratches. [**Run grain of directional finishes with long dimension of each piece.**]
 1. Finish Pattern: [No. 4 polished][No. 6 dull satin][No. 7 high luster][No. 8 mirror]<Insert finish> .
 - G. Steel Finish, Weathering: [Natural]<Insert finish> .
 - H. Titanium Finish: [Mill][Reflective polished]<Insert finish> .
 - I. Zinc Finish, Prepatinated: [Matte gray][Dark black][Colored mineral glaze]<Insert finish> .
 - J. Zinc Titanium Finish: ASTM B69 [Type 1, blue-gray patina][Type 1, bright rolled zinc][Type 2, graphite-gray] .
 - K. Custom finish of [aluminum][copper][steel][titanium][zinc] by <Insert name of finisher> .

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, MCM system supports, and other conditions affecting performance of the Work.
 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required in writing by MCM system manufacturer.
 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required in writing by MCM system manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and assemblies penetrating MCM system to verify actual locations of penetrations relative to seam locations of MCM panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install steel subframing, furring, and other miscellaneous support system members and anchorages in accordance with MCM wall panel manufacturer's written instructions.

3.3 INSTALLATION OF METAL COMPOSITE MATERIAL (MCM) WALL PANELS

- A. Install MCM system in accordance with panel manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor MCM system securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving MCM system.
 2. Flash and seal MCM system at perimeter of all openings. Fasten with self-tapping screws.
 3. Install screw fasteners in predrilled holes.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as MCM system work proceeds.
 6. Align bottoms of MCM panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 7. Provide watertight escutcheons at items penetrating MCM system.
 8. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action **[with gaskets][as recommended in writing by MCM system manufacturer]** .
 9. Attach MCM panels to supports at locations, spacings, and with fasteners recommended in writing by manufacturer to meet listed performance requirements.
- B. PER MCM System Installation: Install vertical **[tracks][drain channels]** and horizontal **[tracks][channels]** providing compartmentalization at locations, at spacings, and with fasteners recommended in writing by system manufacturer.
1. Attach MCM panels by interlocking panel **[clips][perimeter extrusion]** into **[tracks][channels][in a sequential series]** .
 2. Insert matching MCM spline into **[tracks][channels]** at joint reveal locations.
- C. DBVR MCM System Installation: Install vertical **[tracks][drain channels]** and horizontal **[tracks][channels]** at locations, at spacings, and with fasteners recommended in writing by system manufacturer.
1. Attach MCM panels by interlocking panel **[clips][perimeter extrusion]** into **[tracks][channels][in a sequential series]** .
 2. Insert matching MCM spline into **[tracks][channels]** at joint reveal locations.
- D. Dry-Seal MCM System Installation: Attach MCM panels by interlocking panel **[clips][perimeter extrusion]** into **[tracks][channels][in a sequential series]** .
1. Seal horizontal and vertical joints between adjacent MCM panels with manufacturer's standard gaskets.
- E. Wet-Seal MCM System Installation: Attach MCM panels by interlocking panel **[clips][perimeter extrusion]** into **[tracks][channels][in a sequential series]** .
1. Seal horizontal and vertical joints between adjacent MCM panels with sealant backing and sealant in accordance with requirements specified in Section 079200 "Joint Sealants."
- F. MCM Panel Installation: Install assembly required to support MCM panels and to provide a complete wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor

channels. Install panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.

- G. Install accessories with positive anchorage to building and watertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete MCM system assembly including copings, corners, seam covers, [sealants,][gaskets,] fillers, closure strips, and similar items.
- H. Flashing and Trim: Comply with performance requirements and panel manufacturer's written installation instructions. Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
 - 1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install trim to fit substrates and achieve watertight performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 ft. (3 m)** with no joints allowed within **24 inches (605 mm)** of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with mastic sealant (concealed within joints).

3.4 INSTALLATION TOLERANCES

- A. Shim and align MCM panels within installed tolerance of **1/4 inch in 20 ft. (6 mm in 6 m)**, non-accumulative, on level, plumb, and location lines as indicated, and within **1/8-inch (3-mm)** offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: [Owner will engage][Engage] a qualified testing agency to perform tests and inspections.
- B. Water-Spray Test: After installation, test area of wall panel assembly [as indicated on Drawings][as directed by Architect]<Insert area> for water penetration in accordance with AAMA 501.2.
 - 1. After testing, repair leaks, repeat tests, and make further repairs until wall panel assembly installation is watertight.
 - a. Cost of retesting is Contractor's responsibility.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed MCM system installation, including accessories.
 - 1. After testing, repair leaks, repeat tests, and make further repairs until wall panel assembly installation is watertight.
 - a. Cost of retesting is Contractor's responsibility.
- D. Remove and replace MCM panel assembly where tests and inspections indicate that it does not comply with specified requirements.
- E. Additional tests and inspections, at Contractor's expense, will be required to determine if replaced or

additional work complies with specified requirements.

- F. Prepare test and inspection reports.

3.6 CLEANING

- A. Remove temporary protective coverings and strippable films as MCM panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, clean finished surfaces as recommended in writing by MCM panel manufacturer. Maintain in a clean condition during construction.
- B. After installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

3.7 PROTECTION

- A. Maintain MCM panels in a clean condition during the remainder of construction.
- B. Replace MCM panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 13 23



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 42 63 00	01 11 19 00	No Specification Required



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SECTION 07 42 93 00 - SOFFIT PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal soffit panels.

B. Related Requirements:

1. Section 074113.13 "Formed Metal Roof Panels" for lap-seam metal roof panels.
2. Section 074213.13 "Formed Metal Wall Panels" for lap-seam metal wall panels.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:** Conduct conference at **[Project site]<Insert location>**.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Metal soffit panels.

B. Product Data Submittals:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

C. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

D. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than **1-1/2 inches per 12 inches (1:10)**.

E. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

F. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal Panels: **12 inches (305 mm)** long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, tests performed by a qualified testing agency.
- C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.
- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 1. Build mockup of typical roof eave[, **including fascia,**] and soffit as shown on Drawings; approximately **[four panels wide]**<Insert size> by full eave width, including attachments and accessories.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

- E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: **[20][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: **[As indicated on Drawings]<Insert loads>**.

3. Deflection Limits: For wind loads, no greater than [1/180][1/240]<Insert deflection> of the span.
 4. <Insert serviceability requirements>.
- C. Air Infiltration: Air leakage of not more than [0.06 cfm/sq. ft. (0.3 L/s per sq. m)]<Insert rate> when tested according to ASTM E283 at the following test-pressure difference:
1. Test-Pressure Difference: [1.57 lbf/sq. ft. (75 Pa)][6.24 lbf/sq. ft. (300 Pa)].
- D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
1. Test-Pressure Difference: [2.86 lbf/sq. ft. (137 Pa)][6.24 lbf/sq. ft. (300 Pa)].
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): [120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature range>.

2.2 METAL SOFFIT PANELS

- A. Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Metal Soffit Panels: Match profile and material of metal [wall][roof] panels.
1. Finish: [Match finish and color of metal wall panels][Match finish and color of metal roof panels][As indicated on Drawings].
 2. Sealant: Factory applied within interlocking joint.
- C. Flush-Profile Metal Soffit Panels : [Solid][Perforated] panels formed with vertical panel edges and [intermediate stiffening ribs symmetrically spaced][a flat pan] between panel edges; with flush joint between panels.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [AEP Span a brand of ASC Profiles LLC, a part of BlueScope]
 - b. [ATAS International, Inc.]
 - c. [Berridge Manufacturing Company]
 - d. [CENTRIA, a Nucor Brand]
 - e. [Dimensional Metals, Inc.]
 - f. [Drexel Metals Corp.]
 - g. [Elevate; Holcim Building Envelope]
 - h. [Englert, Inc.]
 - i. [Fabral; a brand of Flack Global Metals]
 - j. [Innovative Metals Company, Inc]
 - k. [Knotwood US LLC]
 - l. [MBCI; Cornerstone Building Brands]

- m. [McElroy Metal, Inc]
 - n. [Merchant & Evans Inc.]
 - o. [Metal Sales Manufacturing Corporation]
 - p. [PAC-CLAD; Petersen; a Carlisle company]
 - q. [Sentrigard; NB Handy Company]
 - r. [Ultra Seam Incorporated]
 - s. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [AEP Span a brand of ASC Profiles LLC, a part of BlueScope]
 - b. [ATAS International, Inc.]
 - c. [Berridge Manufacturing Company]
 - d. [CENTRIA, a Nucor Brand]
 - e. [Dimensional Metals, Inc.]
 - f. [Drexel Metals Corp.]
 - g. [Elevate; Holcim Building Envelope]
 - h. [Englert, Inc.]
 - i. [Fabral; a brand of Flack Global Metals]
 - j. [Innovative Metals Company, Inc]
 - k. [Knotwood US LLC]
 - l. [MBCI; Cornerstone Building Brands]
 - m. [McElroy Metal, Inc]
 - n. [Merchant & Evans Inc.]
 - o. [Metal Sales Manufacturing Corporation]
 - p. [PAC-CLAD; Petersen; a Carlisle company]
 - q. [Sentrigard; NB Handy Company]
 - r. [Ultra Seam Incorporated]
 - s. <Insert manufacturer's name>
3. Material: Same material, finish, and color as metal [wall][roof] panels.
4. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, **G90 (Z275)** coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, **Class AZ50 (Class AZM150)** coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Nominal Thickness: [0.022 inch (0.56 mm)][0.028 inch (0.71 mm)][0.034 inch (0.86 mm)][0.040 inch (1.02 mm)][0.052 inch (1.32 mm)].
 - b. Exterior Finish: [Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester]<Insert finish>.
 - c. Color: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.
5. Aluminum Sheet: Coil-coated sheet, **ASTM B209 (ASTM B209M)**, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - a. Thickness: [0.032 inch (0.81 mm)][0.040 inch (1.02 mm)].
 - b. Surface: [Smooth, flat][Embossed] finish.
 - c. Exterior Finish: [Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester][Clear anodized][Color anodized]<Insert finish>.
 - d. Color: [As indicated by manufacturer's designations][Match Architect's samples][As

selected by Architect from manufacturer's full range]<Insert color>.

6. Stainless Steel Sheet: ASTM A240/A240M, [Type 304][Type 316], fully annealed.
 - a. Nominal Thickness: [0.0188 inch (0.477 mm)][0.0250 inch (0.635 mm)][0.0313 inch (0.795 mm)][0.0375 inch (0.952 mm)][0.0500 inch (1.270 mm)].
 - b. Exterior Finish: [ASTM A480/A480M No. 4][ASTM A480/A480M No. 2B]<Insert finish>.
7. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 temper.
 - a. Thickness: [16 oz./sq. ft. (0.55 mm thick)][20 oz./sq. ft. (0.70 mm thick)].
 - b. Exposed Finish: [Mill][Prepatinated].
 - c. Prepatinated Color: [Dark brown][Verdigris]<Insert color>.
8. Panel Coverage: [8 inches (203 mm)][12 inches (305 mm)][16 inches (406 mm)][20 inches (508 mm)]<Insert dimension>.
9. Panel Height: [0.875 inch (22 mm)][1.0 inch (25 mm)][1.5 inches (38 mm)][3.0 inches (76 mm)]<Insert dimension>.

D. Reveal-Joint-Profile Metal Soffit Panels : [Solid][Perforated] panels formed with vertical panel edges and [intermediate stiffening ribs symmetrically spaced][a flat pan] between panel edges; with recessed reveal joint between panels.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [ATAS International, Inc.]
 - b. [Berridge Manufacturing Company]
 - c. [Cheney Flashing Company]
 - d. [Drexel Metals Corp.]
 - e. [Elevate; Holcim Building Envelope]
 - f. [Firestone Metal Products]
 - g. [Merchant & Evans Inc.]
 - h. [PAC-CLAD; Petersen; a Carlisle company]
 - i. [Sentrigard; NB Handy Company]
 - j. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [ATAS International, Inc.]
 - b. [Berridge Manufacturing Company]
 - c. [Cheney Flashing Company]
 - d. [Drexel Metals Corp.]
 - e. [Elevate; Holcim Building Envelope]
 - f. [Firestone Metal Products]
 - g. [Merchant & Evans Inc.]
 - h. [PAC-CLAD; Petersen; a Carlisle company]
 - i. [Sentrigard; NB Handy Company]
 - j. <Insert manufacturer's name>
3. Material: Same material, finish, and color as metal [wall][roof] panels.

4. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, **G90 (Z275)** coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, **Class AZ50 (Class AZM150)** coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Nominal Thickness: **[0.022 inch (0.56 mm)][0.028 inch (0.71 mm)][0.034 inch (0.86 mm)][0.040 inch (1.02 mm)][0.052 inch (1.32 mm)]**.
 - b. Exterior Finish: **[Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester]<Insert finish>**.
 - c. Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>**.
5. Aluminum Sheet: Coil-coated sheet, **ASTM B209 (ASTM B209M)**, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
 - a. Thickness: **[0.032 inch (0.81 mm)][0.040 inch (1.02 mm)]**.
 - b. Surface: **[Smooth, flat][Embossed]** finish.
 - c. Exterior Finish: **[Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester][Clear anodized][Color anodized]<Insert finish>**.
 - d. Color: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>**.
6. Stainless Steel Sheet: ASTM A240/A240M, **[Type 304][Type 316]**, fully annealed.
 - a. Nominal Thickness: **[0.0188 inch (0.477 mm)][0.0250 inch (0.635 mm)][0.0313 inch (0.795 mm)][0.0375 inch (0.952 mm)][0.0500 inch (1.270 mm)]**.
 - b. Exterior Finish: **[ASTM A480/A480M No. 4][ASTM A480/A480M No. 2B]<Insert finish>**.
7. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 temper.
 - a. Thickness: **[16 oz./sq. ft. (0.55 mm thick)][20 oz./sq. ft. (0.70 mm thick)]**.
 - b. Exposed Finish: **[Mill][Prepatinated]**.
 - c. Prepatinated Color: **[Dark brown][Verdigris]<Insert color>**.
8. Panel Coverage: **[8 inches (203 mm)][12 inches (305 mm)][16 inches (406 mm)][20 inches (508 mm)]<Insert dimension>**.
9. Panel Height: **[0.75 inch (19 mm)][1.0 inch (25 mm)][1.5 inches (38 mm)]<Insert dimension>**.
- E. V-Groove-Profile Metal Soffit Panels : **[Solid][Perforated]** panels formed with vertical panel edges and **[intermediate stiffening ribs symmetrically spaced][a flat pan]** between panel edges; with a V-groove joint between panels.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ATAS International, Inc.]**
 - b. **[Berridge Manufacturing Company]**
 - c. **[Dimensional Metals, Inc.]**
 - d. **[Englert, Inc.]**
 - e. **[Fabral; a brand of Flack Global Metals]**
 - f. **[Innovative Metals Company, Inc]**

- g. [McElroy Metal, Inc]
 - h. [PAC-CLAD; Petersen; a Carlisle company]
 - i. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [ATAS International, Inc.]
 - b. [Berridge Manufacturing Company]
 - c. [Dimensional Metals, Inc.]
 - d. [Englert, Inc.]
 - e. [Fabral; a brand of Flack Global Metals]
 - f. [Innovative Metals Company, Inc]
 - g. [McElroy Metal, Inc]
 - h. [PAC-CLAD; Petersen; a Carlisle company]
 - i. <Insert manufacturer's name>
3. Material: Same material, finish, and color as metal [wall][roof] panels.
4. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, **G90 (Z275)** coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, **Class AZ50 (Class AZM150)** coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
- a. Nominal Thickness: [0.022 inch (0.56 mm)][0.028 inch (0.71 mm)][0.034 inch (0.86 mm)][0.040 inch (1.02 mm)][0.052 inch (1.32 mm)].
 - b. Exterior Finish: [Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester]<Insert finish>.
 - c. Color: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.
5. Aluminum Sheet: Coil-coated sheet, **ASTM B209 (ASTM B209M)**, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
- a. Thickness: [0.032 inch (0.81 mm)][0.040 inch (1.02 mm)].
 - b. Surface: [Smooth, flat][Embossed] finish.
 - c. Exterior Finish: [Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Siliconized polyester][Clear anodized][Color anodized]<Insert finish>.
 - d. Color: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.
6. Stainless Steel Sheet: ASTM A240/A240M, [Type 304][Type 316], fully annealed.
- a. Nominal Thickness: [0.0188 inch (0.477 mm)][0.0250 inch (0.635 mm)][0.0313 inch (0.795 mm)][0.0375 inch (0.952 mm)][0.0500 inch (1.270 mm)].
 - b. Exterior Finish: [ASTM A480/A480M No. 4][ASTM A480/A480M No. 2B]<Insert finish>.
7. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 temper.
- a. Thickness: [16 oz./sq. ft. (0.55 mm thick)][20 oz./sq. ft. (0.70 mm thick)].
 - b. Exposed Finish: [Mill][Prepatinated].
 - c. Prepatinated Color: [Dark brown][Verdigris]<Insert color>.

8. Panel Coverage: [6 inches (152 mm)][12 inches (305 mm)][14 inches (356 mm)]<Insert dimension>.
9. Panel Height: [0.375 inch (10 mm)][0.44 inch (11 mm)][0.50 inch (13 mm)][0.625 inch (16 mm)]<Insert dimension>.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, **G90 (Z275)** hot-dip galvanized coating designation or ASTM A792/A792M, **Class AZ50 (Class AZM150)** aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum **1-inch- (25-mm-)** thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape **1/2 inch (13 mm)** wide and **1/8 inch (3 mm)** thick.
 2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.4 FABRICATION

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a

weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal soffit panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Steel Panels and Accessories:
1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
 2. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
 3. Mica Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
 4. Metallic Fluoropolymer: AAMA 621. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
 5. FEVE Fluoropolymer: AAMA 621. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat. Prepare, pretreat, and apply coating to

6. exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
6. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than **0.2 mil (0.005 mm)** for primer and **0.8 mil (0.02 mm)** for topcoat.
7. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of **0.5 mil (0.013 mm)**.

D. Aluminum Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
2. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
3. Mica Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
4. Metallic Fluoropolymer: AAMA 2605. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
5. FEVE Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether (FEVE) resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
6. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than **0.2 mil (0.005 mm)** for primer and **0.8 mil (0.02 mm)** for topcoat.
7. Exposed Anodized Finish:
 - a. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**][**AA-M12C22A31, Class II, 0.010 mm**] or thicker.
 - b. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**][**AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.

E. Stainless Steel Panels and Accessories:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - c. Directional Satin Finish: ASTM A480/A480M No. 4.
3. Bright, Cold-Rolled, Unpolished Finish: ASTM A480/A480M No. 2B.

F. Copper Panels and Accessories:

1. Prepatination: Factory prepatinate according to ASTM B882 to convert the copper surface to an inorganic crystalline structure with the appearance and durability of naturally formed patina.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 - 1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.
 - 2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.
 - a. Verify that air- or water-resistive barriers been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.
 - 1. Soffit Framing: Wire tie[**or clip**] furring channels to supports[, **as required to comply with requirements for assemblies indicated**].

3.3 INSTALLATION OF METAL SOFFIT PANELS

- A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal panels.
 - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
 - 1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
 - 2. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior;

- use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- 3. Copper Panels: Use copper, stainless steel, or hardware-bronze fasteners.
- 4. Stainless Steel Panels: Use stainless steel fasteners.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
 - 1. Apply panels and associated items true to line for neat and weathertight enclosure.
 - 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
 - 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 - 4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
- E. Watertight Installation:
 - 1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
 - 2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
 - 3. At panel splices, nest panels with minimum **6-inch (152-mm)** end lap, sealed with sealant and fastened together by interlocking clamping plates.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
 - 1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 feet (3 m)** with no joints allowed within **24 inches (610 mm)** of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with mastic sealant (concealed within joints).

3.4 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean

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condition during construction.

- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 93 00

SECTION 07 46 16 00 - METAL PLATE WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes metal plate wall panels.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.
1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 7. Review temporary protection requirements for metal panel assembly during and after installation.
 8. Review procedures for repair of metal panels damaged after installation.
 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. Environmental Product Declaration: For each product.
 3. Health Product Declaration: For each product.
 4. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
 5. Environmental Product Declaration: For each product.
 6. Environmental Product Declaration: For each product.
 7. Environmental Product Declaration: For each product.
 8. Third-Party Certifications: For each product.
 9. Third-Party Certified Life Cycle Assessment: For each product.

- C. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of the flashing, trim, and anchorage, at a scale of not less than **1-1/2 inches per 12 inches (1:10)**.
- D. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
 - 1. Include similar Samples of trim and accessories involving color selection.
- E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Metal Panels: **12 inches (305 mm)** long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical metal panel assembly [**as shown on Drawings**]**<Insert size>**, including [**corner**,]**[soffits]**, supports, attachments, and accessories.
 - 2. Water-Spray Test: Conduct water-spray test of mockup of metal panel assembly, testing for water penetration according to AAMA 501.2.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: **[20][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E330:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: **[As indicated on Drawings]<Insert loads>**.
 - 3. Deflection Limits: For wind loads, no greater than **[1/180][1/240]<Insert deflection>** of the span.
 - 4. **<Insert serviceability requirements>**.
- B. Air Infiltration: Air leakage of not more than **0.06 cfm/sq. ft. (0.3 L/s per sq. m)** when tested according to ASTM E283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: **[1.57 lbf/sq. ft. (75 Pa)][6.24 lbf/sq. ft. (300 Pa)]**.
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: **[2.86 lbf/sq. ft. (137 Pa)][6.24 lbf/sq. ft. (300 Pa)]**.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature range>**.
- E. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 METAL PLATE WALL PANELS

- A. Metal Plate Wall Panels: Provide factory-formed, metal plate wall panels fabricated from single sheets of metal formed into profile for installation method indicated. Include attachment assembly components[, **panel stiffeners**], and accessories required for weathertight system.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. **[Alfred, LLC]**
 - b. **[Alply Insulated Panels LLC]**
 - c. **[American Metalcraft Inc.]**
 - d. **[Architectural Specialty Products, Inc]**
 - e. **[Castle Metal Products]**
 - f. **[DAMS Incorporated; D. Architectural Metal Solutions Incorporated]**
 - g. **[Fabral; a brand of Flack Global Metals]**

- h. [Fairview Architectural]
 - i. [Firestone Metal Products]
 - j. [Metal Sales & Service, Inc.]
 - k. [Protean Construction Products, Inc]
 - l. [SAF (Southern Aluminum Finishing Company, Inc.)]
 - m. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Alfred, LLC]
 - b. [Alply Insulated Panels LLC]
 - c. [American Metalcraft Inc.]
 - d. [Architectural Specialty Products, Inc]
 - e. [Castle Metal Products]
 - f. [DAMS Incorporated; D. Architectural Metal Solutions Incorporated]
 - g. [Fabral; a brand of Flack Global Metals]
 - h. [Fairview Architectural]
 - i. [Firestone Metal Products]
 - j. [Metal Sales & Service, Inc.]
 - k. [Protean Construction Products, Inc]
 - l. [SAF (Southern Aluminum Finishing Company, Inc.)]
 - m. <Insert manufacturer's name>
- B. Panel Depth: [2 inches (51 mm)][As indicated on Drawings]<Insert dimension>.
- C. Aluminum Sheet: Tension-leveled, smooth aluminum sheet, **ASTM B209 (ASTM B209M)**, [0.120 inch (3.05 mm)][0.125 inch (3.18 mm)][0.1875 inch (4.76 mm)][0.190 inch (4.82 mm)] thick.
1. Exterior Finish: [Two-coat fluoropolymer][Three-coat fluoropolymer][Mica fluoropolymer][Metallic fluoropolymer][FEVE fluoropolymer][Clear anodized][Color anodized]<Insert finish>.
 - a. Color: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]<Insert color>.
- D. Attachment Assembly: [Manufacturer's standard][Flange attachment][Clip][Subgirt and spline][Track support][Rail support][Rainscreen-principle system].
- 2.3 MISCELLANEOUS MATERIALS
- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, **G90 (Z275 hot-dip galvanized)** coating designation or ASTM A792/A792M, **Class AZ50 (Class AZM150)** aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
 - B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
 - C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer. Provide sealant types that are compatible with panel materials, are nonstaining, and do not damage panel finish.

2.4 FABRICATION

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Aluminum Panels and Accessories:
 - 1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal

- surfaces to comply with coating and resin manufacturers' written instructions.
2. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 3. Mica Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 4. Metallic Fluoropolymer: AAMA 2605. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 5. FEVE Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish containing 100 percent fluorinated ethylene vinyl ether resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 6. Exposed Anodized Finish:
 - a. Clear Anodic Finish: AAMA 611, [AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm] or thicker.
 - b. Color Anodic Finish: AAMA 611, [AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm] or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.3 INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal

panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Attachment Assembly, General: Install attachment assembly required to support metal plate wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

E. Installation: Attach metal plate wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.

1. Wet Seal Systems: Seal horizontal and vertical joints between adjacent metal plate wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."
2. Rainscreen Systems: Do not apply sealants to joints unless otherwise indicated.

F. Flange-Attachment Installation: Attach metal plate wall panels, formed with extended perimeter flanges, to supports at locations, spacings, and with fasteners recommended by manufacturer.

1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."
2. Seal horizontal and vertical joints between adjacent panels with manufacturer's standard gaskets.

G. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended by manufacturer. Attach flanges of metal plate wall panels to panel clips **[with fasteners][by welding][with fasteners or by welding]**, as recommended by manufacturer.

1. Seal horizontal and vertical joints between adjacent metal plate wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."
2. Seal horizontal and vertical joints between adjacent metal plate wall panels with manufacturer's

standard gaskets.

- H. Subgirt-and-Spline Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use manufacturer's standard subgirts and splines that provide support and complete secondary drainage assembly, draining to the exterior at horizontal joints. Attach metal plate wall panels by interlocking perimeter extrusions attached to panels with subgirts and splines. Fully engage integral subgirt-and-spline gaskets and leave horizontal and vertical joints with open reveal. Terminate edge of panels flush with perimeter extrusions.
1. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
 2. Do not apply sealants to joints unless otherwise indicated.
- I. Track-Support Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use manufacturer's standard horizontal tracks and vertical **[tracks][drain channels]** that provide support and secondary drainage assembly, draining to the exterior at horizontal joints through drain tube. Attach metal plate wall panels to tracks by interlocking panel edges with manufacturer's standard "T" clips.
1. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
 2. Seal horizontal and vertical joints between adjacent metal plate wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."
- J. Rail-Support Installation: Install rails at locations, spacings, and with fasteners recommended by manufacturer. Use manufacturer's standard interlocking rails that provide support and complete secondary drainage assembly, draining to the exterior at horizontal joints. Attach metal plate wall panels by overlapping and interlocking support rails with perimeter rails attached to panels. Apply sealant, foam sealant, and tape sealant at locations recommended by manufacturer. Leave horizontal and vertical joints with open reveal.
1. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
 2. Install backer plates before installing support rails.
 3. Do not apply sealants to joints unless otherwise indicated.
- K. Rainscreen-Principle Installation: Install using manufacturer's standard assembly with vertical channel that provides support and secondary drainage assembly, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by manufacturer. Attach metal plate wall panels by inserting horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.
1. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
 2. Do not apply sealants to joints unless otherwise indicated.
- L. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended in writing by metal panel manufacturer.

- M. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of **10 feet (3 m)** with no joints allowed within **24 inches (605 mm)** of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal plate wall panel units within installed tolerance of **1/4 inch in 20 feet (6 mm in 6 m)**, non-accumulative, on level, plumb, and location lines as indicated, and within **1/8-inch (3-mm)** offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified independent testing agency to perform field tests and inspections.
- B. Water-Spray Test: After installation, test area of assembly **[shown on Drawings][as directed by Architect]**<Insert area> for water penetration according to AAMA 501.2.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.
- D. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.



END OF SECTION 07 46 16 00



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SECTION 07 46 16 00A - ALUMINUM SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum siding.
2. Aluminum soffit.
3. Aluminum components.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
2. Section 062013 "Exterior Finish Carpentry" for exterior **[cellular PVC][and][foam-plastic]** trim.
3. Section 072500 "Weather Barriers" for weather-resistive barriers.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

B. Shop Drawings:

1. Include construction details, material descriptions, dimensions of individual components and profiles, **[assembly description and supports details,]** and finishes; **signed and sealed by the qualified professional engineer responsible for their preparation**.

- C. Samples for Initial Selection: For aluminum **[siding][soffit][and][components]** including related accessories.

- D. Samples for Verification: Actual sample of finished products **[for each type, color, texture, and pattern required]**.

1. Size: **[Manufacturers' standard size]<Insert size>**.

E. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
3. Environmental Product Declaration (EPD): For each product.
4. Health Product Declaration (HPD): For each product.
5. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.

6. Environmental Product Declaration (EPD): For each product.
7. Health Product Declaration (HPD): For each product.
8. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
9. Environmental Product Declaration (EPD): For each product.
10. Environmental Product Declaration (EPD): For each product.
11. Environmental Product Declaration (EPD): For each product.
12. Third-Party Certifications: For each product.
13. Third-Party-Certified Life-Cycle Assessment: For each product.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Research/Evaluation Reports: For each type of aluminum siding required, from ICC-ES.
- B. Qualification Statements: For Installer **[and]<Insert entity or specialist>**.
- C. Delegated Design Engineer Qualifications: For component assemblies.
- D. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of product, including related accessories.
- B. Warranty Documentation:
 1. Manufacturers' special warranties.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Furnish full lengths of aluminum **[siding][soffit][and][components]** including related accessories, in a quantity equal to **<Insert value>**.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: **[Fabricator of products][Entity that employs installers and supervisors who are trained and approved by manufacturer][Authorized representative who is trained and approved by manufacturer]**.
- B. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in **[state]<Insert jurisdiction>** where Project is located and who is experienced in providing engineering services of the type indicated.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockup of typical wall area as indicated on Drawings.
2. Build mockups for [**siding**][**soffit**][**and**][**components**] including accessories.
 - a. Size: **[48 inches (1200 mm) long by 60 inches (1800 mm) high]**<Insert dimensions>.
 - b. Include outside corner on one end of mockup[**and inside corner on other end**].
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with labels intact until time of use.
- B. Store and protect materials on elevated platforms, under cover, and in a dry location.

1.10 COORDINATION

- A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including cracking[, **fading**,] and deforming.
 - b. Deterioration of metals, metal finishes, and other materials beyond weathering.
 - c. **<Insert failure modes>**.
 2. Fading is defined as loss of color, after cleaning with product recommended in writing by manufacturer, of more than **[4][5][7]** Hunter color-difference units as measured in accordance with ASTM D2244.
 3. Warranty Period: **[10][15][20][25][50]**<Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain products, including related accessories, from single source from single manufacturer.

2.2 ALUMINUM SIDING

- A. Aluminum Siding: Formed and coated product complying with AAMA 1402.
 1. Manufacturers: Subject to compliance with requirements, [**provide products by the**

following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Architectural Metal Solutions]
 - b. [Gentek Building Products, Inc]
 - c. [Kaycan Ltd]
 - d. [Knotwood US LLC]
 - e. [Longboard Products]
 - f. [Mastic; Ply Gem]
 - g. [Norandex]
 - h. [Rollex Corporation]
 - i. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Architectural Metal Solutions]
 - b. [Gentek Building Products, Inc]
 - c. [Kaycan Ltd]
 - d. [Knotwood US LLC]
 - e. [Longboard Products]
 - f. [Mastic; Ply Gem]
 - g. [Norandex]
 - h. [Rollex Corporation]
 - i. <Insert manufacturer's name>
3. Horizontal Pattern:
 - a. 8-inch (203-mm) exposure in [plain, single-board][beaded-edge, single-board][plain, double, 4-inch (102-mm) board]<Insert requirement> style.
 - b. 10-inch (254-mm) exposure in [plain,][Dutch-lap,]<Insert requirement> double, 5-inch (127-mm) board style.
4. Vertical Pattern: [12-inch (300-mm) exposure in board-and-batten, single-board style][16-inch (400-mm) exposure in V-grooved, triple, 5-1/3-inch (135-mm) board style].
5. Texture: [Smooth][Wood grain]<Insert texture>.
6. Nominal Thickness: [0.019 inch (0.5 mm)][0.024 inch (0.6 mm)][0.062 inch (1.6 mm)]<Insert dimension>.
7. Insulation: Manufacturer's standard integral insulation panels.
8. Related Materials: Provide siding starter strips, edge trim, outside and inside corner caps, and other items as recommended in writing by siding manufacturer for building configuration.
 - a. Provide siding accessories [made from same material as][matching color and texture of] adjacent siding unless otherwise indicated.
9. Flashing: Provide aluminum flashing complying with Section 076200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.
 - a. Finish for Aluminum Flashing: [Same as aluminum siding][Siliconized polyester coating, same color as siding][High-performance organic finish, same color as siding][Factory-prime coating]<Insert finish>.
10. Fasteners:

- a. For fastening to wood, use **[siding nails][ribbed bugle-head screws]** of sufficient length to penetrate a minimum of **1 inch (25 mm)** into substrate.
 - b. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of **1/4 inch (6 mm)**, or three screw-threads, into substrate.
 - c. For fastening aluminum, use aluminum fasteners. Where fasteners are exposed to view, use prefinished aluminum fasteners in color to match item being fastened.
11. Accessories are to be made from same material as adjacent siding unless otherwise indicated.
- a. Corner posts **[with fluted faces]**.
 - b. Door and window casings **[with fluted faces]**.
 - c. Entrance and window head pediments.
 - d. Pilasters **[with fluted faces]**.
 - e. Shutters with **[paneled][louvered]** faces.
 - f. Louvers.
 - g. Fasciae.
 - h. Moldings
 - i. Trim coils.
12. Finish: Manufacturer's standard **[three-coat PVDF][primer and baked-on acrylic][primer and baked-on polyester]<Insert finish>**.
- a. Colors: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range of colors]**.

2.3 ALUMINUM SOFFIT

- A. Aluminum Soffit: Formed and coated product complying with AAMA 1402.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Architectural Metal Solutions]**
 - b. **[Gentek Building Products, Inc]**
 - c. **[Kaycan Ltd]**
 - d. **[Mastic; Ply Gem]**
 - e. **[Norandex]**
 - f. **[Rollex Corporation]**
 - g. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Metal Solutions]**
 - b. **[Gentek Building Products, Inc]**
 - c. **[Kaycan Ltd]**
 - d. **[Mastic; Ply Gem]**
 - e. **[Norandex]**
 - f. **[Rollex Corporation]**
 - g. **<Insert manufacturer's name>**
3. Pattern:

- a. **6-inch (152-mm)** exposure in V-grooved, single-board style.
 - b. **10-inch (254-mm)** exposure in V-grooved, double, **5-inch (127-mm)** board style.
 - c. **12-inch (300-mm)** exposure in V-grooved, double, **6-inch (152-mm)** board style.
 - d. **16-inch (400-mm)** exposure in V-grooved, [**triple, 5-1/3-inch (135-mm)**][**quadruple, 4-inch (102-mm)**]**<Insert requirement>** board style.
4. Texture: [**Smooth**][**Wood grain**]**<Insert texture>**.
5. Ventilation: Provide [**perforated**][**unperforated**] soffit[**unless otherwise indicated**].
6. Nominal Thickness: [**0.019 inch (0.5 mm)**][**0.024 inch (0.6 mm)**][**0.062 inch (1.6 mm)**]**<Insert thickness>**.
7. Insect Screening for Soffit Vents: [**Aluminum, 18-by-16-inch (1.4-by-1.6-mm) mesh**][**PVC-coated, glass-fiber fabric, 18-by-14 or 18-by-16-inch (1.4-by-1.8- or 1.4-by-1.6-mm) mesh**]**<Insert requirement>**.
8. Continuous Soffit Vents: Aluminum, hat-channel shape, with [**stamped louvers**][**perforations**]; **2 inches (51 mm)** wide and not less than **96 inches (2438 mm)** long.
 - a. Net-Free Area: [**4 sq. inch/linear ft. (280 sq. cm/m)**][**6 sq. inch/linear ft. (420 sq. cm/m)**][**8 sq. inch/linear ft. (560 sq. cm/m)**]**<Insert dimension>**.
 - b. Finish: [**Mill finish**][**White paint**][**Brown paint**][**Match soffit**]**<Insert finish>**.
9. Round Soffit Vents: Stamped aluminum louvered vents, [**2 inches (51 mm)**][**2-1/2 inches (64 mm)**][**3 inches (76 mm)**][**4 inches (102 mm)**]**<Insert dimension>** in diameter, made to be inserted in round holes cut into soffit.
 - a. Finish: [**Mill finish**][**White paint**][**Brown paint**][**Match soffit**]**<Insert finish>**.
10. Related Materials: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended in writing by siding manufacturer for building configuration.
 - a. Provide accessories [**made from same material as**][**matching color and texture of**] adjacent siding unless otherwise indicated.
11. Flashing: Provide aluminum flashing complying with Section 076200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.
 - a. Finish for Aluminum Flashing: [**Same as aluminum siding**][**Siliconized polyester coating, same color as siding**][**High-performance organic finish, same color as siding**][**Factory-prime coating**]**<Insert finish>**.
12. Fasteners:
 - a. For fastening to wood, use [**siding nails**][**ribbed bugle-head screws**] of sufficient length to penetrate a minimum of **1 inch (25 mm)** into substrate.
 - b. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of **1/4 inch (6 mm)**, or three screw-threads, into substrate.
 - c. For fastening aluminum, use aluminum fasteners. Where fasteners are exposed to view, use prefinished aluminum fasteners in color to match item being fastened.
13. Finish: Manufacturer's standard [**AAMA 2603**][**AAMA 2604**][**AAMA 2605**][**anti-graffiti**]**<Insert finish>**.
 - a. Colors: [**As indicated by manufacturer's designations**][**Match Architect's samples**][**As selected by Architect from manufacturer's full range of colors**][**Match adjacent siding**].

2.4 ALUMINUM COMPONENTS

- A. Aluminum Components: Precoated, formed, extruded aluminum sheet; minimum 6063-T5 and structural performance to suit Project requirements.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Architectural Metal Solutions]**
 - b. **[B+N Industries, Inc.]**
 - c. **[Knotwood US LLC]**
 - d. **[Longboard Products]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Metal Solutions]**
 - b. **[B+N Industries, Inc.]**
 - c. **[Knotwood US LLC]**
 - d. **[Longboard Products]**
 - e. **<Insert manufacturer's name>**
 3. Component-Type Assembly:
[Cladding][Soffit][Fencing][Screen][Gate][Enclosure][Railing][Awning][Pergola][Trellis][Decking][Interior wall][Ceiling][Partition]<Insert component type>.
 4. Component-Type Materials: Extruded aluminum to match assembly type.
 - a. Plank profile **<Insert size>**.
 - b. Batten profile **<Insert size>**.
 - c. Beam profile **<Insert size>**.
 - d. Cladding boards **<Insert size>**.
 - e. Posts **<Insert size>**.
 - f. Slats **<Insert size>**.
 - g. Gate frames **<Insert size>**.
 - h. **<Insert component-type material><Insert size>**.
 5. Nominal Thickness: **[0.019 inch (0.5 mm)][0.016 inch (0.41 mm)][0.024 inch (0.6 mm)][0.016 inch (0.41 mm)][0.055 inch (1.4 mm)][0.062 inch (1.6 mm)][0.071 inch (1.8 mm)][0.094 inch (2.40 mm)]<Insert thickness>**.
 6. Related Materials: Provide edge trim, mounting supports, clips, clip and grit system, infills, spacers, brackets, end mounts, corner trim, end caps, assembly hardware, **[siding board,][flat reveals,][U-reveals,]** and other items as recommended in writing by component manufacturer for building assembly configuration.
 - a. Provide accessories **[made from same material as][matching color and texture of]** adjacent siding unless otherwise indicated.
 7. Acoustic: Manufacturer's noise reduction material or fabric.
 8. Flashing: Provide aluminum flashing complying with Section 076200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.
 - a. Finish for Aluminum Flashing: **[Same as aluminum siding][Siliconized polyester]**

coating, same color as siding][High-performance organic finish, same color as siding]<Insert finish>.

9. Fasteners:
 - a. For fastening to wood, use sufficient length to penetrate a minimum of **1 inch (25 mm)** into substrate. Provide fastener types as recommended in writing by manufacturer.
 - b. For fastening to metal, provide fastener types as recommended in writing by manufacturer.
 - c. For fastening aluminum, use aluminum fasteners. Where fasteners are exposed to view, use prefinished aluminum fasteners in color to match item being fastened.
10. Finish:
 - a. Type: Manufacturer's standard **[solid][wood grain][metallic][speckle][naturally aged metal][sublimated dye]<Insert finish type>.**
 - b. Texture: **[Smooth][Textured]<Insert texture>.**
 - c. Sheen: Manufacturer's standard **[matte][satin][glossy].**
 - d. Performance: **[AAMA 2603][AAMA 2604][AAMA 2605][and][anti-graffiti]<Insert performance requirement>.**
 - e. Colors: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range of colors].**

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of aluminum **[siding][soffit][and][components]** and related accessories.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION OF ALUMINUM SIDING

- A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 1. Provide thermal movement for materials as recommended in writing by manufacturer.
- B. Install aluminum **[siding][soffit][and][components]** and related accessories in accordance with manufacturer's written instructions.
 1. Install fasteners as recommended in writing by manufacturer.
- C. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.



- D. Where aluminum materials contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape, or installing nonconductive spacers as recommended in writing by manufacturer for this purpose.

3.4 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces in accordance with manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07 46 16 00A



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SECTION 07 46 19 00 - STEEL SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel siding.
2. Steel soffit.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
2. Section 062013 "Exterior Finish Carpentry" for exterior **[cellular PVC][and][foam-plastic]** trim.
3. Section 072500 "Weather Barriers" for weather-resistive barriers.

1.2 COORDINATION

- A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.4 ACTION SUBMITTALS

- A. Product Data: **[Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.]**

1. Steel siding.
2. Steel soffit.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

- C. Samples for Initial Selection: For steel **[siding][and][soffit]** including related accessories.

- D. Samples for Verification: **[For each type, color, texture, and pattern required.]**

1. **12-inch- (300-mm-)** long-by-actual-width Sample of siding.
2. **24-inch- (600-mm-) wide-by-36-inch- (900-mm-)** high Sample panel of siding assembled on plywood backing.
3. **12-inch- (300-mm-)** long-by-actual-width Sample of soffit.
4. **12-inch- (300-mm-)** long-by-actual-width Samples of trim and accessories.

07 - Thermal And Moisture Protection

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of steel **[siding][and][soffit]**.
- B. Research/Evaluation Reports: For each type of steel siding required, from ICC-ES.
- C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish full lengths of steel **[siding][and][soffit]** including related accessories, in a quantity equal to 2 percent of amount installed.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Build mockups for **[siding][and][soffit]** including accessories.
 - a. Size: **[48 inches (1200 mm) long by 60 inches (1800 mm) high]**<Insert dimension(s)>.
 - b. Include outside corner on one end of mockup **[and inside corner on other end]**.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with labels intact until time of use.
- B. Store materials on elevated platforms, under cover, and in a dry location.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Structural failures including cracking and deforming.
 - b. Hail damage, including denting.
 - c. Deterioration of metals and other materials beyond normal weathering.
 - d. Deterioration of metal finishes, including chalking[**and fading**].
 - e. **<Insert failure modes>**.
2. Fading is defined as loss of color, after cleaning with product recommended by manufacturer, of more than [4][5][7] Hunter color-difference units as measured according to ASTM D2244.
 3. Warranty Period: [25][50]**<Insert number>** years from date of Substantial Completion.
 4. Warranty Period for Chalking[**and Fading**]: [10][15]**<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain products, including related accessories, from single source from single manufacturer.

2.2 STEEL SIDING

- A. Steel Siding: Formed product[, **in continuous lengths without end joints,**] made from galvanized steel complying with ASTM A653/A653M, **G90 (Z275)** coating.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[EDCO Products Inc.]**
 - b. **[Gentek Building Products, Inc]**
 - c. **[Norandex]**
 - d. **[Quality Edge]**
 - e. **[Rollex Corporation]**
 - f. **[United States Seamless Inc.]**
 - g. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[EDCO Products Inc.]**
 - b. **[Gentek Building Products, Inc]**
 - c. **[Norandex]**
 - d. **[Quality Edge]**
 - e. **[Rollex Corporation]**
 - f. **[United States Seamless Inc.]**
 - g. **<Insert manufacturer's name>**
- B. Single-Board Horizontal Pattern: **8-inch (203-mm)** exposure in **[plain, single-board][plain, double, 4-inch (102-mm) board]****<Insert requirement>** style.
- C. Double-Board Horizontal Pattern: **10-inch (254-mm)** exposure in **[plain,][Dutch-lap,]****<Insert requirement,>** double, **5-inch (127-mm)** board style.

- D. Vertical Pattern: **12-inch (300-mm)** exposure in [**board-and-batten, single**][**V-grooved, double**]-board style.
- E. Texture: [**Smooth**][**Wood grain**]<Insert requirement>.
- F. Nominal Thickness: [**0.017 inch (0.43 mm)**][**0.019 inch (0.5 mm)**]<Insert dimension>.
- G. Finish: Manufacturer's standard [**primer and heat-fused PVC**]<Insert requirement>.
 - 1. Colors: [**As indicated by manufacturer's designations**][**Match Architect's samples**][**As selected by Architect from manufacturer's full range of colors**].

2.3 STEEL SOFFIT

- A. Steel Soffit: Formed product made from galvanized steel complying with ASTM A653/A653M, **G90 (Z275)** coating.
 - 1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
 - a. [**EDCO Products Inc.**]
 - b. [**Gentek Building Products, Inc**]
 - c. [**Norandex**]
 - d. [**Quality Edge**]
 - e. [**Rollex Corporation**]
 - f. [**United States Seamless Inc.**]
 - g. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert **manufacturer's name; product name or designation**> or comparable product by one of the following:
 - a. [**EDCO Products Inc.**]
 - b. [**Gentek Building Products, Inc**]
 - c. [**Norandex**]
 - d. [**Quality Edge**]
 - e. [**Rollex Corporation**]
 - f. [**United States Seamless Inc.**]
 - g. <Insert manufacturer's name>
- B. Pattern: **12-inch (300-mm)** exposure in [**board-and-batten, single**][**V-grooved, double**]-board style.
- C. Texture: [**Smooth**][**Wood grain**]<Insert requirement>.
- D. Ventilation: Provide [**perforated**][**unperforated**] soffit[**unless otherwise indicated**].
- E. Nominal Thickness: [**0.017 inch (0.43 mm)**][**0.019 inch (0.5 mm)**]<Insert dimension>.
- F. Finish: Manufacturer's standard [**primer and heat-fused PVC**]<Insert requirement>.
 - 1. Colors: [**As indicated by manufacturer's designations**][**Match Architect's samples**][**As**

selected by Architect from manufacturer's full range of colors][Match adjacent siding].

2.4 ACCESSORIES

- A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.
1. Provide accessories **[made from same material as][matching color and texture of]** adjacent siding unless otherwise indicated.
- B. Decorative Accessories: Provide the following steel decorative accessories as indicated:
1. Corner posts.
 2. Door and window casings.
 3. Shutters with **[paneled][louvered]** faces.
 4. Fasciae.
 5. Moldings and trim.
 6. **<Insert accessories>**.
- C. Colors for Decorative Accessories: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range of colors][Match adjacent siding]**.
- D. Flashing: Provide flashing complying with Section 076200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.
- E. Fasteners:
1. For fastening to wood, use **[siding nails][ribbed bugle-head screws]** of sufficient length to penetrate a minimum of **1 inch (25 mm)** into substrate.
 2. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of **1/4 inch (6 mm)**, or three screw-threads, into substrate.
 3. For fastening galvanized steel, use hot-dip galvanized-steel fasteners. Where fasteners are exposed to view, use prefinished galvanized-steel fasteners in color to match item being fastened.
- F. Insect Screening for Soffit Vents: **[PVC-coated, glass-fiber fabric, 18-by-14 or 18-by-16 (1.4-by-1.8- or 1.4-by-1.6-mm) mesh]<Insert requirement>**.
- G. Continuous Soffit Vents: Galvanized-steel, hat-channel shape, with **[stamped louvers][perforations]**; **2 inches (51 mm)** wide and not less than **96 inches (2438 mm)** long.
1. Net-Free Area: **[4 sq. in./linear ft. (280 sq. cm/m)][6 sq. in./linear ft. (420 sq. cm/m)][8 sq. in./linear ft. (560 sq. cm/m)]<Insert dimension>**.
 2. Finish: **[White paint][Brown paint]<Insert requirement>**.
- H. Round Soffit Vents: Stamped galvanized-steel louvered vents, **[2 inches (51 mm)][2-1/2 inches (64 mm)][3 inches (76 mm)][4 inches (102 mm)]<Insert dimension>** in diameter, made to be inserted in round holes cut into soffit.
1. Finish: **[White paint][Brown paint]<Insert requirement>**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of steel [siding][and][soffit] and related accessories.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION OF STEEL SIDING AND SOFFIT

- A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 - 1. Center nails in elongated nailing slots without binding siding to allow for thermal movement.
- B. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.
- C. Where steel siding contacts dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.

3.4 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07 46 19 00



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 46 19 00	07 46 16 00	Metal Plate Wall Panels
07 46 19 00	07 46 16 00a	Aluminum Siding
07 46 23 00	06 10 00 00	Rough Carpentry
07 46 23 00	06 16 00 00	Sheathing
07 46 29 00	06 10 00 00	Rough Carpentry
07 46 29 00	06 16 00 00	Sheathing



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SECTION 07 46 33 00 - PLASTIC SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vinyl siding.
2. Vinyl soffit.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
2. Section 062013 "Exterior Finish Carpentry" for exterior **[cellular PVC][and][foam-plastic]** trim.
3. Section 072500 "Weather Barriers" for weather-resistive barriers.

1.2 COORDINATION

- A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Vinyl siding.
2. Vinyl soffit.

B. Product Data Submittals:

1. For each type of vinyl **[siding][and][soffit]**. **[Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.]**
2. For vinyl siding, include VSI's official certification logo printed on Product Data.

- C. Samples for Initial Selection: For vinyl **[siding][and][soffit]** including related accessories.

- D. Samples for Verification: **[For each type, color, texture, and pattern required.]**

1. **12-inch- (300-mm-)** long-by-actual-width Sample of siding.
2. **24-inch- (600-mm-) wide-by-36-inch- (900-mm-)** high Sample panel of siding assembled on plywood backing.
3. **12-inch- (300-mm-)** long-by-actual-width Sample of soffit.
4. **12-inch- (300-mm-)** long-by-actual-width Samples of trim and accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For vinyl siding Installer.
- B. Product Certificates: For each type of vinyl [siding][and][soffit].
- C. Research/Evaluation Reports: For each type of vinyl siding required, from ICC-ES.
- D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish full lengths of vinyl [siding][and][soffit] including related accessories, in a quantity equal to 2 percent of amount installed.

1.8 QUALITY ASSURANCE

- A. Vinyl Siding Installer Qualifications: A qualified installer who employs a VSI-certified Installer on Project.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Build mockups for vinyl [siding][and][soffit] including accessories.
 - a. Size: **[48 inches (1200 mm) long by 60 inches (1800 mm) high]**<Insert dimensions>.
 - b. Include outside corner on one end of mockup[**and inside corner on other end**].
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with labels intact until time of use.
- B. Store materials under cover.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including cracking[, **fading**,] and deforming.
 - b. Deterioration of materials beyond normal weathering.
 - c. **<Insert failure modes>**.
 2. Fading is defined as loss of color, after cleaning with product recommended by manufacturer, of more than **[4][5][7]** Hunter color-difference units as measured in accordance with ASTM D2244.
 3. Warranty Period: **[10][25][50]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain products, including related accessories, from single source from single manufacturer.

2.2 VINYL SIDING

- A. Vinyl Siding: Integrally colored product complying with ASTM D3679.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Alside Exterior Building Products]**
 - b. **[CertainTeed; SAINT-GOBAIN]**
 - c. **[Gentek Building Products, Inc]**
 - d. **[Kaycan Ltd]**
 - e. **[Mastic; Ply Gem]**
 - f. **[Mitten Inc.]**
 - g. **[Norandex]**
 - h. **[ProVia]**
 - i. **[RMC Siding]**
 - j. **[Royal Building Products, a Westlake Company]**
 - k. **[Veriform; Ply Gem]**
 - l. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Alside Exterior Building Products]**
 - b. **[CertainTeed; SAINT-GOBAIN]**
 - c. **[Gentek Building Products, Inc]**
 - d. **[Kaycan Ltd]**
 - e. **[Mastic; Ply Gem]**
 - f. **[Mitten Inc.]**

- g. **[Norandex]**
- h. **[ProVia]**
- i. **[RMC Siding]**
- j. **[Royal Building Products, a Westlake Company]**
- k. **[Veriform; Ply Gem]**
- l. **<Insert manufacturer's name>**

B. Vinyl Siding Certification Program: Provide products that are listed in VSI's list of certified products.

C. Horizontal Pattern:

1. **6-1/2- or 7-inch (165- or 178-mm)** exposure in beaded-edge, single-board style.
2. **8-inch (203-mm)** exposure in plain, **[single-board][double, 4-inch (102-mm) board][triple, 2-2/3-inch (68-mm) board]<Insert requirement>** style.
3. **8-inch (203-mm)** exposure in Dutch-lap, double, **4-inch (102-mm)** board style.
4. **9-inch (229-mm)** exposure in plain, **[double, 4-1/2-inch (114-mm)][triple, 3-inch (76-mm)]<Insert requirement>** board style.
5. **9-inch (229-mm)** exposure in Dutch-lap, double, **4-1/2-inch (114-mm)** board style.
6. **10-inch (254-mm)** exposure in **[plain,][Dutch-lap,]<Insert requirement>** double, **5-inch (127-mm)** board style.

D. Vertical Pattern:

1. **6-inch (152-mm)** exposure in V-grooved, single-board style.
2. **8-inch (203-mm)** exposure in beaded-edge, double, **4-inch (102-mm)** board style.
3. **10-inch (254-mm)** exposure in V-grooved, double, **5-inch (127-mm)** board style.
4. **12-inch (300-mm)** exposure in V-grooved, **[double, 6-inch (152-mm)][triple, 4-inch (102-mm)]<Insert requirement>** board style.

E. Shingle Pattern: **48-inch- (1200-mm-) wide, [straight-edge notched][staggered-edge notched][half-round edge][octagon edge]<Insert requirement>** sheets with wood-grain texture.

F. Texture: **[Smooth][Wood grain]<Insert requirement>**.

G. Nominal Thickness: **[0.040 inch (1.0 mm)][0.044 inch (1.1 mm)]<Insert dimension>**.

H. Minimum Profile Depth (Butt Thickness): **[1/2 inch (13 mm)][5/8 inch (16 mm)][3/4 inch (19 mm)]<Insert dimension>**.

I. Nailing Hem: Double thickness.

J. Finish: Wood-grain print with clear protective coating containing not less than 70 percent PVDF.

1. Colors: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range of colors]**.

2.3 VINYL SOFFIT

A. Vinyl Soffit: Integrally colored product complying with ASTM D4477.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the**

following]:

- a. [Alside Exterior Building Products]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [Gentek Building Products, Inc]
 - d. [Kaycan Ltd]
 - e. [Mastic; Ply Gem]
 - f. [Mitten Inc.]
 - g. [Norandex]
 - h. [ProVia]
 - i. [RMC Siding]
 - j. [Royal Building Products, a Westlake Company]
 - k. [Veriform; Ply Gem]
 - l. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Alside Exterior Building Products]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [Gentek Building Products, Inc]
 - d. [Kaycan Ltd]
 - e. [Mastic; Ply Gem]
 - f. [Mitten Inc.]
 - g. [Norandex]
 - h. [ProVia]
 - i. [RMC Siding]
 - j. [Royal Building Products, a Westlake Company]
 - k. [Veriform; Ply Gem]
 - l. <Insert manufacturer's name>
- B. Vinyl Siding Certification Program: Provide products that are listed in VSI's list of certified products.
- C. Pattern:
1. **6-inch (152-mm)** exposure in [V-grooved, single-board][beaded-edge, triple, 2-inch (51-mm) board]<Insert requirement> style.
 2. **8-inch (203-mm)** exposure in V-grooved, double, **4-inch (102-mm)** board style.
 3. **10-inch (254-mm)** exposure in V-grooved, double, **5-inch (127-mm)** board style.
 4. **12-inch (300-mm)** exposure in V-grooved, [double, 6-inch (152-mm)][triple, 4-inch (102-mm)]<Insert requirement> board style.
- D. Texture: [Smooth][Wood grain]<Insert requirement>.
- E. Ventilation: Provide [perforated][unperforated] soffit[unless otherwise indicated].
- F. Nominal Thickness: [0.035 inch (0.9 mm)][0.040 inch (1.0 mm)][0.044 inch (1.1 mm)]<Insert dimension>.
- G. Minimum Profile Depth: [1/2 inch (13 mm)][5/8 inch (16 mm)][3/4 inch (19 mm)]<Insert dimension>.
- H. Colors: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range of colors][Match adjacent siding].

2.4 ACCESSORIES

- A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.
 - 1. Provide accessories **[made from same material as][matching color and texture of]** adjacent siding unless otherwise indicated.
- B. Vinyl Accessories: Integrally colored vinyl accessories complying with ASTM D3679 except for wind-load resistance.
 - 1. Texture: **[Smooth][Wood grain]<Insert requirement>**.
- C. Decorative Accessories: Provide the following vinyl decorative accessories as indicated:
 - 1. Corner posts **[with fluted faces]**.
 - 2. Door and window casings **[with fluted faces][and corner rosettes]**.
 - 3. Entrance and window head pediments.
 - 4. Pilasters **[with fluted faces]**.
 - 5. Shutters with **[paneled][louvered]** faces.
 - 6. Louvers.
 - 7. Lattice.
 - 8. Fasciae.
 - 9. Moldings and trim.
 - 10. **<Insert accessories>**.
- D. Colors for Decorative Accessories: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range of colors][Match adjacent siding]**.
- E. Flashing: Provide **[aluminum][stainless steel]<Insert metal>** flashing complying with Section 076200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.
 - 1. Finish for Aluminum Flashing: **[Siliconized polyester coating, same color as siding][High-performance organic finish, same color as siding][Factory-prime coating]<Insert finish>**.
- F. Fasteners:
 - 1. For fastening to wood, use **[siding nails][ribbed bugle-head screws]** of sufficient length to penetrate a minimum of **1 inch (25 mm)** into substrate.
 - 2. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of **1/4 inch (6 mm)**, or three screw-threads, into substrate.
 - 3. For fastening vinyl, use **[aluminum][hot-dip galvanized][stainless steel]** fasteners. Where fasteners are exposed to view, use prefinished aluminum fasteners in color to match item being fastened.
- G. Insect Screening for Soffit Vents: **[Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh][PVC-coated, glass-fiber fabric, 18-by-14 or 18-by-16 (1.4-by-1.8- or 1.4-by-1.6-mm) mesh]<Insert requirement>**.
- H. Continuous Soffit Vents: Aluminum, hat-channel shape, with **[stamped louvers][perforations]; 2 inches (51 mm) wide and not less than 96 inches (2438 mm) long**.
 - 1. Net-Free Area: **[4 sq. in./linear ft. (280 sq. cm/m)][6 sq. in./linear ft. (420 sq. cm/m)][8 sq. in./linear ft. (560 sq. cm/m)]<Insert dimension>**.
 - 2. Finish: **[Mill finish][White paint][Brown paint]<Insert requirement>**.



- I. Round Soffit Vents: Stamped aluminum louvered vents, [2 inches (51 mm)][2-1/2 inches (64 mm)][3 inches (76 mm)][4 inches (102 mm)]<Insert dimension> in diameter, made to be inserted in round holes cut into soffit.
 1. Finish: [Mill finish][White paint][Brown paint]<Insert requirement>.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of vinyl [siding][and][soffit] and related accessories.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 1. Center nails in elongated nailing slots without binding siding to allow for thermal movement.
- B. Install vinyl [siding][and][soffit] and related accessories in accordance with ASTM D4756.
 1. Install fasteners for horizontal vinyl siding no more than [16 inches (400 mm)]<Insert dimension> o.c.
 2. Install fasteners for vertical vinyl siding no more than [12 inches (300 mm)]<Insert dimension> o.c.
- C. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07 46 33 00



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SECTION 07 46 46 00 - FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fiber-cement siding.
2. Fiber-cement soffit.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
2. Section 062013 "Exterior Finish Carpentry" for exterior **[cellular PVC][and][foam-plastic]** trim.
3. Section 072500 "Weather Barriers" for weather-resistive barriers.

1.2 COORDINATION

- ##### A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.3 PREINSTALLATION MEETINGS

- ##### A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Fiber-cement siding.
2. Fiber-cement soffit.

- ##### B. Product Data Submittals: For each type of fiber-cement **[siding][and][soffit]**. **[Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.]**

- ##### C. Samples for Initial Selection: For fiber-cement **[siding][and][soffit]** including related accessories.

- ##### D. Samples for Verification: **[For each type, color, texture, and pattern required.]**

1. **12-inch- (300-mm-)** long-by-actual-width Sample of siding.
2. **24-inch- (600-mm-) wide-by-36-inch- (900-mm-) high** Sample panel of siding assembled on plywood backing.
3. **12-inch- (300-mm-)** long-by-actual-width Sample of soffit.
4. **12-inch- (300-mm-)** long-by-actual-width Samples of trim and accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of fiber-cement [siding][and][soffit].
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.
- C. Research/Evaluation Reports: For each type of fiber-cement siding required, from ICC-ES.
- D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of fiber-cement [siding][and][soffit], including related accessories, to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish full lengths of fiber-cement [siding][and][soffit] including related accessories, in a quantity equal to 2 percent of amount installed.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as shown on Drawings.
 - 2. Build mockups for fiber-cement [siding][and][soffit] including accessories.
 - a. Size: **[48 inches (1200 mm) long by 60 inches (1800 mm) high]**<Insert dimensions>.
 - b. Include outside corner on one end of mockup[**and inside corner on other end**].
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with labels intact until time of use.
- B. Store materials on elevated platforms, under cover, and in a dry location.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or

workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Structural failures including cracking and deforming.
 - b. Deterioration of materials beyond normal weathering.
 - c. **<Insert failure modes>**.
2. Warranty Period: **[10][25][50]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain products, including related accessories, from single source from single manufacturer.

2.2 FIBER-CEMENT SIDING

- A. Fiber-Cement Siding: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested in accordance with ASTM E136; with a flame-spread index of 25 or less when tested in accordance with ASTM E84.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Allura]**
 - b. **[American Fiber Cement Corporation]**
 - c. **[CertainTeed; SAINT-GOBAIN]**
 - d. **[GAF]**
 - e. **[James Hardie Building Products, Inc.]**
 - f. **[Nichiha USA, Inc.]**
 - g. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Allura]**
 - b. **[American Fiber Cement Corporation]**
 - c. **[CertainTeed; SAINT-GOBAIN]**
 - d. **[GAF]**
 - e. **[James Hardie Building Products, Inc.]**
 - f. **[Nichiha USA, Inc.]**
 - g. **<Insert manufacturer's name>**
- B. Labeling: Provide fiber-cement siding that is tested and labeled in accordance with ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.
- C. Nominal Thickness: Not less than **5/16 inch (8 mm)**.

- D. Horizontal Pattern: Boards [5-1/4 inches (133 mm)][6-1/4 to 6-1/2 inches (159 to 165 mm)][7-1/4 to 7-1/2 inches (184 to 190 mm)][8-1/4 to 8-1/2 inches (210 to 216 mm)][9-1/4 to 9-1/2 inches (235 to 241 mm)]<Insert dimensions> wide in [plain][beaded-edge]<Insert requirement> style.
 - 1. Texture: [Smooth][Rough sawn][Wood grain]<Insert requirement>.
- E. Vertical Pattern: 48-inch- (1200-mm-) wide sheets with wood-grain texture and grooves [8 inches (203 mm)][12 inches (300 mm)]<Insert dimension> o.c.
- F. Shingle Pattern: 48-inch- (1200-mm-) wide, [straight-edge notched][staggered-edge notched]<Insert requirement> sheets with wood-grain texture.
- G. Panel Texture: 48-inch- (1200-mm-) wide sheets with [smooth][stucco][wood-grain]<Insert requirement> texture.
- H. Factory Priming: Manufacturer's standard acrylic primer.

2.3 FIBER-CEMENT SOFFIT

- A. Fiber-Cement Soffit: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested in accordance with ASTM E136; with a flame-spread index of 25 or less when tested in accordance with ASTM E84.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Allura]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [James Hardie Building Products, Inc.]
 - d. [Nichiha USA, Inc.]
 - e. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Allura]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [James Hardie Building Products, Inc.]
 - d. [Nichiha USA, Inc.]
 - e. <Insert manufacturer's name>
- B. Nominal Thickness: Not less than 5/16 inch (8 mm).
- C. Pattern: [12-inch- (300-mm-)][16-inch- (400-mm-)][24-inch- (600-mm-)]<Insert dimension> wide sheets with [smooth][wood-grain]<Insert requirement> texture.
- D. Ventilation: Provide [perforated][unperforated] soffit[unless otherwise indicated].
- E. Factory Priming: Manufacturer's standard acrylic primer.

2.4 ACCESSORIES

- A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.
 - 1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.
- B. Decorative Accessories: Provide the following fiber-cement decorative accessories as indicated:
 - 1. Corner posts.
 - 2. Door and window casings.
 - 3. Fasciae.
 - 4. Moldings and trim.
 - 5. **<Insert accessories>**.
- C. Flashing: Provide **[aluminum][stainless steel]<Insert metal>** flashing complying with Section 076200 "Sheet Metal Flashing and Trim" at window and door heads and where indicated.
 - 1. Finish for Aluminum Flashing: **[Siliconized polyester coating][High-performance organic finish][Factory-prime coating]<Insert finish>**.
- D. Fasteners:
 - 1. For fastening to wood, use **[siding nails][ribbed bugle-head screws]** of sufficient length to penetrate a minimum of **1 inch (25 mm)** into substrate.
 - 2. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of **1/4 inch (6 mm)**, or three screw-threads, into substrate.
 - 3. For fastening fiber cement, use **[hot-dip galvanized][stainless steel]** fasteners.
- E. Insect Screening for Soffit Vents: **[Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh][PVC-coated, glass-fiber fabric, 18-by-14 or 18-by-16 (1.4-by-1.8- or 1.4-by-1.6-mm) mesh][Stainless steel, 18-by-18 (1.4-by-1.4-mm) mesh]<Insert requirement>**.
- F. Continuous Soffit Vents: Aluminum, hat-channel shape, with **[stamped louvers][perforations]**; **2 inches (51 mm)** wide and not less than **96 inches (2438 mm)** long.
 - 1. Net-Free Area: **[4 sq. in./linear ft. (280 sq. cm/m)][6 sq. in./linear ft. (420 sq. cm/m)][8 sq. in./linear ft. (560 sq. cm/m)]<Insert dimension>**.
 - 2. Finish: **[Mill finish][White paint][Brown paint]<Insert requirement>**.
- G. Round Soffit Vents: Stamped aluminum louvered vents, **[2 inches (51 mm)][2-1/2 inches (64 mm)][3 inches (76 mm)][4 inches (102 mm)]<Insert dimension>** in diameter, made to be inserted in round holes cut into soffit.
 - 1. Finish: **[Mill finish][White paint][Brown paint]<Insert requirement>**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement **[siding][and][soffit]** and related accessories.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 - 1. Do not install damaged components.
 - 2. Install fasteners no more than **[24 inches (600 mm)]<Insert dimension>** o.c.
- B. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07 46 46 00



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 46 46 00	01 11 19 00	No Specification Required
07 46 46 00	06 40 00 00	Exterior Architectural Woodwork
07 46 46 00	06 40 00 00a	Interior Architectural Woodwork
07 46 63 00	07 46 16 00a	Aluminum Siding



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SECTION 07 51 13 00 - BUILT-UP ASPHALT ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Built-up asphalt roofing (BUR) system.
2. Roofing membrane sheet materials.
3. Base flashing sheet.
4. Asphalt materials.
5. Accessory roofing system materials.
6. Substrate board.
7. Vapor retarder.
8. Roof insulation and accessories.
9. Cover board.
10. Electronic leak-detection (ELD) materials.
11. Roof coating system.
12. Walkways.

- B. Section contains installation of sound-absorbing insulation strips in ribs of acoustical steel roof deck. Sound-absorbing insulation strips are furnished under Section 053100 "Steel Decking."

C. Related Requirements:

1. Section 053100 "Steel Decking" for roof deck panels[**and sound-absorbing insulation strips**].
2. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking, and for wood-based, structural-use roof deck panels.
3. Section 061600 "Sheathing" for wood-based, structural-use roof deck panels.
4. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
5. Section 077100 "Roof Specialties" for [**premanufactured metal copings**][**roof edge fasciae**][**gravel stops**][**reglets**][**roof edge flashings**][**counterflashings**].
6. Section 077129 "Manufactured Roof Expansion Joints" for premanufactured roof expansion-joint assemblies.
7. Section 077200 "Roof Accessories" for manufactured roof curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
8. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
9. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.2 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.3 PREINSTALLATION MEETINGS

- A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at [**Project site**]<Insert location>.

1. Meet with Owner,[**Construction Manager**,] Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing system Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, roofing system Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

B. Preinstallation Roofing Conference: Conduct conference at **[Project site]<Insert location>**.

1. Meet with Owner,[**Construction Manager**,] Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing system Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, roofing system Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base flashings and roofing terminations.
3. Flashing details at penetrations.
4. Tapered insulation, including slopes.
5. Roof plan showing orientation of steel roof deck and roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
6. Crickets, saddles, and tapered edge strips, including slopes.
7. Insulation-fastening patterns for corner, perimeter, and field-of-roof locations.
8. Tie-in with adjoining air barrier.

C. Samples for Verification: For the following products:

1. Cap Sheet: Samples of **[manufacturer's standard colors for selection by Architect]**[specified

- color].
 - 2. Base Flashing Sheet: Samples of [manufacturer's standard colors for selection by Architect][specified color].
 - 3. Roof Coating System: Samples of [manufacturer's standard colors for selection by Architect][specified color].
 - 4. Walkways: Samples of [manufacturer's standard colors for selection by Architect][specified color].
- D. Wind-Uplift-Resistance Submittal: For roofing system, indicating compliance with wind-uplift performance requirements.
- E. Sustainable Design Submittals:
 - 1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.
 - 2. Health Product Declaration (HPD): Provide documentation confirming product compliance with one of the following:
 - a. Inventory or HPD to at least 0.01 percent by weight, with at least 95 percent assessed using GreenScreen Benchmark assessment.
 - b. Cradle to Cradle v3 certification with minimum Silver level of Material Health.
 - c. Living Product Challenge certification indicating achievement of Imperative 09, "Transparent Material Health."

1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer Certificates:
 - 1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.
 - 2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- B. Product Test Reports: For roofing membrane and insulation, for tests performed by an independent, qualified testing agency indicating compliance with specified requirements.
- C. Research Reports: For components of roofing system, from [an agency acceptable to authorities having jurisdiction][ICC-ES]<Insert evaluation agency> showing compliance with specified performance requirements.
- D. Field Test Reports:
 - 1. Concrete internal relative humidity test reports.
 - 2. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.
- E. Field quality control reports.
- F. Qualification Statements: For roofing system [Installer][manufacturer][and][testing agency].
- G. Sample warranties.

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1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system.
- B. Certified statement from existing roof membrane manufacturer, stating that existing roof warranty has not been affected by Work performed under this Section.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is **[UL listed][listed in FM Approvals' RoofNav][listed in SPRI's "Directory of Roof Assemblies"]** for roofing system identical to that used for this Project.
- B. Roofing System Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing system materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing manufacturer.
 - 1. Protect stored liquid material from direct sunlight.
 - 2. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources.
 - 1. Store in a dry location.
 - 2. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing system materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be installed in accordance with roofing system manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty to include all components of roofing system, such as [**substrate board**,][**vapor retarder**,] roof insulation, fasteners, adhesives,[**cover board**,] roofing membranes, base flashing sheet,[**walkway products**,] and other components of roofing system.
 2. Warranty Period: [**10**][**15**][**20**]**<Insert number>** years from date of Substantial Completion.
- B. Roofing System Installer's Warranty: Submit Roofing System Installer's warranty, on warranty form at end of this Section, signed by roofing system Installer, covering the Work of this Section, including all components of roofing system, such as [**substrate board**,][**vapor retarder**,] roof insulation, fasteners, adhesives,[**cover board**,] roofing membranes, base flashing sheet,[**walkway products**,] and other components of roofing system.
1. Warranty Period: [**Two**][**Five**]**<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain components for roofing system from [**roofing membrane manufacturer**][**or**][**manufacturer approved by roofing membrane manufacturer**].

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings to remain watertight.
1. Accelerated Weathering: Roof membrane to withstand 2000 hours of exposure when tested in accordance with ASTM G152, ASTM G154, or ASTM G155.
 2. Impact Resistance: Roof membrane to resist impact damage when tested in accordance with ASTM D3746/C3746M, ASTM D4272/D4272M, or the Resistance to Foot Traffic Test in FM Approvals 4470.
- B. Material Compatibility: Roofing materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- C. Wind-Uplift Resistance: Design roofing system to resist the following wind-uplift pressures when tested in accordance with FM Approvals 4474, UL 580, or UL 1897:
1. Zone 1' (Roof Area Interior): **<Insert lbf/sq. ft. (kPa)>**.
 2. Zone 1 (Roof Area Field): **<Insert lbf/sq. ft. (kPa)>**.
 3. Zone 2 (Roof Area Perimeter): **<Insert lbf/sq. ft. (kPa)>**.
 - a. Location: From roof edge to **<Insert dimension>** inside roof edge.
 4. Zone 3 (Roof Area Corners): **<Insert lbf/sq. ft. (kPa)>**.
 - a. Location: **<Insert dimension>** in each direction from each building corner.
- D. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials

with FM Approvals Certification markings.

1. Fire/Windstorm Classification: **[Class 1A-60][Class 1A-75][Class 1A-90][Class 1A-105][Class 1A-120]<Insert class>**.
 2. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 **[MH][SH][VSH]**.
- E. SPRI's "Directory of Roof Assemblies" Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and are listed in SPRI's "Directory of Roof Assemblies" for roof assembly identical to that specified for this Project.
1. Wind-Uplift Load Capacity: **[60 psf][75 psf][90 psf][105 psf][120 psf]<Insert capacity>**.
- F. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][32]** or initial SRI not less than **[82][39]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- G. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][25]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- H. Solar Reflectance Index (SRI): Not less than **[78][29]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- I. Cool Roof Rating Council (CRRC): Roofing system to be listed by the CRRC for low-slope roof products.
- J. Energy Performance: Roofing system to have an initial solar reflectance of not less than **[0.70]<Insert value>** and an emissivity of not less than **[0.75]<Insert value>** when tested in accordance with CRRC S100.
- K. Exterior Fire-Test Exposure: **[Class A][Class B][Class C]**; for installation and roof slopes indicated; when tested by a qualified testing agency in accordance with ASTM E108 or UL 790.
1. Identify products with appropriate markings of applicable testing agency.
- L. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated.
1. Identify products with appropriate markings of applicable testing agency.
- 2.3 Fiber-Reinforced Cementitious Cover Board
- A. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **<Insert manufacturer's name>**
- 2.4 BUILT-UP ASPHALT ROOFING (BUR) SYSTEM
- A. BUR Roofing System Components: See the following articles for individual roof materials required.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering**

products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Building Products of Canada Corp.]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [Elevate; Holcim Building Envelope]
 - d. [GAF]
 - e. [IKO Industries Inc.]
 - f. [Johns Manville; a Berkshire Hathaway company]
 - g. [Malarkey Roofing Products]
 - h. [Tamko Building Products LLC]
 - i. [Tremco Incorporated]
 - j. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Building Products of Canada Corp.]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [Elevate; Holcim Building Envelope]
 - d. [GAF]
 - e. [IKO Industries Inc.]
 - f. [Johns Manville; a Berkshire Hathaway company]
 - g. [Malarkey Roofing Products]
 - h. [Tamko Building Products LLC]
 - i. [Tremco Incorporated]
 - j. <Insert manufacturer's name>

2.5 ROOFING MEMBRANE SHEET MATERIALS

- A. SBS-Modified-Bitumen, Glass-Fiber-Mat Base Sheet: ASTM D6163/D6163M, [Type I][Type II][Type III], SBS-modified asphalt-impregnated and -coated sheet, with glass-fiber-reinforcing mat, dusted with fine mineral surfacing on both sides.
- B. Asphalt-Coated, Glass-Fiber-Mat Base Sheet: ASTM D4601/D4601M, [Type I][Type II], nonperforated, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.
- C. Asphalt-Coated, Glass-Fiber-Mat, Venting Base Sheet: ASTM D4897/D4897M, Type II, venting, nonperforated, asphalt-impregnated and -coated, glass-fiber base sheet with mineral granule surfacing on bottom surface.
- D. Asphalt-Coated, Organic-Felt Base Sheet: ASTM D2626/D2626M, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides.
- E. Ply Sheet: ASTM D2178/D2178M, [Type IV][Type VI], asphalt-impregnated, glass-fiber felt.
- F. Cap Sheet: ASTM D3909/D3909M, asphalt-impregnated and -coated, glass-fiber cap sheet, with white coarse mineral-granule top surfacing and fine mineral surfacing on bottom surface.

2.6 BASE FLASHING SHEET

- A. Asphalt-Impregnated, Glass-Fiber-Mat Backer Sheet: ASTM D2178/D2178M, [Type IV][Type VI], asphalt-impregnated, glass-fiber felt.



- B. Asphalt-Coated, Glass-Fiber-Mat Backer Sheet: ASTM D4601/D4601M, **[Type I][Type II]**, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.
- C. Asphalt-Coated, Organic-Felt Backer Sheet: ASTM D2626/D2626M, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides.
- D. SBS-Modified-Bitumen Backer Sheet: **[ASTM D6164/D6164M, Type I or II, Grade S, reinforced with polyester fabric][ASTM D6163/D6163M, Type I or II, Grade S, reinforced with glass fibers][ASTM D6162/D6162M, Type I or II, Grade S, reinforced with a combination of polyester fabric and glass fibers]**; smooth surfaced; suitable for application method specified.
- E. SBS-Modified-Bitumen, Granule-Surfaced Flashing Sheet: **[ASTM D6164/D6164M, Type I or II, Grade G, polyester reinforced][ASTM D6163/D6163M, Type I or II, Grade G, glass-fiber reinforced][ASTM D6162/D6162M, Type I or II, Grade G, reinforced with a combination of polyester fabric and glass fibers]**, granule-surfaced; suitable for application method specified, and as follows:
 - 1. Granule Color: **[White][Gray][Tan]<Insert color>**.
- F. SBS-Modified-Bitumen, Metal-Surfaced Flashing Sheet: ASTM D6298, glass-fiber-reinforced, SBS-modified, metal-foil-surfaced asphalt sheet, suitable for application method specified, and as follows:
 - 1. Metal Surfacing: **[Aluminum][Copper][Stainless steel][Aluminum, fluoropolymer-coated finish, of color and gloss selected by Architect from manufacturer's full range]**.
- G. APP-Modified-Bitumen, Smooth-Surfaced Flashing Sheet: **[ASTM D6222/D6222M, Type I or II, Grade S, polyester-reinforced][ASTM D6223/D6223M, Type I or II, Grade S, reinforced with a combination of polyester fabric and glass fibers]**, smooth surfaced, suitable for application method specified.
- H. APP-Modified-Bitumen, Granule-Surfaced Flashing Sheet: **[ASTM D6222/D6222M, Type I or II, Grade G, polyester-reinforced][ASTM D6223/D6223M, Type I or II, Grade G, reinforced with a combination of polyester fabric and glass fibers]**, granule-surfaced, suitable for application method specified, and as follows:
 - 1. Granule Color: **[White][Gray][Tan]<Insert color>**.
- I. Glass-Fiber Fabric: Woven glass-fiber cloth, treated with asphalt, complying with ASTM D1668/D1668M, Type I.
- J. Liquid Flashing System: Roof membrane manufacturer's standard one- or two-part moisture curing resin with low solvent content, consisting of a primer, flashing cement, and scrim.

2.7 ASPHALT MATERIALS

- A. Asphalt Primer: ASTM D41/D41M.
- B. Roofing Asphalt: ASTM D312/D312M, **[Type III][Type IV][Type III or IV as recommended by roofing system manufacturer for application]<Insert type>**, suitable for installation method specified.
- C. SEBS-Modified Roofing Asphalt: ASTM D6152/D6152M, suitable for installation method specified.

2.8 ACCESSORY ROOFING SYSTEM MATERIALS

- A. General: Accessory materials as recommended in writing by roofing membrane manufacturer for intended use, compatible with other roofing system components, and suitable for installation method specified.
 - 1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
 - 2. Verify adhesives and sealants comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Other Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Nonmembrane Roof Sealants: 300 g/L.
 - j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - k. Sealant Primers for Porous Substrates: 775 g/L.
- B. Prefabricated Pipe Flashings: As recommended in writing by roofing membrane manufacturer.
- C. Roof Vents: As recommended in writing by roofing membrane manufacturer.
 - 1. Size: Not less than **4-inch (100-mm)** diameter.
- D. Sheathing Paper: Red-rosin type, minimum **3 lb/100 sq. ft. (0.16 kg/sq. m)**.
- E. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately **1 by 1/8 inch (25 by 3 mm)** thick; with anchors.
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- F. Cold-Applied Trichloroethylene Asphalt Adhesive: ASTM D3019, Type III, roof system manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with roofing system and base flashings.
- G. Cold-Applied Asphalt Adhesive: ASTM D4479/D4479M, Type I or Type II, roof system manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with roofing system and base flashings.
- H. Cold-Applied Polymer-Modified Asphalt Adhesive: Roof membrane manufacturer's standard solvent- and asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with roofing system, base flashings, and aggregate surfacing adhesive.
- I. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required by roofing manufacturer for application.
- J. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying.
- K. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening built-up roofing components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing manufacturer.

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.

L. Aggregate Surfacing: ASTM D1863/D1863M, No. 6 or No. 67, clean, dry, opaque, **[water-worn gravel or crushed stone, free of sharp edges][crushed slag, free of sharp edges]**.

M. Miscellaneous Accessories: As recommended in writing by roofing membrane manufacturer.

2.9 SUBSTRATE BOARD

A. Glass-Mat Gypsum Roof Substrate Board: ASTM C1177/C1177M, water-resistant gypsum board.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. **[CertainTeed; SAINT-GOBAIN]**
- b. **[Georgia-Pacific Gypsum LLC]**
- c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
- d. **[USG Corporation]**
- e. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[CertainTeed; SAINT-GOBAIN]**
- b. **[Georgia-Pacific Gypsum LLC]**
- c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
- d. **[USG Corporation]**
- e. **<Insert manufacturer's name>**

3. Thickness: **[1/4 inch (6 mm)][1/2 inch (13 mm)][Type X, 5/8 inch (16 mm)]**.

4. Surface Finish: **[Factory primed][Unprimed]**.

5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.

B. Fiber-Reinforced Gypsum Roof Board: ASTM C1278/C1278M.

1. Thickness: **[1/4 inch (6 mm)][3/8 inch (10 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.

2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.

C. High-Density Polyisocyanurate Roof Substrate Board: ASTM C1289, Type II, Class 4, Grade 1, **1/2 inch (13 mm)** thick, having a minimum compressive strength of **80 psi (551 kPa)**.

D. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.

2.10 VAPOR RETARDER

- A. Rubberized Asphalt Sheet Vapor Retarder, Self-Adhering: ASTM D1970/D1970M polyethylene film laminated to layer of rubberized asphalt adhesive, minimum **40-mil (1.0-mm)** total thickness; maximum permeance rating of **0.1 perm (6 ng/Pa x s x sq. m)**; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
- B. Butyl Rubber Sheet Vapor Retarder, Self-Adhering: Polyethylene film laminated to layer of butyl rubber adhesive, minimum **30-mil (0.76-mm)** total thickness; maximum permeance rating of **0.1 perm (6 ng/Pa x s x sq. m)**; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
- C. Laminated Sheet Vapor Retarder: Two layers, fire-retardant polyethylene laminate, reinforced with cord grid.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Reef Industries, Inc.]**
 - b. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Reef Industries, Inc.]**
 - b. **<Insert manufacturer's name>**
 - 3. Permeance Rating: Not more than **0.062 perm (3.556 ng/Pa x s x sq. m)** when tested in accordance with ASTM E96/E96M.
 - 4. Flame Spread Index: Not more than 5 when tested in accordance with ASTM E84.
 - 5. Smoke-Developed Index: Not more than 35 when tested in accordance with ASTM E84.
 - 6. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- D. Glass-Fiber Felts: ASTM D2178/D2178M, Type IV, asphalt impregnated.

2.11 ROOF INSULATION AND ACCESSORIES

- A. General: Preformed roof insulation boards manufactured **[or approved]** by roofing membrane manufacturer, approved for use in **[FM Approvals' RoofNav][SPRI's "Directory of Roof Assemblies"]** listed roof assemblies.
- B. Extruded-Polystyrene Board Insulation: ASTM C578, **[Type IV, 1.6-lb/cu. ft. (26-kg/cu. m) minimum density, 25 psi (173 kPa) minimum compressive strength][Type V, 3.0-lb/cu. ft. (48-kg/cu. m) minimum density, 100 psi (690 kPa) minimum compressive strength]**, square edged.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[DuPont de Nemours, Inc.]**

- b. [Kingspan Insulation LLC]
 - c. [Owens Corning]
 - d. [Soprema, Inc.]
 - e. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [DuPont de Nemours, Inc.]
 - b. [Kingspan Insulation LLC]
 - c. [Owens Corning]
 - d. [Soprema, Inc.]
 - e. <Insert manufacturer's name>
 3. Thermal Resistance: R-value of 5.0 per 1 inch (25 mm).
 4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)].
 5. Thickness:
 - a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.
 - b. Upper Layer: <Insert thickness>.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- C. Molded (Expanded) Polystyrene Board Insulation: ASTM C578 Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) minimum density, 13 psi (90 kPa) minimum compressive strength, square edge.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [Carlisle Syntec Systems]
 - c. [Cellofoam North America, Inc.]
 - d. [Kingspan Insulation LLC]
 - e. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [Carlisle Syntec Systems]
 - c. [Cellofoam North America, Inc.]
 - d. [Kingspan Insulation LLC]
 - e. <Insert manufacturer's name>
 3. Thermal Resistance: R-value of 3.8 per 1 inch (25 mm).
 4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)].
 5. Thickness:
 - a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.
 - b. Upper Layer: <Insert thickness>.

6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- D. Composite Molded (Expanded) Polystyrene Board Insulation: ASTM C578, **[Type II, 1.35-lb/cu. ft. (22-kg/cu. m)][Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m)][Type IX, 1.8-lb/cu. ft. (29-kg/cu. m)]** minimum density, with factory-applied facings, as follows:
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Cellofoam North America, Inc.]**
 - b. **[Insulfoam; a Carlisle Company]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Cellofoam North America, Inc.]**
 - b. **[Insulfoam; a Carlisle Company]**
 - c. **<Insert manufacturer's name>**
 3. Facer: **[ASTM C208, Type II, Grade 2, cellulosic-fiber insulation board, asphalt coated, 1/2 inch (13 mm) thick][DOC PS 2, Exposure 1, oriented strand board, 7/16 inch (11 mm) thick]<Insert material>**.
 4. Size: **[48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)]**.
 5. Thickness: **<Insert thickness>**.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- E. Polyisocyanurate Board Insulation: ASTM C1289, Type II, **[Class 1 felt facer][Class 2 coated glass-fiber facer][Class 3 uncoated glass-fiber facer]** on both major surfaces.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Atlas Polyiso Roof and Wall Insulation]**
 - b. **[Carlisle Syntec Systems]**
 - c. **[CertainTeed; SAINT-GOBAIN]**
 - d. **[Elevate; Holcim Building Envelope]**
 - e. **[GAF]**
 - f. **[Hunter Panels; a Carlisle company]**
 - g. **[IKO Industries Inc.]**
 - h. **[Insulfoam; a Carlisle Company]**
 - i. **[Johns Manville; a Berkshire Hathaway company]**
 - j. **[Kingspan Insulation LLC]**
 - k. **[Polyglass U.S.A., Inc.]**
 - l. **[Rmax, A Business Unit of Sika Corporation]**
 - m. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the

following:

- a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [Carlisle Syntec Systems]
 - c. [CertainTeed; SAINT-GOBAIN]
 - d. [Elevate; Holcim Building Envelope]
 - e. [GAF]
 - f. [Hunter Panels; a Carlisle company]
 - g. [IKO Industries Inc.]
 - h. [Insulfoam; a Carlisle Company]
 - i. [Johns Manville; a Berkshire Hathaway company]
 - j. [Kingspan Insulation LLC]
 - k. [Polyglass U.S.A., Inc.]
 - l. [Rmax, A Business Unit of Sika Corporation]
 - m. <Insert manufacturer's name>
3. Compressive Strength: [Grade 2, 20 psi (138 kPa)][Grade 3, 25 psi (172 kPa)].
 4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)]
 5. Thickness:
 - a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.
 - b. Upper Layer: <Insert thickness>.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- F. Composite Polyisocyanurate Board Insulation: ASTM C1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other surface.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [Elevate; Holcim Building Envelope]
 - d. [GAF]
 - e. [Hunter Panels; a Carlisle company]
 - f. [Insulfoam; a Carlisle Company]
 - g. [Johns Manville; a Berkshire Hathaway company]
 - h. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [Elevate; Holcim Building Envelope]
 - d. [GAF]
 - e. [Hunter Panels; a Carlisle company]
 - f. [Insulfoam; a Carlisle Company]
 - g. [Johns Manville; a Berkshire Hathaway company]
 - h. <Insert manufacturer's name>

3. Facer: [Type IV, cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch (13 mm) thick][Type V, oriented strand board facer, 7/16 inch (11 mm) thick][Type VII, glass-mat-faced gypsum board facer, 1/4 inch (6 mm) thick]<Insert material>.
 4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)].
 5. Thickness: <Insert thickness>.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- G. Perlite Board Insulation: ASTM C728, Type I, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [GAF]
 - b. [Johns Manville; a Berkshire Hathaway company]
 - c. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [GAF]
 - b. [Johns Manville; a Berkshire Hathaway company]
 - c. <Insert manufacturer's name>
 3. Thermal Resistance: R-value of 2.78 per 1 inch (25 mm).
 4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)]
 5. Thickness:
 - a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.
 - b. Upper Layer: <Insert thickness>.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- H. Cellulosic-Fiber Board Insulation: ASTM C208, Type II, Grade 2, fibrous-felted, rigid insulation boards of wood fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Blue Ridge Fiberboard]
 - b. [GAF]
 - c. [Georgia-Pacific Gypsum LLC]
 - d. [Homasote Company]
 - e. [Huebert Fiberboard Inc]
 - f. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert

manufacturer's name; product name or designation> or comparable product by one of the following:

- a. **[Blue Ridge Fiberboard]**
 - b. **[GAF]**
 - c. **[Georgia-Pacific Gypsum LLC]**
 - d. **[Homasote Company]**
 - e. **[Huebert Fiberboard Inc]**
 - f. **<Insert manufacturer's name>**
 3. Thermal Resistance: R-value of 2.78 per 1 inch (25 mm).
 4. Size: **[48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)]**.
 5. Thickness:
 - a. Base Layer: **[1 inch (25 mm)][2 inches (51 mm)]<Insert thickness>**.
 - b. Upper Layer: **<Insert thickness>**.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- I. Cellular-Glass Board Insulation: ASTM C552, Type IV, rigid, cellular-glass thermal board insulation faced with manufacturer's standard kraft-paper sheets.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Pittsburgh Corning Corporation]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Pittsburgh Corning Corporation]**
 - b. **<Insert manufacturer's name>**
 3. Thermal Resistance: R-value of 3.44 per 1 inch (25 mm).
 4. Size: **24 by 48 inches (600 by 1200 mm)**.
 5. Thickness: **<Insert thickness>**.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- J. Mineral Wool Board Insulation - Multidensity: ASTM C726, Type I, Class 1, comprising monolithic fibrous material having an upper layer with an **11.2-lb/cu. ft. (180-kg/cu. m)** density and a lower layer with a **7.5-lb/cu. ft. (120-kg/cu. m)** density.
1. Thermal Resistance: R-value of 3.8 per 1 inch (25 mm).
 2. Size: **48 by 48 inches (1200 by 1200 mm)**.
 3. Thickness:
 - a. Base Layer: **[2 inches (51 mm)]<Insert thickness>**.
 - b. Upper Layer: **<Insert thickness>**.

4. Face Treatment: Bitumen coating.
 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- K. Mineral Wool Board Insulation - Single Density: ASTM C726, Type II, Class 1, comprising monolithic fibrous material having a **12.5-lb/cu. ft. (200-kg/cu. m)** density.
1. Thermal Resistance: R-value of 4.0 per **1 inch (25 mm)**.
 2. Size: **48 by 48 inches (1200 by 1200 mm)**.
 3. Thickness: **1 inch (25 mm)**.
 4. Face Treatment: Bitumen coating.
 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- L. Tapered Insulation: Provide factory-tapered insulation boards.
1. Material: **[Match roof insulation]<Insert material>**.
 2. Minimum Thickness: **1/4 inch (6 mm)**.
 3. Slope:
 - a. Roof Field: **[1/4 inch per foot (1:48)]<Insert slope>** unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: **[1/2 inch per foot (1:24)]<Insert slope>** unless otherwise indicated on Drawings.
 4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- M. Roof Insulation Accessories, General: As recommended in writing by insulation manufacturer for intended use and compatible with other roofing system components.
- N. Insulation Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate and acceptable to roofing membrane manufacturer.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- O. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation **[to substrate][and]** to another insulation layer as follows:
1. Modified asphaltic, asbestos-free, cold-applied adhesive.
 2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
 3. Full-spread spray-applied, low-rise, two-component urethane adhesive.
 4. Verify adhesives and sealants comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Other Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Nonmembrane Roof Sealants: 300 g/L.
 - j. Sealant Primers for Nonporous Substrates: 250 g/L.

k. Sealant Primers for Porous Substrates: 775 g/L.

5. Verify adhesives and sealants comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
6. Verify adhesives and sealants comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
7. Verify adhesives and sealants comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.

P. Insulation Cant Strips: **[ASTM C728, perlite insulation board][ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board]**.

Q. Wood Nailer Strips: Comply with requirements in Section 061000 "Rough Carpentry."

R. Tapered Edge Strips: **[ASTM C728, perlite insulation board][ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board]**.

2.12 COVER BOARD

A. General: Cover board as recommended in writing by roofing membrane manufacturer for intended use; compatible with other roofing system components and suitable for installation method specified.

B. Cellulosic-Fiber Insulation Cover Board: ASTM C208, Type II, Grade 2, high-density cellulosic-fiber insulation board, having a minimum compressive strength of **40 psi (276 kPa)**.

1. Thickness: **[1/2 inch (13 mm)][1 inch (25 mm)]<Insert thickness>**.
2. Surface Finish: **[Primed one side][Primed two sides with non-asphaltic primer][Integral coating, six sides][Unprimed]<Insert finish>**.
3. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.

C. Oriented Strand Board: DOC PS 2, Exposure 1, **7/16 inch (11 mm)** thick.

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.

D. Glass-Mat Gypsum Cover Board: ASTM C1177/C1177M, water-resistant gypsum board.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. **[CertainTeed; SAINT-GOBAIN]**
- b. **[Georgia-Pacific Gypsum LLC]**
- c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
- d. **[USG Corporation]**
- e. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
 3. Thickness: **[1/4 inch (6 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
 4. Surface Finish: **[Fiberglass facer][Factory primed][Unprimed]**.
 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- E. Fiber-Reinforced Gypsum Roof Board: ASTM C1278/C1278M, cellulosic-fiber-reinforced, water-resistant gypsum board.
1. Thickness: **[1/4 inch (6 mm)][3/8 inch (10 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- F. Fiber-Reinforced Cementitious Cover Board: ASTM C1325, fiber-mat-reinforced cementitious board.
1. Thickness: **[7/16 inch (11 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- G. Fiber-Reinforced Recycled Plastic Cover Board: Cellulose fiber blended with recycled plastic board.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Continuus Materials, LLC]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Continuus Materials, LLC]**
 - b. **<Insert manufacturer's name>**
 3. Thickness: **[1/4 inch (6 mm)][1/2 inch (13 mm)]**.
 4. Surface Finish: **[Fiberglass facer][Paper facer]**.
 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- H. High-Density Polyisocyanurate Cover Board: ASTM C1289, Type II, Class 4, Grade 1, 1/2 inch (13 mm) thick, having a minimum compressive strength of 80 psi (551 kPa).
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.

- I. Polyisocyanurate Insulation Cover Board: ASTM C1289 Type II, Class 4, Grade 1, 1/2 inch (13 mm) thick, having a minimum compressive strength of **80 psi (551 kPa)**.
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.

2.13 ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Conductive Medium: Electrically conductive material specifically designed to enable ELD testing procedures as approved in writing by roofing membrane manufacturer.
 - 1. Conductive medium to be located directly under roofing membrane in accordance with ASTM D7877 and ASTM D8231.
- B. Moisture-Monitoring System: Permanently embedded, continuously monitored moisture-detection system.
 - 1. Sensors measuring moisture content to be placed within roofing system and connected to a monitoring program, with a notification indicating location of breach.

2.14 ROOF COATING SYSTEM

- A. Primer: Roof coating manufacturer's standard primer to enhance the adhesion of roof coating to substrate.
- B. Asphalt Emulsion Coating, Asbestos Free: ASTM D1227/D1227M, Type II, **[Class 1, mineral-colloid-emulsified, fibered][Class 2, chemically emulsified, filled or fibered]**.
- C. Asphalt Emulsion Coating, Nonfibered: ASTM D1227/D1227M, Type III, **[Class 1, mineral-colloid-emulsified][Class 2, chemically emulsified]**.
- D. Aluminum-Pigmented Asphaltic Coating: ASTM D2824/D2824M, **[Type I, nonfibered][Type III, fibered, asbestos-free]**.
- E. Acrylic Elastomer Emulsion Coating: ASTM D6083/D6083M, formulated for use on bituminous roof surfaces.
- F. Silicone Coating: ASTM D6694/D6694M, formulated for use on bituminous roof surfaces.
- G. Color: **[White][Highly reflective white][Gray][Tan]<Insert color>**.

2.15 WALKWAYS

- A. Walkway Pads: **[Reinforced asphaltic composition pads with slip-resisting mineral-granule surface][Polymer-modified, reconstituted rubber pads with slip-resisting textured surface]**, manufactured as a traffic pad for foot traffic and acceptable to roofing membrane manufacturer.
 - 1. Pad Size: Approximately **[36 by 60 inches (914 mm by 1524 mm)][30 by 30 inches (762 mm by 762mm)]<Insert size>**.
 - 2. Color: **[Contrasting with cap sheet][Gray][Yellow][White]<Insert color>**.
 - 3. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content

not less than <Insert number> percent.

- B. Walkway Cap Sheet Strips: Matching cap sheet; suitable for installation method specified, and as follows:
 - 1. Size: [36 by 60 inches (914 mm by 1524 mm)]<Insert size>.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with roofing system Installer present, for compliance with requirements and other conditions affecting performance of the Work:
 - 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 - 2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
 - 4. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of **1/16 inch (1.6 mm)** out of plane relative to adjoining deck.
 - 5. Verify that minimum concrete drying period recommended by roofing manufacturer has passed.
 - 6. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than [75]<Insert number> percent, or as recommended by roofing system manufacturer, when tested in accordance with ASTM F2170.
 - a. Test Frequency: One test probe per each [1000 sq. ft. (93 sq. m)]<Insert area>, or portion thereof, of roof deck, with not less than three test probes.
 - b. Submit test reports within 24 hours of performing tests.
 - 7. Verify that concrete-curing compounds that impair adhesion of roofing components to roof deck have been removed.
 - 8. Verify that joints in precast concrete roof decks have been grouted flush with top of concrete.
 - 9. Verify that minimum curing period recommended by roofing system manufacturer for lightweight insulating concrete roof decks has passed.
 - 10. Verify that any damaged sections of cementitious wood-fiber decks have been repaired or replaced.
 - 11. Verify that adjacent cementitious wood fiber panels are vertically aligned to within **1/8-inch (3 mm)** at top surface.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation in accordance with roofing manufacturer's written installation instructions.
 - 1. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.



1. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Prime surface of concrete deck with asphalt primer at a rate of **3/4 gal./100 sq. ft. (0.3 L/sq. m)**, and allow primer to dry.
- D. Perform fastener-pullout tests in accordance with roof system manufacturer's written instructions.
 1. Submit test result within 24 hours of performing tests.
 - a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind-uplift requirements.
- E. Install sound-absorbing insulation strips in ribs of acoustical steel roof decks in accordance with roof deck manufacturer's written installation instructions.

3.3 INSTALLATION OF BUILT-UP ASPHALT ROOFING SYSTEM, GENERAL

- A. Install roofing system in accordance with manufacturer's written instructions, **[FM Approvals' RoofNav][SPRI's "Directory of Roof Assemblies"]** listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast.
 1. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition[**and to not void warranty for existing roofing system**].
- D. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under **[Section 072713 "Modified Bituminous Sheet Air Barriers."][Section 072715 "Nonbituminous Self-Adhering Sheet Air Barriers."][Section 072726 "Fluid-Applied Membrane Air Barriers."]**
- E. Asphalt Heating:
 1. Heat asphalt to its equiviscous temperature, measured at the mop cart or mechanical spreader immediately before application.
 2. Circulate asphalt during heating.
 - a. Do not raise asphalt temperature above equiviscous temperature range more than one hour before time of application.
 3. Do not exceed asphalt manufacturer's recommended temperature limits during asphalt heating.
 4. Do not heat asphalt within **25 deg F (14 deg C)** of flash point.
 5. Discard asphalt maintained at a temperature exceeding finished blowing temperature for more than four hours.
 - a. Apply hot roofing asphalt within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
- F. SEBS-Modified Asphalt Heating: Heat and apply roofing asphalt in accordance with roofing manufacturer's written instructions.

- G. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing components or adjacent building construction.

3.4 INSTALLATION OF SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than **24 inches (600 mm)** in adjacent rows.
1. Install substrate board at right angle to flutes of steel roof deck. Locate end joints over crests of steel roof deck.
 2. Tightly butt substrate boards together.
 3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 4. Fasten substrate board to top flanges of steel deck in accordance with recommendations in **[FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's "Directory of Roof Assemblies" listed roof assembly requirements for specified wind-uplift load capacity]** and FM Global Property Loss Prevention Data Sheet Global Property Loss Prevention Data Sheet 1-29.
 5. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof in accordance with roofing system manufacturer's written instructions.
 6. Loosely lay substrate board over roof deck.

3.5 INSTALLATION OF VAPOR RETARDER

- A. Install vapor retarder in a single layer over roof area in accordance with manufacturer's written installation instructions, side and end lapping each sheet a minimum of **2 and 6 inches (50 and 150 mm)**, respectively.
1. Extend vertically up parapet walls and projections to a minimum height equal to height of the insulation and cover board.
 2. Continuously seal side and end laps.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.6 INSTALLATION OF ROOF INSULATION AND ACCESSORIES

- A. Coordinate installing roofing system components, so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system and insulation manufacturer's written installation instructions. Install minimum of two layers of insulation under area of roofing to achieve required thickness.
- C. Install each layer of insulation with **[joints staggered not less than 24 inches (600 mm) in adjacent rows][end joints staggered not less than 12 inches (300 mm) in adjacent rows]** and offset not less than **12 inches (300 mm)** from previous layer.
1. Trim insulation neatly to fit around penetrations and projections, and to fit tightly to intersecting sloping roof decks.
 2. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 3. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus **24 inches (600 mm)**.
 4. Trim insulation, so that water flow is unrestricted.

5. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 6. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 7. Secure insulation in accordance with **[FM Approvals' RoofNav for specified Windstorm Resistance Classification][SPRI's "Directory of Roof Assemblies" for specified wind-uplift load capacity]**.
 8. Secure insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
- D. Nailer Strips: Mechanically fasten **4-inch nominal- (89-mm actual-)** width, wood nailer strips of same thickness as insulation perpendicular to sloped roof deck at the following spacing:
1. **[16 feet (4.88 m)]<Insert dimension>** apart for roof slopes greater than **1 inch per 12 inches (1:12)** but less than **3 inches per 12 inches (3:12)**.
 2. **[48 inches (1200 mm)]<Insert dimension>** apart for roof slopes greater than **3 inches per 12 inches (3:12)**.
- E. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane with vertical surfaces or angle changes greater than 45 degrees.

3.7 INSTALLATION OF COVER BOARD

- A. Install cover board over insulation with long joints in continuous straight lines, with end joints staggered between rows. Offset joints of insulation below a minimum of **6 inches (150 mm)** in each direction.
1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 2. At internal roof drains, conform to slope of drain sump.
 3. Trim cover board so that water flow is unrestricted.
 4. Cut and fit cover board tight to nailers, projections, and penetrations.
 5. Adhere cover board to substrate in accordance with **[FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's "Directory of Roof Assemblies" listed roof assembly requirements for specified wind-uplift load capacity]** and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Install sheathing paper over cover board and immediately beneath roofing membrane.

3.8 INSTALLATION OF ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Install conductive medium directly under roofing membrane in accordance with ASTM D7877 and ASTM D8231.
- B. Install sensors, connections, and accessory items required for complete continuously monitored moisture-detection system in accordance with manufacturer's written installation instructions.

3.9 INSTALLATION OF BUILT-UP ROOFING MEMBRANE

- A. Install roofing membrane in accordance with roofing system manufacturer's written installation instructions and applicable recommendations of NRCA's "Quality Control Guidelines for the Application of Built-up Roofing" and as follows:
1. Base Sheet: **[One][One, installed over sheathing paper]**.
 2. Number of Ply Sheets: **[Two][Three][Four]<Insert number>**.

3. Surfacing: **[Aggregate][Asphalt surfacing or coating][Mineral-granule-surfaced cap sheet]**.
 4. Mineral-granule-surfaced cap sheet is in addition to number of ply sheets specified.
- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel **[and Owner's testing and inspection agency]**.
- C. Where roof slope exceeds **[1/2 inch per 12 inches (1:24)][3/4 inch per 12 inches (1:18)]<Insert slope>**, install roofing ply sheets parallel with slope.
1. Backnail roofing ply sheets to **[nailer strips][substrate]** in accordance with roofing system manufacturer's written instructions.
- D. Coordinate installation of roofing, so insulation and other components of roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.
 2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
 3. Remove and discard temporary seals before beginning work on adjoining roofing.
- E. Loosely lay one course of sheathing paper, lapping edges and ends a minimum of **2 inches (51 mm)** and **6 inches (150 mm)**, respectively.
- F. Install lapped base sheet course, extending sheet over and terminating beyond cants. Attach base sheet as follows:
1. Mechanically fasten to substrate.
 2. Spot or strip mop to substrate with hot roofing asphalt.
 3. Adhere to substrate **[in a solid mopping of hot roofing asphalt][using cold-applied asphalt adhesive][using cold-applied polymer-modified asphalt adhesive]**.
- G. Install **[three][four]** ply sheets, starting at low point of roof.
1. Align ply sheets without stretching.
 2. Shingle side laps of ply sheets uniformly to achieve required number of plies throughout thickness of roofing membrane.
 - a. Shingle in direction to shed water.
 3. Extend ply sheets over and terminate above cants.
 4. Embed each ply sheet in a solid mopping of hot roofing asphalt applied at rate required by roofing manufacturer, to form a uniform membrane without ply sheets touching.
 5. Embed each ply sheet in cold-applied asphalt adhesive applied at a rate required by roofing manufacturer, to form a uniform membrane without ply sheets touching.
 6. Embed each ply in cold-applied polymer-modified asphalt adhesive applied at a rate required by roofing manufacturer, to form a uniform membrane without ply sheets touching.
 7. Install ply sheets without wrinkles, tears, and free from air pockets.
- H. Cap Sheet: Install lapped granulated cap sheet, starting at low point of roofing.
1. Offset laps from laps of preceding ply sheets, and align cap sheet without stretching.
 2. Lap in direction to shed water.
 3. Extend cap sheet over and terminate above cants.

4. Embed cap sheet in a solid mopping of hot roofing asphalt applied at rate required by roofing system manufacturer.
 5. Embed each ply sheet in cold-applied asphalt adhesive applied at a rate required by roofing system manufacturer.
 6. Embed each ply in cold-applied polymer-modified asphalt adhesive applied at a rate required by roofing system manufacturer.
 7. Install cap sheet without wrinkles, tears, and free from air pockets.
- I. Aggregate Surfacing: After installing and testing roofing, base flashing, and stripping, promptly apply flood coat to roof surface with **[60 lb/100 sq. ft. (3.0 kg/sq. m) of hot roofing asphalt][cold-applied polymer-modified asphalt adhesive at rate recommended by roof system manufacturer]**. **[While flood coat is hot and fluid, cast][Cast]** the following average weight of aggregate in a uniform course:
1. Aggregate Weight: **[400 lb/100 sq. ft. (20 kg/sq. m)][300 lb/100 sq. ft. (15 kg/sq. m)]**.
 2. If aggregate surfacing is delayed, promptly apply glaze coat of **[hot roofing asphalt at a rate of 10 lb/100 sq. ft. (0.5 kg/sq. m)][cold-applied polymer-modified asphalt adhesive at a rate recommended by roof system manufacturer]**.
- J. Glaze-coat roofing surface with hot roofing asphalt applied at a rate of **10 to 15 lb/100 sq. ft. (0.5 to 0.75 kg/sq. m)**.

3.10 INSTALLATION OF FLASHING AND STRIPPING

- A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof; secure to substrates in accordance with roofing system manufacturer's written instructions and as follows:
1. Prime substrates with asphalt primer if required by roofing system manufacturer.
 2. Backer Sheet Application: **[Mechanically fasten backer sheet to walls or parapets. Adhere backer sheet over roofing membrane at cants][Adhere backer sheet to substrate]** in **[a solid mopping of hot roofing asphalt][cold-applied adhesive][cold-applied polymer-modified adhesive]**.
 3. Flashing Sheet Application, Hot: **[Adhere flashing sheet to substrate in a solid mopping of hot roofing asphalt applied at not less than 425 deg F (218 deg C). Apply hot roofing asphalt to back of flashing sheet if recommended by roofing manufacturer][Torch-apply flashing sheet to substrate]**.
 4. Flashing Sheet Application, Cold: Adhere flashing sheet to substrate in **[cold-applied adhesive][cold-applied polymer-modified adhesive][asphalt roofing cement]** at rate required by roofing manufacturer.
- B. Extend base flashing up walls or parapets a minimum of **8 inches (200 mm)** above built-up roofing and **4 inches (100 mm)** onto field of roofing membrane.
- C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
1. Seal top termination of base flashing **[with a strip of glass-fiber fabric set in asphalt roofing cement]**.
- D. Install liquid flashing system in accordance with manufacturer's recommendations.
1. Extend liquid flashing not less than **3 inches (76 mm)** in all directions from edges of item being flashed.
 2. Embed granules, matching color of roof membrane, into wet compound.

- E. Install stripping in accordance with roofing system manufacturer's written instructions, where metal flanges and edgings are set on roofing membrane.
 - 1. Install flashing sheet stripping in a continuous coating of asphalt roofing cement, in **[a solid mopping of hot roofing asphalt applied at not less than 425 deg F (218 deg C), and extend onto roofing membrane][cold-applied adhesive][cold-applied polymer-modified adhesive]**.
 - 2. Install flashing sheet stripping by heat welding and extend onto roofing membrane.
 - 3. Install stripping of not fewer than two roofing ply sheets, setting each ply in a continuous coating of asphalt roofing cement, in **[a solid mopping of hot roofing asphalt][cold-applied adhesive][cold-applied polymer-modified adhesive]**, and extend onto roofing membrane **4 inches (100 mm) and 6 inches (150 mm)**, respectively.
- F. Roof Drains: Set **[30-by-30-inch (760-by-760-mm)]<Insert dimensions> 4-pound (1.8-kg)** lead flashing in bed of asphaltic adhesive on completed roofing membrane.
 - 1. Cover metal flashing with roofing cap sheet stripping, and extend a minimum of **[4 inches (100 mm)][6 inches (150 mm)]** beyond edge of metal flashing onto field of roofing membrane.
 - 2. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
 - 3. Install stripping in accordance with roofing manufacturer's written instructions.

3.11 INSTALLATION OF ROOF COATING SYSTEM

- A. Apply coating to **[roofing membrane][and][base flashings]** in accordance with manufacturer's written instructions, by spray, roller, or other suitable application method[, **to provide a dry film thickness of not less than 20 mils (0.5 mm)**].

3.12 INSTALLATION OF WALKWAYS

- A. Walkway Pads: Install walkway pads, using units of size indicated or, if not indicated, of manufacturer's standard size, in accordance with walkway pad manufacturer's written instructions.
 - 1. Install walkways at following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - f. Locations indicated on Drawings.
 - g. As required by roof membrane manufacturer's warranty requirements.
 - 2. Provide **3-inch (76-mm)** clearance between adjoining pads.
 - 3. Set walkway pads **[in additional pour coat of hot roofing asphalt][in cold-applied adhesive][in cold-applied polymer-modified adhesive]** after sweeping away loose aggregate surfacing.
- B. Walkway Cap-Sheet Strips: Install walkway cap-sheet strips, approximately **36 inches (914 mm)** wide and in lengths not exceeding **10 feet (3 m)**, over roofing membrane, using same application method as used for roofing cap sheet. **[Install walkway cap-sheet strips before flood coat and aggregate surface is applied.]**

1. Install walkways strips at following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - f. Locations indicated on Drawings.
 - g. As required by roof membrane manufacturer's warranty requirements.
2. Provide **3-inch (76-mm)** clearance between adjoining strips.

C. Roof-Paver Walkways: Install walkway roof pavers in accordance with roofing manufacturer's written instructions.

1. Install roof paver walkways at following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - f. Locations indicated on Drawings.
 - g. As required by roof membrane manufacturer's warranty requirements.
2. Provide **3-inch (76-mm)** clearance between adjacent roof pavers.

3.13 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to inspect substrate conditions, surface preparation, roof membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Tests and Inspections:
 1. ELD Testing: Testing agency surveys entire roof area and flashings to locate discontinuities in the roof membrane using ELD in accordance with ASTM D7877 and ASTM D8231.
 - a. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
 2. Flood Testing: Flood test each roofing area for leaks, in accordance with recommendations in ASTM D5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

- a. Perform tests before overlying construction is placed.
 - b. Flood to an average depth of [2-1/2 inches (65 mm)]<Insert depth> with a minimum depth of [1 inch (25 mm)]<Insert depth> and not exceeding a depth of [4 inches (100 mm)]<Insert depth>. Maintain 2 inches (51 mm) of clearance from top of base flashing.
 - c. Flood each area for [24][48][72] hours.
 - d. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - e. Testing agency to prepare survey report indicating locations of initial leaks, if any, and final survey report.
3. Infrared Thermography Testing: Testing agency surveys entire roof area using infrared color thermography in accordance with ASTM C1153.
 - a. Perform tests before overlying construction is placed.
 - b. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or nuclear hydrogen detection testing.
 - c. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - d. Testing agency to prepare survey report of initial scan indicating locations of entrapped moisture, if any.
4. Electrical Capacitance/Impedance Testing: Testing agency surveys entire roof area for entrapped water within roof assembly in accordance with ASTM D7954/D7954M.
 - a. Perform tests before overlying construction is placed.
 - b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
5. Nuclear Hydrogen Detection Testing: Testing agency surveys entire roof area for entrapped water within roof assembly in accordance with SPRI/RCI NT-1.
 - a. Perform tests before overlying construction is placed.
 - b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
- C. Test Cuts: Remove test specimens to evaluate problems observed during quality-assurance inspections of roofing system as follows:
 1. Determine approximate quantities of components within roofing system in accordance with ASTM D3617/D3617M.
 2. Examine test specimens for interply voids in accordance with ASTM D3617/D3617M and to comply with criteria established in Appendix 3 in NRCA's "Quality Control Guidelines for the

- Application of Built-up Roofing."
3. Repair areas where test cuts were made in accordance with roofing manufacturer's written instructions.

D. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

1. Notify Architect[**and Owner**] 48 hours in advance of date and time of inspection.

E. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

1. Roofing system will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

3.14 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period.

1. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and in accordance with warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.15 ROOFING SYSTEM INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing System Installer," has performed roofing and associated Work on the following project:

1. Owner: **<Insert name of Owner>**.
2. Owner Address: **<Insert address>**.
3. Building Name/Type: **<Insert information>**.
4. Building Address: **<Insert address>**.
5. Area of Work: **<Insert information>**.
6. Warranty Period: **[Two][Five]<Insert number>** years from date of Substantial Completion.
7. Date of Substantial Completion: _____.

B. AND WHEREAS Roofing System Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said Work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing System Installer hereby warrants, subject to terms and conditions herein

set forth, that during Warranty Period, Roofing System Installer will, at Roofing System Installer's own cost and expense, make or cause to be made such repairs to or replacements of said Work as are necessary to correct faulty and defective work and as are necessary to maintain said Work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding **<Insert mph (m/s)>**;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the Work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When Work has been damaged by any of foregoing causes, Warranty will be null and void until such damage has been repaired by Roofing System Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing System Installer is responsible for damage to Work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of Work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing System Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty will become null and void on date of said alterations, but only to the extent said alterations affect Work covered by this Warranty. If Owner engages Roofing System Installer to perform said alterations, Warranty will not become null and void unless Roofing System Installer, before starting said Work, will have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate Work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty will become null and void on date of said change, but only to the extent said change affects Work covered by this Warranty.
6. Owner will promptly notify Roofing System Installer of observed, known, or suspected leaks, defects, or deterioration and will afford reasonable opportunity for Roofing System Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing System Installer on said Work and will not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty will not operate to relieve Roofing System Installer of responsibility for performance of original Work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.



07 - Thermal And Moisture Protection

END OF SECTION 07 51 13 00



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 51 13 00	07 01 50 81	Built-Up Coal Tar Roofing
07 51 13 00	07 52 13 00	Atactic-Polypropylene (APP) Modified Bituminous Membrane Roofing
07 51 13 00	07 52 16 00	Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing
07 51 13 00	07 53 23 00	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing



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SECTION 07 52 13 00 - ATACTIC-POLYPROPYLENE (APP) MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Atactic-polypropylene (APP)-modified bituminous membrane roofing system.
2. Base sheet.
3. Cap sheet.
4. Base flashing sheet.
5. Accessory roofing system materials.
6. Substrate board.
7. Vapor retarder.
8. Roof insulation and accessories.
9. Cover board.
10. Electronic leak-detection (ELD) materials.
11. Roof coating system.
12. Walkways.

- B. Section contains installation of sound-absorbing insulation strips in ribs of acoustical steel roof deck. Sound-absorbing insulation strips are furnished under Section 053100 "Steel Decking."

C. Related Requirements:

1. Section 053100 "Steel Decking" for roof deck panels[**and sound-absorbing insulation strips**].
2. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking, and for wood-based, structural-use roof deck panels.
3. Section 061600 "Sheathing" for wood-based, structural-use roof deck panels.
4. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
5. Section 077100 "Roof Specialties" for [**premanufactured metal copings**][**roof edge fasciae**][**gravel stops**][**reglets**][**roof edge flashings**][**counterflashings**].
6. Section 077129 "Manufactured Roof Expansion Joints" for premanufactured roof expansion-joint assemblies.
7. Section 077200 "Roof Accessories" for manufactured roof curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
8. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
9. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.2 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.3 PREINSTALLATION MEETINGS

- A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at [**Project site**]<**Insert location**>.

1. Meet with Owner,[**Construction Manager**,] Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing system Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and other installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing system installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, roofing system Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

B. Preinstallation Roofing Conference: Conduct conference at [**Project site**]<**Insert location**>.

1. Meet with Owner,[**Construction Manager**,] Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing system Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and other installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing system installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, roofing system Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, sections, and attachment details to other Work, including the following:

1. Layout and thickness of insulation.
2. Base flashings and membrane terminations.
3. Flashing details at penetrations.
4. Tapered insulation, including slopes.
5. Roof plan showing orientation of roof deck and orientation of roofing membrane, fastener spacings, and pattern for corner, perimeter, and field-of-roof locations.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
7. Crickets, saddles, and tapered edge strips, including slopes.
8. Tie-in with adjoining wall system air barrier.

C. Samples for Verification: For the following products:

1. Cap Sheet: Samples of [manufacturer's standard colors for selection by Architect][specified color].
 2. Base Flashing Sheet: Samples of [manufacturer's standard colors for selection by Architect][specified color].
 3. Roof Coating System: Samples of [manufacturer's standard colors for selection by Architect][specified color].
 4. Walkways: Samples of [manufacturer's standard colors for selection by Architect][specified color].
- D. Wind-Uplift Resistance Submittal: For roofing system indicating compliance with wind-uplift performance requirements.
- E. Sustainable Design Submittals:
1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.
 2. Health Product Declaration (HPD): Provide documentation confirming product compliance with one of the following:
 - a. Inventory or HPD to at least 0.01 percent by weight, with at least 95 percent assessed using GreenScreen Benchmark assessment.
 - b. Cradle to Cradle v3 certification with minimum Silver level of Material Health.
 - c. Living Product Challenge certification indicating achievement of Imperative 09, "Transparent Material Health."

1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer Certificates:
1. Performance Requirement Certificate: Signed by roofing membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.
 2. Special Warranty Certificate: Signed by roofing membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- B. Product Test Reports: For roofing membrane and insulation, for tests performed by an independent, qualified testing agency indicating compliance with specified requirements.
- C. Research Reports: For components of membrane roofing system, from [an agency acceptable to authorities having jurisdiction][ICC-ES]<Insert evaluation agency> showing compliance with specified performance requirements.
- D. Field Test Reports:
1. Concrete internal relative humidity test reports.
 2. Fastener pullout test results and manufacturer's revised requirements for fastener patterns.
- E. Field quality control reports.
- F. Qualification Statements: For roofing system [Installer][manufacturer][and][testing agency].

- G. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system.
- B. Certified statement from existing roofing system manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is **[UL listed][listed in FM Approvals' RoofNav][listed in SPRI's "Directory of Roof Assemblies"]** for roofing system identical to that used for this Project.
- B. Roofing System Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
 - 1. Certified Roofing System Installer: Entity that employs **[a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified modified bitumen system installers][a supervisor who is an NRCA ProCertified Roofing Foreman][a supervisor who is an NRCA ProCertified Roofing Foreman and not less than 20 percent of installers who are NRCA ProCertified modified bitumen system installers]**.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing system materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.
 - 1. Protect stored liquid material from direct sunlight.
 - 2. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources.
 - 1. Store in a dry location.
 - 2. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing system materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be installed in accordance with roofing system manufacturer's written installation instructions and warranty requirements.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
1. Special warranty to include all components of roofing system, such as [substrate board,][vapor retarder,] roof insulation, fasteners, adhesives,[cover board,] roofing membranes, base flashing sheet,[walkway products,] and other components of roofing system.
 2. Warranty Period: [10][15][20][25][30]<Insert number> years from date of Substantial Completion.
- B. Roofing System Installer's Warranty: Submit roofing system Installer's warranty, on warranty form at end of this Section, signed by roofing system Installer, covering the Work of this Section, including all components of roofing system, such as [substrate board,][vapor retarder,] roof insulation, fasteners, adhesives,[cover board,] roofing membranes, base flashing sheet,[walkway products,] and other components of roofing system.
1. Warranty Period: [Two][Five]<Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain components for roofing system from [roofing membrane manufacturer][or][manufacturer approved by roofing membrane manufacturer].

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing system and flashings to remain watertight.
1. Accelerated Weathering: Roofing membrane to withstand 2000 hours of exposure when tested in accordance with ASTM G152, ASTM G154, or ASTM G155.
 2. Impact Resistance: Roofing membrane to resist impact damage when tested in accordance with ASTM D3746/D3746M, ASTM D4272/D4272M, or the Resistance to Foot Traffic Test section in FM Approvals 4470.
- B. Material Compatibility: Roofing system materials to be compatible with one another and adjacent materials under conditions of service and installation required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
- C. Wind-Uplift Resistance: Design roofing system to resist the following wind-uplift pressures when tested in accordance with FM Approvals 4474, UL 580, or UL 1897:



1. Zone 1' (Roof Area Interior): <Insert lbf/sq. ft. (kPa)>.
2. Zone 1 (Roof Area Field): <Insert lbf/sq. ft. (kPa)>.
3. Zone 2 (Roof Area Perimeter): <Insert lbf/sq. ft. (kPa)>.
 - a. Location: From roof edge to <Insert dimension> inside roof edge.
4. Zone 3 (Roof Area Corners): <Insert lbf/sq. ft. (kPa)>.
 - a. Location: <Insert dimension> in each direction from each building corner.
- D. FM Approvals' RoofNav Listing: Roofing membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
 1. Fire/Windstorm Classification: [Class 1A-60][Class 1A-75][Class 1A-90][Class 1A-105][Class 1A-120]<Insert class>.
 2. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34, [MH][SH][VSH].
- E. SPRI's "Directory of Roof Assemblies" Listing: Roofing membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and are listed in SPRI's "Directory of Roof Assemblies" for roof assembly identical to that specified for this Project.
 1. Wind-Uplift Load Capacity: [60 psf][75 psf][90 psf][105 psf][120 psf]<Insert capacity>.
- F. Solar Reflectance Index (SRI): Three-year-aged SRI not less than [64][32] or initial SRI not less than [82][39] when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- G. Solar Reflectance Index (SRI): Three-year-aged SRI not less than [64][25] when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- H. Solar Reflectance Index (SRI): Not less than [78][29] when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- I. Cool Roof Rating Council (CRRC): Roofing system to be listed by the CRRC for low-slope roof products.
- J. Energy Performance: Roofing system to have an initial solar reflectance index (SRI) of not less than [0.70]<Insert value> and an emissivity of not less than [0.75]<Insert value> when tested in accordance with CRRC S100.
- K. Exterior Fire-Test Exposure: [Class A][Class B][Class C]; for installation and roof slopes indicated; when tested by a qualified testing agency in accordance with ASTM E108 or UL 790.
 1. Identify products with appropriate markings of applicable testing agency.
- L. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated.
 1. Identify products with appropriate markings of applicable testing agency.

2.3 ATACTIC-POLYPROPYLENE (APP)-MODIFIED BITUMINOUS MEMBRANE ROOFING SYSTEM

- A. APP Roofing System Components: See the following articles for individual roof materials required for **[two][three]<Insert number>**-ply roofing system; **[cold-applied adhesive][heat-welded (torch)]** installation method **[with self-adhered base sheet layer][with mechanically fastened base sheet layer]**.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Bitec, Inc]**
 - b. **[CertainTeed; SAINT-GOBAIN]**
 - c. **[Elevate; Holcim Building Envelope]**
 - d. **[GAF]**
 - e. **[Johns Manville; a Berkshire Hathaway company]**
 - f. **[Mule-Hide Products Co., Inc]**
 - g. **[Performance Roof Systems]**
 - h. **[Polyglass U.S.A., Inc.]**
 - i. **[Tremco Incorporated]**
 - j. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Bitec, Inc]**
 - b. **[CertainTeed; SAINT-GOBAIN]**
 - c. **[Elevate; Holcim Building Envelope]**
 - d. **[GAF]**
 - e. **[Johns Manville; a Berkshire Hathaway company]**
 - f. **[Mule-Hide Products Co., Inc]**
 - g. **[Performance Roof Systems]**
 - h. **[Polyglass U.S.A., Inc.]**
 - i. **[Tremco Incorporated]**
 - j. **<Insert manufacturer's name>**

2.4 BASE SHEET

- A. APP-Modified Bitumen, Polyester-Mat Base Sheet: ASTM D6222/D6222M, **[Type I][Type II]**, Grade S, reinforced with polyester fabric; smooth surfaced; suitable for installation method specified.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Bitec, Inc]**
 - b. **[CertainTeed; SAINT-GOBAIN]**
 - c. **[Elevate; Holcim Building Envelope]**
 - d. **[GAF]**
 - e. **[Johns Manville; a Berkshire Hathaway company]**
 - f. **[Mule-Hide Products Co., Inc]**

- g. **[Performance Roof Systems]**
 - h. **[Polyglass U.S.A., Inc.]**
 - i. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Bitec, Inc]**
 - b. **[CertainTeed; SAINT-GOBAIN]**
 - c. **[Elevate; Holcim Building Envelope]**
 - d. **[GAF]**
 - e. **[Johns Manville; a Berkshire Hathaway company]**
 - f. **[Mule-Hide Products Co., Inc]**
 - g. **[Performance Roof Systems]**
 - h. **[Polyglass U.S.A., Inc.]**
 - i. **<Insert manufacturer's name>**
- B. APP-Modified Bitumen, Polyester- and Glass-Fiber-Mat Base Sheet: ASTM D6223/D6223M, **[Type I][Type II]**, Grade S, reinforced with a combination of polyester fabric and glass fibers; smooth surfaced; suitable for installation method specified.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **[Performance Roof Systems]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **[Performance Roof Systems]**
 - c. **<Insert manufacturer's name>**
- C. APP-Modified Bitumen, Glass-Fiber-Mat Base Sheet: ASTM D6509/D6509M, reinforced with glass fibers; smooth surfaced; suitable for installation method specified.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Elevate; Holcim Building Envelope]**
 - c. **[Johns Manville; a Berkshire Hathaway company]**
 - d. **[Mule-Hide Products Co., Inc]**
 - e. **[Performance Roof Systems]**
 - f. **[Polyglass U.S.A., Inc.]**
 - g. **[Tremco Incorporated]**

- h. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [CertainTeed; SAINT-GOBAIN]
 - b. [Elevate; Holcim Building Envelope]
 - c. [Johns Manville; a Berkshire Hathaway company]
 - d. [Mule-Hide Products Co., Inc]
 - e. [Performance Roof Systems]
 - f. [Polyglass U.S.A., Inc.]
 - g. [Tremco Incorporated]
 - h. <Insert manufacturer's name>
 - D. Asphalt-Coated, Glass-Fiber-Mat Base Sheet: ASTM D4601/D4601M, Type II, nonperforated, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.
 - E. Asphalt-Coated, Glass-Fiber-Mat, Venting Base Sheet: ASTM D4897/D4897M, Type II, venting, nonperforated, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on bottom surface.
- 2.5 CAP SHEET
- A. APP-Modified Bitumen, Polyester-Mat, Smooth-Surfaced Cap Sheet: ASTM D6222/D6222M, [Type I][Type II], Grade S, reinforced with polyester fabric; suitable for installation method specified.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Bitec, Inc]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [Elevate; Holcim Building Envelope]
 - d. [GAF]
 - e. [Mule-Hide Products Co., Inc]
 - f. [Polyglass U.S.A., Inc.]
 - g. [Tremco Incorporated]
 - h. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Bitec, Inc]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [Elevate; Holcim Building Envelope]
 - d. [GAF]
 - e. [Mule-Hide Products Co., Inc]
 - f. [Polyglass U.S.A., Inc.]
 - g. [Tremco Incorporated]
 - h. <Insert manufacturer's name>

- B. APP-Modified Bitumen, Polyester- and Glass-Fiber-Mat, Smooth-Surfaced Cap Sheet: ASTM D6223/D6223M, **[Type I][Type II]**, Grade S, reinforced with a combination of polyester fabric and glass fibers; suitable for installation method specified.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **[Performance Roof Systems]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **[Performance Roof Systems]**
 - c. **<Insert manufacturer's name>**
- C. APP-Modified Bitumen, Polyester-Mat, Granule-Surfaced Cap Sheet: ASTM D6222/D6222M, **[Type I][Type II]**, Grade G, reinforced with polyester fabric; suitable for installation method specified.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Bitec, Inc]**
 - b. **[CertainTeed; SAINT-GOBAIN]**
 - c. **[Elevate; Holcim Building Envelope]**
 - d. **[GAF]**
 - e. **[Johns Manville; a Berkshire Hathaway company]**
 - f. **[Mule-Hide Products Co., Inc]**
 - g. **[Performance Roof Systems]**
 - h. **[Polyglass U.S.A., Inc.]**
 - i. **[Tremco Incorporated]**
 - j. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Bitec, Inc]**
 - b. **[CertainTeed; SAINT-GOBAIN]**
 - c. **[Elevate; Holcim Building Envelope]**
 - d. **[GAF]**
 - e. **[Johns Manville; a Berkshire Hathaway company]**
 - f. **[Mule-Hide Products Co., Inc]**
 - g. **[Performance Roof Systems]**
 - h. **[Polyglass U.S.A., Inc.]**
 - i. **[Tremco Incorporated]**
 - j. **<Insert manufacturer's name>**

3. Granule Color: **[White][Highly reflective white][Gray][Tan]<Insert color>**.
- D. APP-Modified Bitumen, Polyester- and Glass-Fiber-Mat, Granule-Surfaced Cap Sheet: ASTM D6223/D6223M, **[Type I][Type II]**, Grade G, reinforced with a combination of polyester fabric and glass fibers; suitable for installation method specified.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **[Performance Roof Systems]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **[Performance Roof Systems]**
 - c. **<Insert manufacturer's name>**
 3. Granule Color: **[White][Highly reflective white][Gray][Tan]<Insert color>**.

2.6 BASE FLASHING SHEET

- A. APP-Modified Bitumen, Base Flashing Sheet: Matching cap sheet, suitable for installation method specified.
- B. Liquid Base Flashing System: Roofing membrane manufacturer's standard moisture-curing resin with low solvent content, consisting of a primer, flashing cement, and reinforcing scrim; suitable for installation method specified.

2.7 ACCESSORY ROOFING SYSTEM MATERIALS

- A. General: Accessory materials as recommended in writing by roofing membrane manufacturer for intended use, compatible with other roofing system components, and suitable for installation method specified.
 1. Adhesives and Sealants: Comply with VOC limits of authorities having jurisdiction.
 2. Verify adhesives and sealants comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Other Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Nonmembrane Roof Sealants: 300 g/L.

- j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - k. Sealant Primers for Porous Substrates: 775 g/L.
3. Verify adhesives and sealants comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. Verify adhesives and sealants comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 5. Verify adhesives and sealants comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.
- B. Prefabricated Pipe Flashings: As recommended in writing by roofing membrane manufacturer.
- C. Roof Vents: As recommended in writing by roofing membrane manufacturer.
1. Size: Not less than **4-inch (100-mm)** diameter.
- D. Sheathing Paper: Red-rosin type, minimum **3 lb/100 sq. ft. (0.16 kg/sq. m)**.
- E. Metal Termination Bars: Manufacturer's standard, predrilled, stainless steel or aluminum bars, approximately **1 by 1/8 inch (25 by3 mm)** thick; with anchors.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- F. Cold-Applied Trichloroethylene Asphalt Adhesive: ASTM D3019, Type III, roofing membrane manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive; specially formulated for compatibility and use with **[roofing membrane sheets][and][base flashing sheets]**; designed for adhering roofing system components to substrate and each other; tested by roofing system manufacturer to meet performance requirements.
- G. Cold-Applied Polymer-Modified Asphalt Adhesive: Roofing membrane manufacturer's standard solvent- and asbestos-free, cold-applied adhesive; specially formulated for compatibility and use with **[roofing membrane sheets][and][base flashing sheets]**; designed for adhering roofing system components to substrate and each other; tested by roofing system manufacturer to meet performance requirements.
- H. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying.
- I. Self-Adhered Primer: Roofing membrane manufacturer's standard primer to enhance the adhesion of membrane to substrate.
- J. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate; tested for required pullout strength, and acceptable to roofing membrane manufacturer.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.

- K. Roofing Granules: Roofing membrane manufacturer's standard ceramic-coated mineral roofing granules, No. 11 screen size with 100 percent passing **No. 8 (2.36-mm)** sieve and 98 percent of mass retained on **No. 40 (0.425-mm)** sieve; color matching cap sheet.
- L. Safety Accessories: Roofing membrane manufacturer's standard yellow seaming tape for designating safety perimeters and rooftop hazards.
- M. Miscellaneous Accessories: As recommended in writing by roofing membrane manufacturer.

2.8 SUBSTRATE BOARD

- A. Glass-Mat Gypsum Roof Substrate Board: ASTM C1177/C1177M, water-resistant gypsum board.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
 - 3. Thickness: **[1/4 inch (6 mm)][1/2 inch (13 mm)][Type X, 5/8 inch (16 mm)]**.
 - 4. Surface Finish: **[Factory primed][Unprimed]**.
 - 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- B. Fiber-Reinforced Gypsum Roof Substrate Board: ASTM C1278/C1278M.
 - 1. Thickness: **[1/4 inch (6 mm)][3/8 inch (10 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
 - 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- C. High-Density Polyisocyanurate Roof Substrate Board: ASTM C1289, Type II, Class 4, Grade 1, **1/2 inch (13 mm)** thick, having a minimum compressive strength of **80 psi (551 kPa)**.
- D. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.

2.9 VAPOR RETARDER

- A. Rubberized-Asphalt-Sheet Vapor Retarder, Self-Adhering: ASTM D1970/D1970M polyethylene film laminated to layer of rubberized asphalt adhesive, minimum **40-mil (1.0-mm)** total thickness; maximum permeance rating of **0.1 perm (6 ng/Pa x s x sq. m)**; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
- B. Butyl Rubber Sheet Vapor Retarder, Self-Adhering: Polyethylene film laminated to layer of butyl rubber adhesive, minimum **30-mil (0.76-mm)** total thickness; maximum permeance rating of **0.1 perm (6 ng/Pa x s x sq. m)**; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
- C. Laminated Sheet Vapor Retarder: Two layers, fire-retardant polyethylene laminate, reinforced with cord grid.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Reef Industries, Inc.]**
 - b. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Reef Industries, Inc.]**
 - b. **<Insert manufacturer's name>**
 - 3. Permeance Rating: Not more than **0.062 perm (3.556 ng/Pa x s x sq. m)** when tested in accordance with ASTM E96/E96M.
 - 4. Flame-Spread Index: Not more than 5 when tested in accordance with ASTM E84.
 - 5. Smoke-Developed Index: Not more than 35 when tested in accordance with ASTM E84.
 - 6. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.10 ROOF INSULATION AND ACCESSORIES

- A. General: Preformed roof insulation boards, manufactured **[or approved]** by roofing membrane manufacturer, approved for use in **[FM Approvals' RoofNav-listed roof assemblies][SPRI's "Directory of Roof Assemblies" listed roof assemblies]**.
- B. Extruded-Polystyrene Board Insulation: ASTM C578, **[Type IV, 1.45 lb/cu. ft. (23 kg/cu. m) minimum density, 25 psi (173 kPa) minimum compressive strength][Type V, 3.00 lb/cu. ft. (48 kg/cu. m) minimum density, 100 psi (690 kPa) minimum compressive strength]**, square edged.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. [DuPont de Nemours, Inc.]
 - b. [Kingspan Insulation LLC]
 - c. [Owens Corning]
 - d. [Soprema, Inc.]
 - e. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [DuPont de Nemours, Inc.]
 - b. [Kingspan Insulation LLC]
 - c. [Owens Corning]
 - d. [Soprema, Inc.]
 - e. <Insert manufacturer's name>
 3. Thermal Resistance: R-value of 5.0 per 1 inch (25 mm).
 4. Size: [48 by 48 inches (1219 by 1219 mm)][48 by 96 inches (1219 by 2438 mm)].
 5. Thickness:
 - a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.
 - b. Upper Layer: <Insert thickness>.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- C. Molded (Expanded) Polystyrene Board Insulation: ASTM C578, Type VIII, 1.15 lb/cu. ft. (18 kg/cu. m) minimum density, 13 psi (90 kPa) minimum compressive strength, square edge.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [Carlisle Syntec Systems]
 - c. [Cellofoam North America, Inc.]
 - d. [Kingspan Insulation LLC]
 - e. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [Carlisle Syntec Systems]
 - c. [Cellofoam North America, Inc.]
 - d. [Kingspan Insulation LLC]
 - e. <Insert manufacturer's name>
 3. Thermal Resistance: R-value of 3.8 per 1 inch (25 mm).
 4. Size: [48 by 48 inches (1219 by 1219 mm)][48 by 96 inches (1219 by 2438 mm)].
 5. Thickness:
 - a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.

- b. Upper Layer: **<Insert thickness>**.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- D. Composite Molded (Expanded) Polystyrene Board Insulation: ASTM C578, **[Type II, 1.35 lb/cu. ft. (22 kg/cu. m)]****[Type VIII, 1.15 lb/cu. ft. (18 kg/cu. m)]****[Type IX, 1.8 lb/cu. ft. (29 kg/cu. m)]** minimum density, with factory-applied facings, as follows:
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following]****[provide products by one of the following]****[available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Cellofoam North America, Inc.]**
 - b. **[Insulfoam; a Carlisle Company]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Cellofoam North America, Inc.]**
 - b. **[Insulfoam; a Carlisle Company]**
 - c. **<Insert manufacturer's name>**
 3. Facer: **[ASTM C208, Type II, Grade 2 cellulosic-fiber insulation board, asphalt coated, 1/2 inch (13 mm) thick]****[DOC PS 2, Exposure 1, oriented strand board, 7/16 inch (11 mm) thick]****<Insert material>**.
 4. Size: **[48 by 48 inches (1219 by 1219 mm)]****[48 by 96 inches (1219 by 2438 mm)]**.
 5. Thickness: **<Insert thickness>**.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- E. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, **[Class 1 felt facer]****[Class 2 coated glass-fiber facer]****[Class 3 uncoated glass-fiber facer]** on both major surfaces.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following]****[provide products by one of the following]****[available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Atlas Polyiso Roof and Wall Insulation]**
 - b. **[Carlisle Syntec Systems]**
 - c. **[CertainTeed; SAINT-GOBAIN]**
 - d. **[Elevate; Holcim Building Envelope]**
 - e. **[GAF]**
 - f. **[Hunter Panels; a Carlisle company]**
 - g. **[IKO Industries Inc.]**
 - h. **[Insulfoam; a Carlisle Company]**
 - i. **[Johns Manville; a Berkshire Hathaway company]**
 - j. **[Kingspan Insulation LLC]**
 - k. **[Polyglass U.S.A., Inc.]**
 - l. **[Rmax, A Business Unit of Sika Corporation]**

- m. <Insert manufacturer's name>
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [Carlisle Syntec Systems]
 - c. [CertainTeed; SAINT-GOBAIN]
 - d. [Elevate; Holcim Building Envelope]
 - e. [GAF]
 - f. [Hunter Panels; a Carlisle company]
 - g. [IKO Industries Inc.]
 - h. [Insulfoam; a Carlisle Company]
 - i. [Johns Manville; a Berkshire Hathaway company]
 - j. [Kingspan Insulation LLC]
 - k. [Polyglass U.S.A., Inc.]
 - l. [Rmax, A Business Unit of Sika Corporation]
 - m. <Insert manufacturer's name>
- 3. Compressive Strength: [Grade 2, 20 psi (138 kPa)][Grade 3, 25 psi (172 kPa)].
- 4. Size: [48 by 48 inches (1219 by 1219 mm)][48 by 96 inches (1219 by 2438 mm)].
- 5. Thickness:
 - a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.
 - b. Upper Layer: <Insert thickness>.
- 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- F. Composite Polyisocyanurate Board Insulation: ASTM C1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other surface.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [Elevate; Holcim Building Envelope]
 - d. [GAF]
 - e. [Hunter Panels; a Carlisle company]
 - f. [Insulfoam; a Carlisle Company]
 - g. [Johns Manville; a Berkshire Hathaway company]
 - h. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [Elevate; Holcim Building Envelope]
 - d. [GAF]

- e. [Hunter Panels; a Carlisle company]
 - f. [Insulfoam; a Carlisle Company]
 - g. [Johns Manville; a Berkshire Hathaway company]
 - h. <Insert manufacturer's name>
3. Facer: [Type IV cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch (13 mm) thick][Type V oriented strand board facer, 7/16 inch (11 mm) thick][Type VII glass-mat-faced gypsum board facer, 1/4 inch (6 mm) thick]<Insert material>.
 4. Size: [48 by 48 inches (1219 by 1219 mm)][48 by 96 inches (1219 by 2438 mm)].
 5. Thickness: <Insert thickness>.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- G. Cellulosic-Fiber Board Insulation: ASTM C208, Type II, Grade 2, fibrous-felted, rigid insulation boards of wood fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Blue Ridge Fiberboard]
 - b. [GAF]
 - c. [Georgia-Pacific Gypsum LLC]
 - d. [Homasote Company]
 - e. [Huebert Fiberboard Inc]
 - f. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Blue Ridge Fiberboard]
 - b. [GAF]
 - c. [Georgia-Pacific Gypsum LLC]
 - d. [Homasote Company]
 - e. [Huebert Fiberboard Inc]
 - f. <Insert manufacturer's name>
 3. Thermal Resistance: R-value of 2.78 per 1 inch (25 mm).
 4. Size: [48 by 48 inches (1219 by 1219 mm)][48 by 96 inches (1219 by 2438 mm)].
 5. Thickness:
 - a. Base Layer: [1 inch (25 mm)][2 inches (51 mm)]<Insert thickness>.
 - b. Upper Layer: <Insert thickness>.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- H. Mineral Wool Board Insulation - Multi-Density: ASTM C726, Type I, Class 1, comprising monolithic fibrous material having an upper layer with 11.2 lb/cu. Ft. (180 kg/cu. M) density and a lower layer with 7.5 lb/cu. Ft. (120 kg/cu. M) density.

1. Thermal Resistance: R-value of 3.8 per 1 inch (25 mm).
 2. Size: 48 by 48 inches (1219 by 1219 mm).
 3. Thickness:
 - a. Base Layer: [2 inches (51 mm)]<Insert thickness>.
 - b. Upper Layer: <Insert thickness>.
 4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- I. Mineral Wool Board Insulation - Single Density: ASTM C726, Type II, Class 1, comprising monolithic fibrous material with 12.5 lb/cu. Ft. (200 kg/cu. M) density.
1. Thermal Resistance: R-value of 4.0 per 1 inch (25 mm).
 2. Size: 48 by 48 inches (1219 by 1219 mm).
 3. Thickness: 1 inch (25 mm).
 4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- J. Tapered Insulation: Provide factory-tapered insulation boards.
1. Material: [Match roof insulation]<Insert material>.
 2. Minimum Thickness: 1/4 inch (6 mm).
 3. Slope:
 - a. Roof Field: [1/4 inch per foot (1:48)]<Insert slope> unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: [1/2 inch per foot (1:24)]<Insert slope> unless otherwise indicated on Drawings.
 4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- K. Roof Insulation Accessories, General: As recommended in writing by insulation manufacturer for intended use, compatibility with other roofing system components, and suitable for installation method specified.
- L. Insulation Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- M. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation [to substrate][and] to another insulation layer as follows:
1. Modified asphaltic, asbestos-free, cold-applied adhesive.
 2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
 3. Full-spread, spray-applied, low-rise, two-component urethane adhesive.
 4. Verify adhesives and sealants comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.

- c. Multipurpose Construction Adhesives: 70 g/L.
- d. Fiberglass Adhesives: 80 g/L.
- e. Contact Adhesives: 80 g/L.
- f. PVC Welding Compounds: 510 g/L.
- g. Other Adhesives: 250 g/L.
- h. Single-Ply Roof Membrane Sealants: 450 g/L.
- i. Nonmembrane Roof Sealants: 300 g/L.
- j. Sealant Primers for Nonporous Substrates: 250 g/L.
- k. Sealant Primers for Porous Substrates: 775 g/L.

- 5. Verify adhesives and sealants comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- 6. Verify adhesives and sealants comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
- 7. Verify adhesives and sealants comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.

- N. Insulation Cant Strips: **[ASTM C728, perlite insulation board][ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board]**.
- O. Wood Nailer Strips: Comply with requirements in Section 061000 "Rough Carpentry."
- P. Tapered Edge Strips: **[ASTM C728, perlite insulation board][ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board]**.

2.11 COVER BOARD

- A. General: Cover board as recommended in writing by roofing membrane manufacturer for intended use; compatible with other roofing system components and suitable for installation method specified.
- B. Cellulosic-Fiber Cover Board: ASTM C208, Type II, Grade 2, high-density cellulosic-fiber insulation board, having a minimum compressive strength of **40 psi (276 kPa)**.
 - 1. Thickness: **[1/2 inch (13 mm)][1 inch (25 mm)]<Insert thickness>**.
 - 2. Surface Finish: **[Primed one side][Primed two sides with non-asphaltic primer][Integral coating, six sides][Unprimed]<Insert finish>**.
 - 3. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- C. Oriented Strand Board: DOC PS 2, Exposure 1, **7/16 inch (11 mm)** thick.
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- D. Glass-Mat Gypsum Cover Board: ASTM C1177/C1177M, water-resistant gypsum board.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
 3. Thickness: **[1/4 inch (6 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
 4. Surface Finish: **[Fiberglass facer][Factory primed][Unprimed]**.
 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- E. Fiber-Reinforced Gypsum Panel Cover Board: ASTM C1278/C1278M, cellulosic-fiber reinforced, water-resistant gypsum board.
1. Thickness: **[1/4 inch (6 mm)][3/8 inch (10 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- F. Fiber-Reinforced Cementitious Cover Board: ASTM C1325, fiber-mat-reinforced cementitious board.
1. Thickness: **[7/16 inch (11 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- G. Fiber-Reinforced Recycled Plastic Cover Board: Cellulose fiber blended with recycled plastic board.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Continuous Materials, LLC]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Continuous Materials, LLC]**
 - b. **<Insert manufacturer's name>**

3. Thickness: [1/4 inch (6 mm)][1/2 inch (13 mm)].
4. Surface Finish: [Fiberglass][Paper] facer.
5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.

H. High-Density Polyisocyanurate Cover Board: ASTM C1289, Type II, Class 4, Grade 1, 1/2 inch (13 mm) thick, having a minimum compressive strength of 80 psi (551 kPa).

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.

I. Polyisocyanurate Cover Board: ASTM C1289, Type II, Class 1, 1/2 inch (13 mm) thick.

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.

2.12 ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

A. Conductive Medium: Electrically conductive material specifically designed to enable ELD testing procedures as approved in writing by roofing membrane manufacturer.

1. Conductive medium to be located directly under roofing membrane in accordance with ASTM D7877 and ASTM D8231.

B. Moisture-Monitoring System: Permanently embedded, continuously monitored moisture-detection system.

1. Sensors measuring moisture content to be placed within roofing system and connected to a monitoring program, with a notification indicating location of breach.

2.13 ROOF COATING SYSTEM

A. Primer: Roof coating manufacturer's standard primer to enhance the adhesion of roof coating to substrate.

B. Asphalt Emulsion Coating, Asbestos Free: ASTM D1227/D1227M, Type II, [Class 1, mineral-colloid-emulsified, fibered][Class 2, chemically emulsified, filled or fibered].

C. Asphalt Emulsion Coating, Nonfibered: ASTM D1227/D1227M, Type III, [Class 1, mineral-colloid-emulsified][Class 2, chemically emulsified].

D. Aluminum-Pigmented Asphaltic Coating: ASTM D2824/D2824M, [Type I, nonfibered][Type III, fibered, asbestos-free].

E. Acrylic Elastomer Emulsion Coating: ASTM D6083/D6083M, formulated for use on bituminous roof surfaces.

F. Silicone Coating: ASTM D6694/D6694M, formulated for use on bituminous roof surfaces.

G. Color: [White][Highly reflective white][Gray][Tan]<Insert color>.

2.14 WALKWAYS

- A. Walkway Pads: **[Reinforced asphaltic composition pads with slip-resisting mineral-granule surface][Polymer-modified, reconstituted rubber pads with slip-resisting textured surface]**, manufactured as a traffic pad for foot traffic and acceptable to roofing membrane manufacturer.
1. Pad Size: Approximately **[36 by 60 inches (914 mm by 1524 mm)][30 by 30 inches (762 mm by 762mm)]<Insert size>**.
 2. Color: **[Contrasting with cap sheet][Gray][Yellow][White]<Insert color>**.
 3. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- B. Walkway Cap Sheet Strips: Matching cap sheet; suitable for installation method specified, and as follows:
1. Size: **[36 by 60 inches (914 mm by 1524 mm)]<Insert size>**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with roofing system Installer present, for compliance with requirements and other conditions affecting performance of the Work.
1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
 4. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of **1/16 inch (1.6 mm)** out of plane relative to adjoining deck.
 5. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 6. Verify that concrete substrate is visibly dry and free of moisture and that minimum concrete internal relative humidity is not more than **[75]<Insert number>** percent, or as recommended by roofing system manufacturer, when tested in accordance with ASTM F2170.
 - a. Test Frequency: One test probe per each **[1000 sq. ft. (93 sq. m)]<Insert area>**, or portion thereof, of roof deck, with not less than three test probes.
 - b. Submit test reports within 24 hours of performing tests.
 7. Verify that concrete-curing compounds that impair adhesion of roofing components to roof deck have been removed.
 8. Verify that joints in precast concrete roof decks have been grouted flush with top of concrete.
 9. Verify that minimum curing period recommended by roofing system manufacturer for lightweight insulating concrete roof decks has passed.
 10. Verify that any damaged sections of cementitious wood-fiber decks have been repaired or replaced.
 11. Verify that adjacent cementitious wood-fiber panels are vertically aligned to within **1/8 inch (3 mm)** at top surface.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

**Atactic-Polypropylene (APP) Modified Bituminous
Membrane Roofing**

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation in accordance with roofing system manufacturer's written installation instructions.
 - 1. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.
 - 1. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Prime surface of concrete deck with primer in accordance with roofing system manufacturer's written installation instructions and allow primer to dry.
- D. Perform fastener-pullout tests in accordance with roofing system manufacturer's written instructions.
 - 1. Submit test result within 24 hours of performing tests.
 - a. Include roofing system manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind-uplift requirements.
- E. Install sound-absorbing insulation strips in ribs of acoustical steel roof deck in accordance with roof deck manufacturer's written installation instructions.

3.3 INSTALLATION OF ATACTIC-POLYPROPYLENE (APP)-MODIFIED BITUMINOUS MEMBRANE ROOFING SYSTEM, GENERAL

- A. Install roofing system materials and components in accordance with roofing system manufacturer's written installation instructions, **[FM Approvals' RoofNav][SPRI's "Directory of Roof Assemblies"]** listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings. Provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast.
 - 1. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roofing membrane and auxiliary materials to tie into existing roofing to maintain weathertightness of transition **[and to not void warranty for existing roofing system]**.
- D. Coordinate installation and transition of roofing system component serving as an air barrier with wall system air barrier specified in **[Section 072713 "Modified Bituminous Sheet Air Barriers."][Section 072715 "Nonbituminous Self-Adhering Sheet Air Barriers."][Section 072726 "Fluid-Applied Membrane Air Barriers."]**
- E. Substrate-Joint Penetrations: Prevent adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.4 INSTALLATION OF SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less

than **24 inches (600 mm)** in adjacent rows.

1. Install substrate board at right angle to flutes of steel roof deck. Locate end joints over crests of steel roof deck.
2. Tightly butt substrate boards together.
3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
4. Fasten substrate board to top flanges of steel roof deck in accordance with roofing system manufacturer's written installation instructions and **[FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's "Directory of Roof Assemblies" listed roof assembly requirements for specified wind-uplift load capacity]** and FM Global Property Loss Prevention Data Sheet 1-29.
5. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof in accordance with roofing system manufacturer's written installation instructions.
6. Loosely lay substrate board over roof deck.

3.5 INSTALLATION OF VAPOR RETARDER

- A. Install vapor retarder in a single layer over roof area in accordance with manufacturer's written installation instructions, side and end lapping each sheet a minimum of **2 and 6 inches (50 and 150 mm)**, respectively.
 1. Extend vertically up parapet walls and projections to a minimum height equal to height of the insulation and cover board.
 2. Continuously seal side and end laps.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.6 INSTALLATION OF ROOF INSULATION AND ACCESSORIES

- A. Coordinate installation of roofing system components, so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written installation instructions. Install minimum of two layers of insulation under area of roofing to achieve required thickness.
- C. Install each layer of insulation with **[joints staggered not less than 24 inches (600 mm) in adjacent rows][end joints staggered not less than 12 inches (300 mm) in adjacent rows]** and offset not less than **12 inches (300 mm)** from previous layer.
 1. Trim insulation neatly to fit around penetrations and projections, and to fit tightly to intersecting sloping roof decks.
 2. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 3. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus **24 inches (600 mm)**.
 4. Trim insulation, so that water flow is unrestricted.
 5. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 6. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 7. Secure insulation in accordance with **[FM Approvals' RoofNav for specified Windstorm Resistance Classification][SPRI's "Directory of Roof Assemblies" for specified wind-uplift load capacity]**.
 8. Secure insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

Atactic-Polypropylene (APP) Modified Bituminous

Membrane Roofing

- D. Nailer Strips: Mechanically fasten **4-inch nominal- (89-mm actual-)** width, wood nailer strips of same thickness as insulation perpendicular to sloped roof deck at the following spacing:
 - 1. **[16 ft. (4.88 m)]<Insert dimension>** apart for roof slopes greater than **1 inch per 12 inches (1:12)** but less than **3 inches per 12 inches (3:12)**.
 - 2. **[48 inches (1219 mm)]<Insert dimension>** apart for roof slopes greater than **3 inches per 12 inches (3:12)**.
- E. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing system with vertical surfaces or angle changes greater than 45 degrees.

3.7 INSTALLATION OF COVER BOARD

- A. Comply with roofing system and insulation manufacturer's written installation instructions.
- B. Install cover board over insulation with long joints in continuous straight lines, with end joints staggered between rows. Offset joints of insulation below a minimum of **6 inches (150 mm)** in each direction.
 - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 2. At internal roof drains, conform to slope of drain sump.
 - 3. Trim cover board so that water flow is unrestricted.
 - 4. Cut and fit cover board tight to nailers, projections, and penetrations.
 - 5. Secure cover board to substrate in accordance with **[FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's "Directory of Roof Assemblies" listed roof assembly requirements for specified wind-uplift load capacity]** and FM Global Property Loss Prevention Data Sheet 1-29.
 - 6. Secure cover board to resist specified uplift pressure at corners, perimeter, and field of roof.
- C. Install sheathing paper over cover board and immediately beneath roofing membrane.

3.8 INSTALLATION OF ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Install conductive medium directly under roofing membrane in accordance with ASTM D7877 and ASTM D8231.
- B. Install sensors, connections, and accessory items required for complete continuously monitored moisture-detection system in accordance with manufacturer's written installation instructions.

3.9 INSTALLATION OF APP ROOFING MEMBRANE, GENERAL

- A. Install roofing membrane in accordance with roofing system manufacturer's written installation instructions and applicable recommendations in NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel **[and Owner's testing and inspection agency]**.
- C. Where roof slope exceeds **[1/2 inch per 12 inches (1:24)][3/4 inch per 12 inches (1:18)]<Insert slope>**, install roofing membrane sheets parallel with slope.

1. Backnail roofing sheets to **[nailer strips][substrate]** in accordance with roofing system manufacturer's written installation instructions.
- D. Coordinate installation of roofing system so insulation and other components of roofing system not permanently exposed are not subjected to precipitation or left uncovered at end of workday or when rain is forecast.
 1. Provide tie-offs at end of day's work to cover exposed roofing sheets and insulation with a course of roofing membrane set in adhesive, with joints and edges sealed.
 2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
 3. Remove and discard temporary seals before beginning work on adjoining roofing.

3.10 INSTALLATION OF BASE SHEET

- A. Prime surface of substrate with primer in accordance with roofing membrane manufacturer's written installation instructions and allow primer to dry.
- B. Before installing, unroll base sheet, cut into workable lengths, and allow to lie flat for time recommended by roofing membrane manufacturer for the ambient temperature at which base sheet will be installed.
- C. Loosely lay one course of sheathing paper, lapping edges and ends a minimum of **2 and 6 inches (50 and 150 mm)**, respectively.
- D. Installation of Base Sheet:
 1. Install base sheet in accordance with roofing membrane manufacturer's written installation instructions, starting at low point of roof.
 2. Extend base sheet over and terminate above cants.
 3. Install base sheet in a shingle fashion.
 4. Adhere base sheet to substrate in a uniform coating of cold-applied adhesive.
 5. Heat-weld (torch-apply) base sheet to substrate.
 - a. Perform torch application in accordance with NFPA 241, including two-hour fire watch after torches have been extinguished.
 6. Self-adhere base sheet to substrate.
 7. Mechanically fasten base sheet to substrate using fasteners specifically designed and sized for **[wood][wood panel]** decks.
 - a. Fasten base sheet to resist specified uplift pressure at corners, perimeter, and field of roof.
 8. Install base sheet without wrinkles, rears, and free from air pockets.
 9. Laps: Accurately align base sheet, without stretching, and maintain uniform side and end laps.
 - a. Lap side laps as recommended by roofing membrane manufacturer, but not less than **3 inches (75 mm)**.
 - b. Lap end laps as recommended by roofing membrane manufacturer, but not less than **12 inches (300 mm)**. Stagger end laps not less than **18 inches (450 mm)**.
 - c. **[Heat-weld end][Completely bond and seal]** laps, leaving no voids.
 - d. Roll laps with a **20 lb (9 kg)** roller.
 10. Repair tears and voids in laps and lapped seams not completely sealed.

11. Apply pressure to body of base sheet in accordance with roofing membrane manufacturer's written installation instructions, to remove air pockets and to result in complete adhesion of base sheet to substrate.

E. Installation of Venting Base Sheet:

1. **[Mechanically fasten sheet to substrate, using fasteners specifically designed and sized for substrate][Spot or strip mop sheet to substrate with cold-applied adhesive]** with venting side down.
 - a. Secure venting base sheet to substrate in accordance with requirements in **[FM Approvals' RoofNav for specified Windstorm Resistance Classification][SPRI's Directory of Roof Assemblies for specified wind-uplift load capacity]**.
 - b. Secure venting base sheet to resist uplift pressure at corners, perimeter, and field of roof.

3.11 INSTALLATION OF CAP SHEET

- A. Before installing, unroll cap sheet, cut into workable lengths, and allow to lie flat for time recommended by roofing membrane manufacturer for the ambient temperature at which cap sheet will be installed.
- B. Install cap sheet in accordance with roofing membrane manufacturer's written installation instructions, starting at low point of roof.
 1. Extend cap sheet over and terminate above cants.
 2. Install cap sheet in a shingle fashion.
 3. Adhere cap sheet to bottom layer in a uniform coating of cold-applied adhesive.
 4. Heat-weld (torch-apply) cap sheet to bottom layer.
 - a. Perform heat-welded installation in accordance with NFPA 241, including two-hour fire watch after torches have been extinguished.
 5. Install cap sheet without wrinkles or tears, and free from air pockets.
 6. Install cap sheet so side and end laps shed water.
- C. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps.
 1. Lap side laps as recommended by roofing membrane manufacturer, but not less than **3 inches (75 mm)**.
 2. Lap end laps as recommended by roofing membrane manufacturer, but not less than **12 inches (300 mm)**.
 3. Stagger end laps not less than **18 inches (450 mm)**.
 4. **[Heat-weld end][Completely bond and seal]** laps, leaving no voids.
 5. Roll laps with a **20 lb (9 kg)** roller.
 6. Repair tears and voids in laps and lapped seams not completely sealed.
- D. Apply pressure to body of cap sheet in accordance with roofing membrane written manufacturer's instructions, to remove air pockets and to result in complete adhesion of cap sheet to substrate.
- E. Apply roofing granules of same color as cap sheet to cover exuded bead at laps while bead is hot, to provide a continuous color appearance.

3.12 INSTALLATION OF BASE FLASHING AND STRIPPING

- A. Install base flashing sheet over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof; secure to substrates in accordance with roofing system manufacturer's written installation instructions and as follows:
 - 1. Prime substrates with primer if required by roofing system manufacturer.
 - 2. Base Flashing Sheet Application, Cold: Adhere base flashing sheet to substrate in cold-applied adhesive at rate required by roofing system manufacturer.
 - 3. Base Flashing Sheet Application, Hot: Head-weld (torch-apply) base flashing sheet to substrate.
 - a. Perform torch application in accordance with NFPA 241, including two-hour fire watch after torches have been extinguished.
- B. Extend base flashing sheet up walls or parapets a minimum of **8 inches (200 mm)** above roofing membrane and **4 inches (100 mm)** onto field of roofing membrane.
- C. Mechanically fasten top of base flashing sheet securely at terminations and perimeter of roofing.
 - 1. Seal top termination of base flashing sheet.
- D. Install liquid flashing system in accordance with roofing system manufacturer's written installation instructions.
 - 1. Extend liquid flashing not less than **3 inches (75 mm)** in all directions from edges of item being flashed.
 - 2. Embed granules, matching color of cap sheet, into wet compound.
- E. Install cap sheet stripping where metal flanges and edgings are set on roof in accordance with roofing system manufacturer's written installation instructions.
- F. Roof Drains: Set [**30-by-30-inch (760-by-760-mm)**]**<Insert dimensions>**, **4 lb (1.8 kg)** flashing in bed of adhesive on completed roofing membrane.
 - 1. Cover flashing with cap sheet stripping, and extend a minimum of [**4 inches (100 mm)**][**6 inches (150 mm)**] beyond edge of metal flashing onto field of roofing membrane.
 - 2. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
 - 3. Install stripping in accordance with roofing system manufacturer's written installation instructions.

3.13 INSTALLATION OF ROOF COATING SYSTEM

- A. Apply coating to [**smooth-surfaced cap sheet**][**and**][**base flashing sheet**] in accordance with roofing membrane manufacturer's written application instructions, by spray, roller, or other suitable application method[, **to provide a dry film thickness of not less than 20 mils (0.5 mm)**].

3.14 INSTALLATION OF WALKWAYS

- A. Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size, secure to cap sheet in accordance with roofing system manufacturer's written installation instructions.
 - 1. Install walkways at the following locations:

- a. Perimeter of each rooftop unit.
- b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
- c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
- d. Top and bottom of each roof access ladder.
- e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
- f. Locations indicated on Drawings.
- g. As required by roofing system manufacturer's warranty requirements.

2. Provide **3-inch (75-mm)** clearance between adjoining pads.

- B. Walkway Cap Sheet Strips: Install walkway cap sheet strips over roofing membrane, using same installation method as that used for cap sheet.

1. Install walkways strips at the following locations:

- a. Perimeter of each rooftop unit.
- b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
- c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
- d. Top and bottom of each roof access ladder.
- e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
- f. Locations indicated on Drawings.
- g. As required by roofing membrane manufacturer's warranty requirements.

2. Provide **3-inch (76-mm)** clearance between adjoining strips.

3.15 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections of substrate conditions, surface preparation, and installation of roofing membrane, flashings, protection, and drainage components, and to furnish reports to Architect.

- B. Tests and Inspections:

1. ELD Testing: Testing agency surveys entire roof area and flashings to locate discontinuities in the roof membrane using ELD in accordance with ASTM D7877 and ASTM D8231.
 - a. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
2. Flood Testing: Flood test each roof area for leaks, in accordance with recommendations in ASTM D5957 after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

- a. Flood to an average depth of [2-1/2 inches (63 mm)]<Insert depth> with a minimum depth of [1 inch (25 mm)]<Insert depth> and not exceeding a depth of [4 inches (100 mm)]<Insert depth>. Maintain 2 inches (50 mm) of clearance from top of base flashing.
 - b. Flood each area for [24][48][72] hours.
 - c. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - d. Testing agency to prepare survey report indicating locations of initial leaks, if any, and final survey report.
3. Infrared Thermography Testing: Testing agency surveys entire roof area using infrared color thermography in accordance with ASTM C1153. Perform tests before overlying construction is placed.
 - a. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or by nuclear hydrogen detection testing.
 - b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report of initial scan indicating locations of entrapped moisture, if any.
4. Electrical Capacitance/Impedance Testing: Testing agency surveys entire roof area for entrapped water within roof assembly in accordance with ASTM D7954/D7954M. Perform tests before overlying construction is placed.
 - a. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
5. Nuclear Hydrogen Detection Testing: Testing agency surveys entire roof area for entrapped water within roof assembly in accordance with ANSI/SPRI/RCI NT-1. Perform tests before overlying construction is placed.
 - a. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
- C. Test Cuts: Remove test specimens to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:
 1. Determine approximate quantities of components within roofing membrane in accordance with ASTM D3617/D3617M.

2. Examine test specimens for voids between plies in accordance with ASTM D3617/D3617M and to comply with criteria established in Appendix 3 in NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
 3. Repair areas where test cuts were made in accordance with roofing system manufacturer's written installation instructions.
- D. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
1. Notify Architect[**and Owner**] 48 hours in advance of date and time of inspection.
- E. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
1. Roofing system will be considered defective if it does not pass tests and inspections.
- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.
- G. Prepare test and inspection reports.

3.16 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period.
1. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and in accordance with warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.17 ROOFING SYSTEM INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing System Installer," has performed roofing and associated Work on the following project:
1. Owner: **<Insert name of Owner>**.
 2. Owner Address: **<Insert address>**.
 3. Building Name/Type: **<Insert information>**.
 4. Building Address: **<Insert address>**.
 5. Area of Work: **<Insert information>**.
 6. Warranty Period: **[Two][Five]<Insert number>** years from date of Substantial Completion.
 7. Date of Substantial Completion: _____.
- B. AND WHEREAS Roofing System Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said Work against leaks and faulty or defective materials and workmanship for

designated Warranty Period,

- C. NOW THEREFORE Roofing System Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period, Roofing System Installer will, at Roofing System Installer's own cost and expense, make or cause to be made such repairs to or replacements of said Work as are necessary to correct faulty and defective Work and as are necessary to maintain said Work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding <Insert mph (m/s)>;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the Work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When work has been damaged by any of foregoing causes, Warranty will be null and void until such damage has been repaired by Roofing System Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing System Installer is responsible for damage to Work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of Work.
 4. During Warranty Period, if Owner allows alteration of Work by anyone other than Roofing System Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty will become null and void on date of said alterations, but only to the extent said alterations affect Work covered by this Warranty. If Owner engages Roofing System Installer to perform said alterations, Warranty will not become null and void unless Roofing System Installer, before starting said Work, will have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate Work, thereby reasonably justifying a limitation or termination of this Warranty.
 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty will become null and void on date of said change, but only to the extent said change affects Work covered by this Warranty.
 6. Owner will promptly notify Roofing System Installer of observed, known, or suspected leaks, defects, or deterioration and afford reasonable opportunity for Roofing System Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
 7. This Warranty is recognized to be the only warranty of Roofing System Installer on said Work and will not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty will not operate to relieve Roofing System Installer of responsibility for performance of original Work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.
- E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.



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-
1. Authorized Signature: _____.
 2. Name: _____.
 3. Title: _____.

END OF SECTION 07 52 13 00



SECTION 07 52 16 00 - STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Styrene-butadiene-styrene (SBS) modified bituminous membrane roofing system.
2. Base sheet.
3. Cap sheet.
4. Base flashing sheet.
5. Asphalt materials.
6. Accessory roofing system materials.
7. Substrate board.
8. Vapor retarder.
9. Roof insulation and accessories.
10. Cover board.
11. Electronic leak-detection (ELD) materials.
12. Walkways.

- B. Section contains installation of sound-absorbing insulation strips in ribs of acoustical steel roof deck. Sound-absorbing insulation strips are furnished under Section 053100 "Steel Decking."

C. Related Requirements:

1. Section 053100 "Steel Decking" for roof deck panels[**and sound-absorbing insulation strips**].
2. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking, and for wood-based, structural-use roof deck panels.
3. Section 061600 "Sheathing" for wood-based, structural-use roof deck panels.
4. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
5. Section 077100 "Roof Specialties" for [**premanufactured metal copings**][**roof edge fasciae**][**gravel stops**][**reglets**][**roof edge flashings**][**counterflashings**].
6. Section 077129 "Manufactured Roof Expansion Joints" for premanufactured roof expansion-joint assemblies.
7. Section 077200 "Roof Accessories" for manufactured roof curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
8. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
9. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.2 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.3 PREINSTALLATION MEETINGS

- A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at [Project

site]<Insert location>.

1. Meet with Owner, [**Construction Manager**,] Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing system Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and other installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing system installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, roofing system Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

B. Preinstallation Roofing Conference: Conduct conference at [**Project site**] <Insert location>.

1. Meet with Owner, [**Construction Manager**,] Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing system Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and other installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing system installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, roofing system Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, sections, and attachment details to other Work, including the following:

1. Layout and thickness of insulation.
2. Base flashings and membrane terminations.
3. Flashing details at penetrations.
4. Tapered insulation layout, including slopes.
5. Roof plan showing orientation of roof deck and orientation of roofing membrane, fastener spacings, and pattern for corner, perimeter, and field-of-roof locations.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
7. Crickets, saddles, and tapered edge strips, including slopes.
8. Tie-in with adjoining wall system air barrier.

- C. Samples for Verification: Actual sample of finished products for the following products:
 - 1. Cap Sheet: Samples of **[manufacturer's standard colors for selection by Architect][specified color]**.
 - 2. Base Flashing Sheet: Samples of **[manufacturer's standard colors for selection by Architect][specified color]**.
 - 3. Walkways: Samples of **[manufacturer's standard colors for selection by Architect][specified color]**.
- D. Wind-Uplift-Resistance Submittal: For roofing system, indicating compliance with wind-uplift performance requirements.
- E. Sustainable Design Submittals:
 - 1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.
 - 2. Health Product Declaration (HPD): Provide documentation confirming product compliance with one of the following:
 - a. Inventory or HPD to at least 0.01 percent by weight, with at least 95 percent assessed using GreenScreen Benchmark assessment.
 - b. Cradle to Cradle v3 certification with minimum Silver level of Material Health.
 - c. Living Product Challenge certification indicating achievement of Imperative 09, "Transparent Material Health."

1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer Certificates:
 - 1. Performance Requirement Certificate: Signed by roofing membrane manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of complying with performance requirements.
 - 2. Special Warranty Certificate: Signed by roofing membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- B. Product Test Reports: For roofing membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.
- C. Research Reports: For components of roofing system, from **[an agency acceptable to authorities having jurisdiction][ICC-ES]<Insert evaluation agency>** showing compliance with specified performance requirements.
- D. Field Test Reports:
 - 1. Concrete internal relative humidity test reports.
 - 2. Fastener pullout test results and manufacturer's revised requirements for fastener patterns.
- E. Field quality control reports.
- F. Qualification Statements: For roofing system **[Installer][manufacturer][and][testing agency]**.

- G. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system.
- B. Certified statement from existing roofing system manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is **[UL listed][listed in FM Approvals' RoofNav][listed in SPRI's "Directory of Roof Assemblies"]** for roofing system identical to that used for this Project.
- B. Roofing System Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
 - 1. Certified Roofing System Installer: Entity that employs **[a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified modified bitumen system installers][a supervisor who is an NRCA ProCertified Roofing Foreman][a supervisor who is an NRCA ProCertified Roofing Foreman and not less than 20 percent of installers who are NRCA ProCertified modified bitumen system installers]**.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing system materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.
 - 1. Protect stored liquid material from direct sunlight.
 - 2. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources.
 - 1. Store in a dry location.
 - 2. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing system materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing to be installed in accordance with roofing system manufacturer's written installation instructions and warranty requirements.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
1. Special warranty to include all components of roofing system, such as **[substrate board,][vapor retarder,]** roof insulation, fasteners, adhesives, **[cover board,]** roofing membranes, base flashing sheet, **[walkway products,]** and other components of roofing system.
 2. Warranty Period: **[10][15][20][25][30]<Insert number>** years from date of Substantial Completion.
- B. Roofing System Installer's Warranty: Submit roofing system Installer's warranty, on warranty form at end of this Section, signed by Roofing System Installer, covering the Work of this Section, including all components of roofing system, such as **[substrate board,][vapor retarder,]** roof insulation, fasteners, adhesives, **[cover board,]** roofing membranes, base flashing sheet, **[walkway products,]** and other components of roofing system.
1. Warranty Period: **[Two][Five]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain components for roofing system from **[roofing membrane manufacturer][or][manufacturer approved by roofing membrane manufacturer]**.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing system and flashings to remain watertight.
1. Accelerated Weathering: Roofing membrane to withstand 2000 hours of exposure when tested in accordance with ASTM G152, ASTM G154, or ASTM G155.
 2. Impact Resistance: Roofing membrane to resist impact damage when tested in accordance with ASTM D3746/D3746M, ASTM D4272/D4272M, or the Resistance to Foot Traffic Test section in FM Approvals 4470.
- B. Material Compatibility: Roofing system materials to be compatible with one another and adjacent materials under conditions of service and installation required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
- C. Wind-Uplift Resistance: Design roofing system to resist the following wind-uplift pressures when tested in accordance with FM Approvals 4474, UL 580, or UL 1897:

1. Zone 1' (Roof Area Interior): **<Insert lbf/sq. ft. (kPa)>**.
2. Zone 1 (Roof Area Field): **<Insert lbf/sq. ft. (kPa)>**.
3. Zone 2 (Roof Area Perimeter): **<Insert lbf/sq. ft. (kPa)>**.
 - a. Location: From roof edge to **<Insert dimension>** inside roof edge.
4. Zone 3 (Roof Area Corners): **<Insert lbf/sq. ft. (kPa)>**.
 - a. Location: **<Insert dimension>** in each direction from each building corner.
- D. FM Approvals' RoofNav Listing: Roofing membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
 1. Fire/Windstorm Classification: **[Class 1A-60][Class 1A-75][Class 1A-90][Class 1A-105][Class 1A-120]<Insert class>**.
 2. Hail-Resistance Rating: FM 1-34 **[MH][SH][VSH]**.
- E. SPRI's "Directory of Roof Assemblies" Listing: Roofing membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and are listed in SPRI's "Directory of Roof Assemblies" for roof assembly identical to that specified for this Project.
 1. Wind-Uplift Load Capacity: **[60 psf][75 psf][90 psf][105 psf][120 psf]<Insert capacity>**.
- F. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][32]** or initial SRI not less than **[82][39]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- G. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][25]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- H. Solar Reflectance Index (SRI): Not less than **[78][29]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- I. Cool Roof Rating Council (CRRC): Roofing system to be listed by the CRRC for low-slope roof products.
- J. Energy Performance: Roofing system to have an initial Solar Reflectance Index (SRI) of not less than **[0.70]<Insert value>** and an emissivity of not less than **[0.75]<Insert value>** when tested in accordance with CRRC S100.
- K. Exterior Fire-Test Exposure: **[Class A][Class B][Class C]**; for installation and roof slopes indicated; when tested by a qualified testing agency in accordance with ASTM E108 or UL 790.
 1. Identify products with appropriate markings of applicable testing agency.
- L. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated.
 1. Identify products with appropriate markings of applicable testing agency.

2.3 STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS MEMBRANE ROOFING SYSTEM

- A. Roofing System Components: See the following articles for individual roof materials required for [two-][three-]<Insert number> ply roofing system; [hot-applied asphalt][cold-applied adhesive][heat-welded (torch)][self-adhered][mechanically fastened] installation method.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Bitec, Inc]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [Elevate; Holcim Building Envelope]
 - d. [GAF]
 - e. [Garland Company, Inc. (The)]
 - f. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
 - g. [Johns Manville; a Berkshire Hathaway company]
 - h. [Malarkey Roofing Products]
 - i. [MBTechnology]
 - j. [Mule-Hide Products Co., Inc]
 - k. [Polyglass U.S.A., Inc.]
 - l. [Siplast]
 - m. [Soprema, Inc.]
 - n. [Tamko Building Products LLC]
 - o. [Tremco Incorporated]
 - p. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Bitec, Inc]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [Elevate; Holcim Building Envelope]
 - d. [GAF]
 - e. [Garland Company, Inc. (The)]
 - f. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
 - g. [Johns Manville; a Berkshire Hathaway company]
 - h. [Malarkey Roofing Products]
 - i. [MBTechnology]
 - j. [Mule-Hide Products Co., Inc]
 - k. [Polyglass U.S.A., Inc.]
 - l. [Siplast]
 - m. [Soprema, Inc.]
 - n. [Tamko Building Products LLC]
 - o. [Tremco Incorporated]
 - p. <Insert manufacturer's name>

2.4 BASE SHEET

- A. SBS-Modified Bitumen Polyester-Mat Base Sheet: ASTM D6164/D6164M, [Type I][Type II], Grade S,
Styrene-Butadiene-Styrene (SBS) Modified Bituminous

reinforced with polyester fabric, smooth surfaced, suitable for installation method specified.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Elevate; Holcim Building Envelope]**
 - c. **[GAF]**
 - d. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - e. **[Johns Manville; a Berkshire Hathaway company]**
 - f. **[Polyglass U.S.A., Inc.]**
 - g. **[Siplast]**
 - h. **[Soprema, Inc.]**
 - i. **[Tremco Incorporated]**
 - j. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Elevate; Holcim Building Envelope]**
 - c. **[GAF]**
 - d. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - e. **[Johns Manville; a Berkshire Hathaway company]**
 - f. **[Polyglass U.S.A., Inc.]**
 - g. **[Siplast]**
 - h. **[Soprema, Inc.]**
 - i. **[Tremco Incorporated]**
 - j. **<Insert manufacturer's name>**

- B. SBS-Modified Bitumen Glass-Fiber-Mat Base Sheet: ASTM D6163/D6163M, **[Type I][Type II][Type III]**, Grade S, reinforced with glass fibers, smooth surfaced, suitable for installation method specified.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Bitec, Inc]**
 - b. **[CertainTeed; SAINT-GOBAIN]**
 - c. **[Elevate; Holcim Building Envelope]**
 - d. **[GAF]**
 - e. **[Garland Company, Inc. (The)]**
 - f. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - g. **[Johns Manville; a Berkshire Hathaway company]**
 - h. **[Malarkey Roofing Products]**
 - i. **[Mule-Hide Products Co., Inc]**
 - j. **[Polyglass U.S.A., Inc.]**

- k. [Siplast]
 - l. [Soprema, Inc.]
 - m. [Tamko Building Products LLC]
 - n. [Tremco Incorporated]
 - o. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Bitec, Inc]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [Elevate; Holcim Building Envelope]
 - d. [GAF]
 - e. [Garland Company, Inc. (The)]
 - f. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
 - g. [Johns Manville; a Berkshire Hathaway company]
 - h. [Malarkey Roofing Products]
 - i. [Mule-Hide Products Co., Inc]
 - j. [Polyglass U.S.A., Inc.]
 - k. [Siplast]
 - l. [Soprema, Inc.]
 - m. [Tamko Building Products LLC]
 - n. [Tremco Incorporated]
 - o. <Insert manufacturer's name>
- C. SBS-Modified Bitumen Polyester- and Glass-Fiber-Mat Base Sheet: ASTM D6162/D6162M, [Type I][Type II][Type III], Grade S, reinforced with a combination of polyester fabric and glass fibers, smooth surfaced, suitable for installation method specified.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- a. [Bitec, Inc]
 - b. [Garland Company, Inc. (The)]
 - c. [Johns Manville; a Berkshire Hathaway company]
 - d. [MBTechnology]
 - e. [Polyglass U.S.A., Inc.]
 - f. [Soprema, Inc.]
 - g. [Tremco Incorporated]
 - h. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Bitec, Inc]
 - b. [Garland Company, Inc. (The)]
 - c. [Johns Manville; a Berkshire Hathaway company]
 - d. [MBTechnology]
 - e. [Polyglass U.S.A., Inc.]
 - f. [Soprema, Inc.]

- g. **[Tremco Incorporated]**
- h. **<Insert manufacturer's name>**

2.5 CAP SHEET

- A. SBS-Modified Bitumen, Granule-Surfaced, Polyester-Mat Cap Sheet: ASTM D6164/D6164M, **[Type I][Type II]**, Grade G, reinforced with polyester fabric, suitable for installation method specified.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Elevate; Holcim Building Envelope]**
 - c. **[GAF]**
 - d. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - e. **[Johns Manville; a Berkshire Hathaway company]**
 - f. **[Mule-Hide Products Co., Inc]**
 - g. **[Polyglass U.S.A., Inc.]**
 - h. **[Siplast]**
 - i. **[Soprema, Inc.]**
 - j. **[Tamko Building Products LLC]**
 - k. **[Tremco Incorporated]**
 - l. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Elevate; Holcim Building Envelope]**
 - c. **[GAF]**
 - d. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - e. **[Johns Manville; a Berkshire Hathaway company]**
 - f. **[Mule-Hide Products Co., Inc]**
 - g. **[Polyglass U.S.A., Inc.]**
 - h. **[Siplast]**
 - i. **[Soprema, Inc.]**
 - j. **[Tamko Building Products LLC]**
 - k. **[Tremco Incorporated]**
 - l. **<Insert manufacturer's name>**
3. Granule Color: **[White][Highly reflective white][Gray][Tan]<Insert color>**.

- B. SBS-Modified Bitumen, Granule-Surfaced, Glass-Fiber-Mat Cap Sheet: ASTM D6163/D6163M, **[Type I][Type II][Type III]**, Grade G, SBS-modified asphalt sheet, reinforced with glass fibers, suitable for installation method specified.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering**

products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Bitec, Inc]
- b. [CertainTeed; SAINT-GOBAIN]
- c. [Elevate; Holcim Building Envelope]
- d. [GAF]
- e. [Garland Company, Inc. (The)]
- f. [Johns Manville; a Berkshire Hathaway company]
- g. [Malarkey Roofing Products]
- h. [MBTechnology]
- i. [Polyglass U.S.A., Inc.]
- j. [Siplast]
- k. [Soprema, Inc.]
- l. [Tremco Incorporated]
- m. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Bitec, Inc]
- b. [CertainTeed; SAINT-GOBAIN]
- c. [Elevate; Holcim Building Envelope]
- d. [GAF]
- e. [Garland Company, Inc. (The)]
- f. [Johns Manville; a Berkshire Hathaway company]
- g. [Malarkey Roofing Products]
- h. [MBTechnology]
- i. [Polyglass U.S.A., Inc.]
- j. [Siplast]
- k. [Soprema, Inc.]
- l. [Tremco Incorporated]
- m. <Insert manufacturer's name>

3. Granule Color: [White][Highly reflective white][Gray][Tan]<Insert color>.

- C. SBS-Modified Bitumen, Granule-Surfaced, Polyester and Glass-Fiber-Mat Cap Sheet: ASTM D6162/D6162M, [Type I][Type III], Grade G, reinforced with a combination of polyester fabric and glass fibers, suitable for installation method specified.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Bitec, Inc]
- b. [CertainTeed; SAINT-GOBAIN]
- c. [Garland Company, Inc. (The)]
- d. [Johns Manville; a Berkshire Hathaway company]
- e. [Soprema, Inc.]
- f. [Tremco Incorporated]
- g. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert

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manufacturer's name; product name or designation> or comparable product by one of the following:

- a. **[Bitec, Inc]**
- b. **[CertainTeed; SAINT-GOBAIN]**
- c. **[Garland Company, Inc. (The)]**
- d. **[Johns Manville; a Berkshire Hathaway company]**
- e. **[Soprema, Inc.]**
- f. **[Tremco Incorporated]**
- g. **<Insert manufacturer's name>**

3. Granule Color: **[White][Highly reflective white][Gray][Tan]<Insert color>**.

2.6 BASE FLASHING SHEET

- A. SBS-Modified Bitumen, Smooth-Surfaced Backer Sheet: Matching base sheet, suitable for installation method specified.
- B. Asphalt-Coated, Glass-Fiber-Mat Backer Sheet: ASTM D4601/D4601M, **[Type I][Type II]**, asphalt-impregnated and coated glass-fiber sheet, dusted with fine mineral surfacing on both sides, suitable for installation method specified.
- C. SBS-Modified Bitumen, Granule-Surfaced Base Flashing Sheet: Matching cap sheet, suitable for installation method specified.
- D. SBS-Modified Bitumen, Metal-Surfaced Base Flashing Sheet: ASTM D6298/D6298M, metal-foil-surfaced sheet, reinforced with glass fibers, suitable for installation method specified, and as follows:
 - 1. Metal Surfacing: **[Aluminum][Copper][Stainless steel][Aluminum, fluoropolymer-coated finish, of color and gloss selected by Architect from manufacturer's full range]**.
- E. Liquid Base Flashing System: Roofing membrane manufacturer's standard moisture curing resin with low solvent content, consisting of a primer, flashing cement, and reinforcing scrim, suitable for installation method specified.

2.7 ASPHALT MATERIALS

- A. Asphalt Primer: ASTM D41/D41M.
- B. Roofing Asphalt: ASTM D312/D312M, **[Type III][Type IV][Type III or IV as recommended by roofing system manufacturer]**, suitable for installation method specified.
- C. SEBS-Modified Roofing Asphalt: ASTM D6152/D6152M, suitable for installation method specified.

2.8 ACCESSORY ROOFING SYSTEM MATERIALS

- A. General: Accessory materials as recommended in writing by roofing membrane manufacturer for intended use, compatible with other roofing system components, and suitable for installation method specified.

1. Adhesives and Sealants: Comply with VOC limits of authorities having jurisdiction.
 2. Verify adhesives and sealants comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 3. Verify adhesives and sealants comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 4. Verify adhesives and sealants comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.
- B. Prefabricated Pipe Flashings: As recommended in writing by roofing membrane manufacturer.
- C. Roof Vents: As recommended in writing by roofing membrane manufacturer.
1. Size: Not less than **4-inch (100-mm)** diameter.
- D. Sheathing Paper: Red-rosin type, minimum **3 lb/100 sq. ft. (0.16 kg/sq. m)**.
- E. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately **1 by 1/8 inch (25 by 3 mm)** thick; with anchors.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- F. Cold-Applied Trichloroethylene Asphalt Adhesive: ASTM D3019, Type III, roofing membrane manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with **[roofing membrane sheets][and][base flashing sheets]**; designed for adhering roofing system components to substrate and each other, tested by roofing system manufacturer to meet performance requirements.
- G. Cold-Applied Polymer-Modified Asphalt Adhesive: Roofing membrane manufacturer's standard solvent- and asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with **[roofing membrane sheets][and][base flashing sheets]**; designed for adhering roofing system components to substrate and each other, tested by roofing system manufacturer to meet performance requirements.
- H. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required by roofing membrane manufacturer.
- I. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying.
- J. Self-Adhered Primer: Roofing membrane manufacturer's standard primer to enhance the adhesion of membrane to substrate.
- K. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate; tested for required pullout strength, and acceptable to roofing membrane manufacturer.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.

- L. Roofing Granules: Roofing membrane manufacturer's standard ceramic-coated mineral roofing granules, No. 11 screen size with 100 percent passing **No. 8 (2.36-mm)** sieve and 98 percent of mass retained on **No. 40 (0.425-mm)** sieve; color matching cap sheet.
- M. Safety Accessories: Roofing membrane manufacturer's standard yellow seaming tape for designating safety perimeters and rooftop hazards.
- N. Miscellaneous Accessories: As recommended in writing by roofing membrane manufacturer.

2.9 SUBSTRATE BOARD

- A. Glass-Mat Gypsum Roof Substrate Board: ASTM C1177/C1177M, water-resistant gypsum board.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
 - 3. Thickness: **[1/4 inch (6 mm)][1/2 inch (13 mm)][Type X, 5/8 inch (16 mm)]**.
 - 4. Surface Finish: **[Factory primed][Unprimed]**.
 - 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- B. Fiber-Reinforced Gypsum Roof Board: ASTM C1278/C1278M.
 - 1. Thickness: **[1/4 inch (6 mm)][3/8 inch (10 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
 - 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- C. High-Density Polyisocyanurate Cover Board: ASTM C1289, Type II, Class 4, Grade 1, **1/2 inch (13 mm)** thick, having a minimum compressive strength of **80 psi (551 kPa)**.
- D. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content

not less than <Insert number> percent.

2.10 VAPOR RETARDER

- A. Rubberized-Asphalt-Sheet Vapor Retarder, Self-Adhering: ASTM D1970/D1970M polyethylene film laminated to layer of rubberized asphalt adhesive, minimum **40-mil (1.0-mm)** total thickness; maximum permeance rating of **0.1 perm (6 ng/Pa x s x sq. m)**; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
- B. Butyl-Rubber-Sheet Vapor Retarder, Self-Adhering: Polyethylene film laminated to layer of butyl rubber adhesive, minimum **30-mil (0.76-mm)** total thickness; maximum permeance rating of **0.1 perm (6 ng/Pa x s x sq. m)**; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.
- C. Laminated Sheet Vapor Retarder: Two layers, fire-retardant polyethylene laminate, reinforced with cord grid.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Reef Industries, Inc.]**
 - b. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Reef Industries, Inc.]**
 - b. **<Insert manufacturer's name>**
 - 3. Permeance Rating: Not more than **0.062 perm (3.556 ng/Pa x s x sq. m)** when tested in accordance with ASTM E96/E96M.
 - 4. Flame Spread Index: Not more than 5 when tested in accordance with ASTM E84.
 - 5. Smoke-Developed Index: Not more than 35 when tested in accordance with ASTM E84.
 - 6. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.11 ROOF INSULATION AND ACCESSORIES

- A. General: Preformed roof insulation boards, manufactured **[or approved]** by roofing membrane manufacturer, approved for use in **[FM Approvals' RoofNav][SPRI's "Directory of Roof Assemblies"]** listed roof assemblies.
- B. Extruded-Polystyrene Board Insulation: ASTM C578, **[Type IV, 1.45 lb/cu. Ft. (23 kg/cu. M) minimum density, 25 psi (173 kPa) minimum compressive strength][Type V, 3.00 lb/cu. Ft. (48 kg/cu. M) minimum density, 100 psi (690 kPa) minimum compressive strength]**, square edged.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the**

following]:

- a. [DuPont]
- b. [Kingspan Insulation LLC]
- c. [Owens Corning]
- d. [Soprema, Inc.]
- e. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [DuPont]
- b. [Kingspan Insulation LLC]
- c. [Owens Corning]
- d. [Soprema, Inc.]
- e. <Insert manufacturer's name>

3. Thermal Resistance: R-value of 5.0 per 1 inch (25 mm).

4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)].

5. Thickness:

- a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.
- b. Upper Layer: <Insert thickness>.

6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.

- C. Molded (Expanded) Polystyrene Board Insulation: ASTM C578, Type VIII, 1.15 lb/cu. Ft. (18 kg/cu. M) minimum density, 13 psi (90 kPa) minimum compressive strength, square edge.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
- b. [Carlisle Syntec Systems]
- c. [Cellofoam North America, Inc.]
- d. [Kingspan Insulation LLC]
- e. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
- b. [Carlisle Syntec Systems]
- c. [Cellofoam North America, Inc.]
- d. [Kingspan Insulation LLC]
- e. <Insert manufacturer's name>

3. Thermal Resistance: R-value of 3.8 per 1 inch (25 mm).

4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)].

5. Thickness:
 - a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.
 - b. Upper Layer: <Insert thickness>.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- D. Composite Molded (Expanded) Polystyrene Board Insulation: ASTM C578, [Type II, 1.35 lb/cu. Ft. (22 kg/cu. M)][Type VIII, 1.15 lb/cu. Ft. (18 kg/cu. M)][Type IX, 1.8 lb/cu. Ft. (29 kg/cu. M)] minimum density, with factory-applied facings, as follows:
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Cellofoam North America, Inc.]
 - b. [Insulfoam; a Carlisle Company]
 - c. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Cellofoam North America, Inc.]
 - b. [Insulfoam; a Carlisle Company]
 - c. <Insert manufacturer's name>
 3. Facer: [ASTM C208, Type II, Grade 2, cellulosic-fiber insulation board, asphalt coated, 1/2 inch (13 mm) thick][DOC PS 2, Exposure 1, oriented strand board, 7/16 inch (11 mm) thick]<Insert material>.
 4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)].
 5. Thickness: <Insert thickness>.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- E. Polyisocyanurate Board Insulation: ASTM C1289, Type II, [Class 1 felt facer][Class 2 coated glass-fiber facer][Class 3 uncoated glass-fiber facer] on both major surfaces.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [Carlisle Syntec Systems]
 - c. [CertainTeed; SAINT-GOBAIN]
 - d. [Elevate; Holcim Building Envelope]
 - e. [GAF]
 - f. [Hunter Panels; a Carlisle company]
 - g. [IKO Industries Inc.]
 - h. [Insulfoam; a Carlisle Company]
 - i. [Johns Manville; a Berkshire Hathaway company]
 - j. [Kingspan Insulation LLC]

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- k. [Polyglass U.S.A., Inc.]
 - l. [Rmax, A Business Unit of Sika Corporation]
 - m. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [Carlisle Syntec Systems]
 - c. [CertainTeed; SAINT-GOBAIN]
 - d. [Elevate; Holcim Building Envelope]
 - e. [GAF]
 - f. [Hunter Panels; a Carlisle company]
 - g. [IKO Industries Inc.]
 - h. [Insulfoam; a Carlisle Company]
 - i. [Johns Manville; a Berkshire Hathaway company]
 - j. [Kingspan Insulation LLC]
 - k. [Polyglass U.S.A., Inc.]
 - l. [Rmax, A Business Unit of Sika Corporation]
 - m. <Insert manufacturer's name>
 3. Compressive Strength: [Grade 2, 20 psi (138 kPa)][Grade 3, 25 psi (172 kPa)].
 4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)].
 5. Thickness:
 - a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.
 - b. Upper Layer: <Insert thickness>.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- F. Composite Polyisocyanurate Board Insulation: ASTM C1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber-mat facer on the other surface.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [Carlisle Syntec Systems]
 - c. [CertainTeed; SAINT-GOBAIN]
 - d. [Elevate; Holcim Building Envelope]
 - e. [GAF]
 - f. [Hunter Panels; a Carlisle company]
 - g. [IKO Industries Inc.]
 - h. [Insulfoam; a Carlisle Company]
 - i. [Johns Manville; a Berkshire Hathaway company]
 - j. [Kingspan Insulation LLC]
 - k. [Polyglass U.S.A., Inc.]
 - l. [Rmax, A Business Unit of Sika Corporation]
 - m. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Atlas Polyiso Roof and Wall Insulation]**
 - b. **[Carlisle Syntec Systems]**
 - c. **[CertainTeed; SAINT-GOBAIN]**
 - d. **[Elevate; Holcim Building Envelope]**
 - e. **[GAF]**
 - f. **[Hunter Panels; a Carlisle company]**
 - g. **[IKO Industries Inc.]**
 - h. **[Insulfoam; a Carlisle Company]**
 - i. **[Johns Manville; a Berkshire Hathaway company]**
 - j. **[Kingspan Insulation LLC]**
 - k. **[Polyglass U.S.A., Inc.]**
 - l. **[Rmax, A Business Unit of Sika Corporation]**
 - m. **<Insert manufacturer's name>**
 3. Facer: **[Type IV cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch (13 mm) thick][Type V oriented strand board facer, 7/16 inch (11 mm) thick][Type VII glass-mat-faced gypsum board facer, 1/4 inch (6 mm) thick]<Insert material>**.
 4. Size: **[48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)]**.
 5. Thickness: **<Insert thickness>**.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- G. Perlite Board Insulation: ASTM C728, Type 1, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[GAF]**
 - b. **[Johns Manville; a Berkshire Hathaway company]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[GAF]**
 - b. **[Johns Manville; a Berkshire Hathaway company]**
 - c. **<Insert manufacturer's name>**
 3. Thermal Resistance: R-value of 2.78 per 1 inch (25 mm).
 4. Size: **[48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)]**.
 5. Thickness:
 - a. Base Layer: **[1-1/2 inches (38 mm)]<Insert thickness>**.
 - b. Upper Layer: **<Insert thickness>**.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content

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not less than **<Insert number>** percent.

- H. Cellulosic-Fiber Board Insulation: ASTM C208, Type II, Grade 2, fibrous-felted, rigid insulation boards of wood fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Blue Ridge Fiberboard]**
 - b. **[GAF]**
 - c. **[Georgia-Pacific Gypsum LLC]**
 - d. **[Homasote Company]**
 - e. **[Huebert Fiberboard Inc]**
 - f. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Blue Ridge Fiberboard]**
 - b. **[GAF]**
 - c. **[Georgia-Pacific Gypsum LLC]**
 - d. **[Homasote Company]**
 - e. **[Huebert Fiberboard Inc]**
 - f. **<Insert manufacturer's name>**
 3. Thermal Resistance: R-value of 2.78 per 1 inch (25 mm).
 4. Size: **[48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)]**.
 5. Thickness:
 - a. Base Layer: **[1 inch (25 mm)][2 inches (50 mm)]<Insert thickness>**.
 - b. Upper Layer: **<Insert thickness>**.
 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- I. Cellular-Glass Board Insulation: ASTM C552, Type IV, rigid, cellular-glass thermal board insulation faced with manufacturer's standard kraft-paper sheets.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Pittsburgh Corning Corporation]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Pittsburgh Corning Corporation]**
 - b. **<Insert manufacturer's name>**
- 3. Thermal Resistance: R-value of 3.44 per 1 inch (25 mm).
- 4. Size: **24 by 48 inches (600 by 1200 mm)**.
- 5. Thickness: **<Insert thickness>**.
- 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- J. Mineral Wool Board Insulation - Multi-Density: ASTM C726, Type I, Class 1, comprising monolithic fibrous material having an upper layer with a **11.2 lb/cu. Ft. (180 kg/cu. M)** density and a lower layer with a **7.5 lb/cu. Ft. (120 kg/cu. M)** density.
 - 1. Thermal Resistance: R-value of 3.8 per 1 inch (25 mm).
 - 2. Size: **48 by 48 inches (1200 by 1200 mm)**.
 - 3. Thickness:
 - a. Base Layer: **[2 inches (50 mm)]<Insert thickness>**.
 - b. Upper Layer: **<Insert thickness>**.
 - 4. Face Treatment: Bitumen coating.
 - 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- K. Mineral Wool Board Insulation - Single Density: ASTM C726, Type II, Class 1, comprising monolithic fibrous material having a **12.5 lb/cu. Ft. (200 kg/cu. M)** density.
 - 1. Thermal Resistance: R-value of 4.0 per 1 inch (25 mm).
 - 2. Size: **48 by 48 inches (1200 by 1200 mm)**.
 - 3. Thickness: **1 inch (25 mm)**.
 - 4. Face Treatment: Bitumen coating.
 - 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- L. Tapered Insulation: Provide factory-tapered insulation boards.
 - 1. Material: **[Match roof insulation]<Insert material>**.
 - 2. Minimum Thickness: **1/4 inch (6 mm)**.
 - 3. Slope:
 - a. Roof Field: **[1/4 inch per foot (1:48)]<Insert slope>** unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: **[1/2 inch per foot (1:24)]<Insert slope>** unless otherwise indicated on Drawings.
 - 4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- M. Roof Insulation Accessories, General: As recommended in writing by insulation manufacturer for intended use, compatible with other roofing system components and suitable for installation method specified.
- N. Insulation Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing membrane manufacturer.

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1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.

O. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation **[to substrate][and]** to another insulation layer as follows:

1. Modified asphaltic, asbestos-free, cold-applied adhesive.
2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
3. Full-spread, spray-applied, low-rise, two-component urethane adhesive.
4. Verify adhesives and sealants comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Other Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Nonmembrane Roof Sealants: 300 g/L.
 - j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - k. Sealant Primers for Porous Substrates: 775 g/L.
5. Verify adhesives and sealants comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
6. Verify adhesives and sealants comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
7. Verify adhesives and sealants comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.

P. Insulation Cant Strips: **[ASTM C728, perlite insulation board][ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board]**.

Q. Wood Nailer Strips: Comply with requirements in Section 061000 "Rough Carpentry."

R. Tapered Edge Strips: **[ASTM C728, perlite insulation board][ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board]**.

2.12 COVER BOARD

- A. General: Cover board as recommended in writing by roofing membrane manufacturer for intended use; compatible with other roofing system components and suitable for installation method specified.
- B. Cellulosic-Fiber Cover Board: ASTM C208, Type II, Grade 2, high-density cellulosic-fiber insulation board, having a minimum compressive strength of **40 psi (276 kPa)**.
 1. Thickness: **[1/2 inch (13 mm)][1 inch (25 mm)]<Insert thickness>**.

2. Surface Finish: **[Primed one side][Primed two sides with nonasphaltic primer][Integral coating, six sides][Unprimed]<Insert finish>**.
 3. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- C. Oriented Strand Board: DOC PS 2, Exposure 1, **7/16 inch (11 mm)** thick.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- D. Glass-Mat Gypsum Cover Board: ASTM C1177/C1177M, water-resistant gypsum board.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
 3. Thickness: **[1/4 inch (6 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
 4. Surface Finish: **[Fiberglass facer][Factory primed][Unprimed]**.
 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- E. Fiber-Reinforced Gypsum Panel Cover Board: ASTM C1278/C1278M, cellulosic-fiber-reinforced, water-resistant gypsum board.
1. Thickness: **[1/4 inch (6 mm)][3/8 inch (10 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**
 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- F. Fiber-Reinforced Cementitious Cover Board: ASTM C1325, fiber-mat-reinforced cementitious board.
1. Thickness: **[7/16 inch (11 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- G. Fiber-Reinforced Recycled Plastic Cover Board: Cellulose fiber blended with recycled plastic board.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the**

following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Continuus Materials, LLC]
- b. <Insert manufacturer's name>

- 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Continuus Materials, LLC]
- b. <Insert manufacturer's name>

- 3. Thickness: [1/4 inch (6 mm)][1/2 inch (13 mm)].
- 4. Surface Finish: [Fiberglass facer][Paper facer].
- 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.

- H. High-Density Polyisocyanurate Cover Board: ASTM C1289, Type II, Class 4, Grade 1, 1/2 inch (13 mm) thick, having a minimum compressive strength of 80 psi (551 kPa).

- 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.

- I. Polyisocyanurate Cover Board: ASTM C1289, Type II, Class 1, 1/2 inch (13 mm) thick.

- 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.

2.13 ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Conductive Medium: Electrically conductive material specifically designed to enable ELD testing procedures as approved in writing by roofing membrane manufacturer.

- 1. Conductive medium to be located directly under roofing membrane in accordance with ASTM D7877 and ASTM D8231.

- B. Moisture-Monitoring System: Permanently embedded, continuously monitored moisture-detection system.

- 1. Sensors measuring moisture content to be placed within roofing system and connected to a monitoring program, with a notification indicating location of breach.

2.14 WALKWAYS

- A. Walkway Pads: [Reinforced asphaltic composition pads with slip-resisting mineral-granule surface][Polymer-modified, reconstituted rubber pads with slip-resisting textured surface], manufactured as a traffic pad for foot traffic and acceptable to roofing membrane manufacturer.

- 1. Pad Size: Approximately [36 by 60 inches (914 mm by 1524 mm)][30 by 30 inches

- (762 mm by 762mm)]<Insert size>.
 - 2. Color: [Contrasting with cap sheet][Gray][Yellow][White]<Insert color>.
 - 3. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- B. Walkway Cap Sheet Strips: Matching cap sheet; suitable for installation method specified, and as follows:
- 1. Size: [36 by 60 inches (914 mm by 1524 mm)]<Insert size>.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with roofing system Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 - 2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
 - 4. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of **1/16 inch (1.6 mm)** out of plane relative to adjoining deck.
 - 5. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - 6. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than **[75]<Insert number>** percent, or as recommended by roofing system manufacturer, when tested in accordance with ASTM F2170.
 - a. Test Frequency: One test probe per each **[1000 sq. ft. (93 sq. m)]<Insert area>**, or portion thereof, of roof deck, with not less than three test probes.
 - b. Submit test reports within 24 hours of performing tests.
 - 7. Verify that concrete-curing compounds that impair adhesion of roofing components to roof deck have been removed.
 - 8. Verify that joints in concrete roof decks have been grouted flush with top of concrete.
 - 9. Verify that minimum curing period recommended by roofing system manufacturer for lightweight insulating concrete roof decks has passed.
 - 10. Verify that any damaged sections of cementitious wood-fiber decks have been repaired or replaced.
 - 11. Verify that adjacent cementitious wood-fiber panels are vertically aligned to within **1/8 inch (3 mm)** at top surface.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation in accordance with roofing system manufacturer's written installation instructions.

1. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.
 1. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Prime surface of concrete roof deck with asphalt primer in accordance with roofing system manufacturer's written installation instructions and allow primer to dry.
- D. Perform fastener-pullout tests in accordance with roofing system manufacturer's written instructions.
 1. Submit test result within 24 hours of performing tests.
 - a. Include roofing system manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind-uplift requirements.
- E. Install sound-absorbing insulation strips in ribs of acoustical steel roof decks in accordance with roof deck manufacturer's written installation instructions.

3.3 INSTALLATION OF STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS MEMBRANE ROOFING SYSTEM, GENERAL

- A. Install roofing system materials and components in accordance with roofing system manufacturer's written installation instructions, **[FM Approvals' RoofNav listed roof][SPRI's "Directory of Roof Assemblies" listed roof]** assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings. Provide temporary seals to prevent water from entering completed sections of roofing system at the end of workday or when rain is forecast.
 1. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roofing membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition **[and to not void warranty for existing roofing system]**.
- D. Coordinate installation and transition of roofing system component serving as an air barrier with wall system air barrier specified in **[Section 072713 "Modified Bituminous Sheet Air Barriers."]****[Section 072715 "Nonbituminous Self-Adhering Sheet Air Barriers."]****[Section 072726 "Fluid-Applied Membrane Air Barriers."]**
- E. Asphalt Heating: Heat and apply hot asphalt in accordance with roofing system manufacturer's written installation instructions.
 1. Heat asphalt to its equiviscous temperature, measured at the mop cart or mechanical spreader immediately before installation.
 2. Circulate asphalt during heating.
 3. Do not raise asphalt temperature above equiviscous temperature range more than one hour before time of installation.
 4. Do not exceed asphalt manufacturer's recommended temperature limits during asphalt heating.
 5. Do not heat asphalt within **25 deg F (14 deg C)** of flash point.
 6. Discard asphalt maintained at a temperature exceeding finished blowing temperature for more

- than four hours.
7. Apply hot asphalt within **plus or minus 25 deg F (plus or minus 14 deg C)** of equiviscous temperature.
- F. SEBS-Modified Asphalt Heating: Heat and apply hot asphalt in accordance with roofing system manufacturer's written installation instructions.
- G. Substrate-Joint Penetrations: Prevent hot-applied asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.4 INSTALLATION OF SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than **24 inches (600 mm)** in adjacent rows.
1. Install substrate board at right angle to flutes of steel roof deck. Locate end joints over crests of steel roof deck.
 2. Tightly butt substrate boards together.
 3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 4. Fasten substrate board to top flanges of steel roof deck in accordance with roofing system manufacturer's written installation instructions and **[FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's "Directory of Roof Assemblies" listed roof assembly requirements for specified wind-uplift load capacity]** and FM Global Property Loss Prevention Data Sheet 1-29.
 5. Fasten substrate board to top flanges of steel roof deck to resist uplift pressure at corners, perimeter, and field of roof in accordance with roofing system manufacturer's written installation instructions.
 6. Loosely lay substrate board over roof deck.

3.5 INSTALLATION OF VAPOR RETARDER

- A. Install vapor retarder in a single layer over roof area in accordance with manufacturer's written installation instructions, side and end lapping each sheet a minimum of **2 and 6 inches (50 and 150 mm)**, respectively.
1. Extend vertically up parapet walls and projections to a minimum height equal to height of the insulation and cover board.
 2. Continuously seal side and end laps.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.6 INSTALLATION OF ROOF INSULATION AND ACCESSORIES

- A. Coordinate installation of roofing system components, so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written installation instructions. Install minimum of two layers of insulation under area of roofing to achieve required thickness.

- C. Install each layer of insulation with **[joints staggered not less than 24 inches (600 mm) in adjacent rows]**~~end joints staggered not less than 12 inches (300 mm) in adjacent rows~~ and offset not less than **12 inches (300 mm)** from previous layer.
1. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 2. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 3. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl **plus 24 inches (600 mm)**.
 4. Trim insulation, so that water flow is unrestricted.
 5. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 6. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 7. Secure insulation in accordance with **[FM Approvals' RoofNav for specified Windstorm Resistance Classification]**~~[SPRI's "Directory of Roof Assemblies" for specified wind-uplift load capacity]~~.
 8. Secure insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
- D. Nailer Strips: Mechanically fasten **4-inch nominal- (89-mm actual-)** width, wood nailer strips of same thickness as insulation perpendicular to sloped roof deck at the following spacing:
1. **[16 ft. (4.88 m)]**~~<Insert dimension>~~ apart for roof slopes greater than **1 inch per 12 inches (1:12)** but less than **3 inches per 12 inches (3:12)**.
 2. **[48 inches (1200 mm)]**~~<Insert dimension>~~ apart for roof slopes greater than **3 inches per 12 inches (3:12)**.
- E. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing system with vertical surfaces or angle changes greater than 45 degrees.

3.7 INSTALLATION OF COVER BOARD

- A. Comply with roofing system and insulation manufacturer's written installation instructions.
- B. Install cover board over insulation with long joints in continuous straight lines, with end joints staggered between rows. Offset joints of insulation below a minimum of **6 inches (150 mm)** in each direction.
1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 2. At internal roof drains, conform to slope of drain sump.
 3. Trim cover board, so that water flow is unrestricted.
 4. Cut and fit cover board tight to nailers, projections, and penetrations.
 5. Secure cover board to insulation in accordance with **[FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification]**~~[SPRI's "Directory of Roof Assemblies" listed roof assembly requirements for specified wind-uplift load capacity]~~ and FM Global Property Loss Prevention Data Sheet 1-29.
 6. Secure cover board to resist specified uplift pressure at corners, perimeter, and field of roof.
- C. Install sheathing paper over cover board and immediately beneath roofing membrane.

3.8 INSTALLATION OF ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Install conductive medium directly under roofing membrane in accordance with ASTM D7877 and ASTM

D8231.

- B. Install sensors, connections, and accessory items required for complete continuously monitored moisture-detection system in accordance with manufacturer's written installation instructions.

3.9 INSTALLATION OF SBS ROOFING MEMBRANE, GENERAL

- A. Install roofing membrane in accordance with roofing system manufacturer's written installation instructions and applicable recommendations in NRCA's "Quality-Control Guidelines for the Application of Polymer-Modified Bitumen Roofing."
- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel[**and Owner's testing and inspection agency**].
- C. Where roof slope exceeds **[1/2 inch per 12 inches (1:24)][3/4 inch per 12 inches (1:18)]**<Insert **slope**>, install roofing membrane sheets parallel with slope.
 - 1. Backnail roofing sheets to **[nailer strips][substrate]** in accordance with roofing system manufacturer's written installation instructions.
- D. Coordinate installation of roofing system so insulation and other components of roofing system not permanently exposed are not subjected to precipitation or left uncovered at end of workday or when rain is forecast.
 - 1. Provide tie-offs at end of each day's work to cover exposed roofing sheets and insulation with a course of coated felt set in adhesive, with joints and edges sealed.
 - 2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
 - 3. Remove and discard temporary seals before beginning work on adjoining roofing.

3.10 INSTALLATION OF BASE SHEET

- A. Prime surface of substrate with primer in accordance with roofing membrane manufacturer's written installation instructions and allow primer to dry.
- B. Before installing, unroll base sheet, cut into workable lengths, and allow to lie flat for a time period recommended by roofing membrane manufacturer for the ambient temperature at which base sheet will be installed.
- C. Loosely lay one course of sheathing paper, lapping edges, and ends a minimum of **2 inches (50 mm)** and **6 inches (150 mm)**, respectively.
- D. Installation of Base Sheet:
 - 1. Install base sheet in accordance with roofing membrane manufacturer's written installation instructions, starting at low point of roof.
 - 2. Extend base sheet over and terminate above cants.
 - 3. Install base sheet in a shingle fashion.
 - 4. Adhere base sheet to substrate in a uniform coating of **[hot-applied asphalt][cold-applied adhesive]**.
 - 5. Self-adhere base sheet to substrate.
 - 6. Heat-weld (torch-apply) base sheet to substrate.

- a. Perform heat-welded installation in accordance with NFPA 241, including two-hour fire watch after torches have been extinguished.
7. Mechanically fasten base sheet to substrate using fasteners specifically designed and sized for **[wood][wood panel]** decks.
 - a. Fasten base sheet to resist specified uplift pressure at corners, perimeter, and field of roof.
8. Install base sheet without wrinkles or rears, and free from air pockets.
9. Laps: Accurately align base sheet, without stretching, and maintain uniform side and end laps.
 - a. Lap side laps as recommended by roofing membrane manufacturer but not less than **3 inches (75 mm)**.
 - b. Lap end laps as recommended by roofing membrane manufacturer but not less than **12 inches (300 mm)**. Stagger end laps not less than **18 inches (450 mm)**.
 - c. **[Heat-weld end laps,][Completely bond and seal laps,]** leaving no voids.
 - d. Roll laps with a **20 lb (9 kg)** roller.
10. Repair tears and voids in laps and lapped seams not completely sealed.
11. Apply pressure to body of base sheet in accordance with roofing membrane manufacturer's written installation instructions, to remove air pockets and to result in complete adhesion of base sheet to substrate.

E. Installation of Vented Base Sheet:

1. **[Mechanically fasten, using fasteners specifically designed and sized for applicable substrate][Spot or strip mop to substrate with hot-applied asphalt]** vented base sheet with vented side down.
 - a. Fasten vented base sheet in accordance with **[FM Approval's RoofNav for specified Windstorm Resistance Classification][SPRI's "Directory of Roof Assemblies" for specified wind-uplift load capacity]**.
 - b. Fasten vented base sheet to resist uplift pressure at corners, perimeter, and field of roof.

3.11 INSTALLATION OF CAP SHEET

- A. Before installing, unroll cap sheet, cut into workable lengths, and allow to lie flat for a time period recommended by roofing membrane manufacturer for the ambient temperature at which cap sheet will be installed.
- B. Install cap sheet in accordance with roofing membrane manufacturer's written installation instructions, starting at low point of roof.
 1. Extend cap sheet over and terminate above cants.
 2. Install cap sheet in a shingle fashion.
 3. Adhere cap sheet to bottom layer in a uniform coating of **[hot-applied asphalt][cold-applied adhesive]**.
 4. Self-adhere cap sheet to bottom layer.
 5. Heat-weld (torch-apply) cap sheet to bottom layer.
 - a. Perform heat-welded installation in accordance with NFPA 241, including two-hour fire watch after torches have been extinguished.

6. Mechanically fasten cap sheet to bottom layer using fasteners specifically designed and sized for **[wood][wood panel]** decks.
 - a. Fasten cap sheet to resist specified uplift pressure at corners, perimeter, and field of roof.
 7. Install cap sheet without wrinkles or tears, and free from air pockets.
 8. Install cap sheet so side and end laps shed water.
- C. Laps: Accurately align roof sheets, without stretching, and maintain uniform side and end laps.
1. Lap side laps as recommended by roofing membrane manufacturer but not less than **3 inches (75 mm)**.
 2. Lap end laps as recommended by roofing membrane manufacturer but not less than **12 inches (300 mm)**. Stagger end laps not less than **18 inches (450 mm)**.
 3. **[Heat-weld laps][Completely bond and seal laps]**, leaving no voids.
 4. Roll laps with a **20 lb (9 kg)** roller.
 5. Repair tears and voids in laps and lapped seams not completely sealed.
- D. Apply pressure to body of cap sheet in accordance with roofing membrane manufacturer's written installation instructions, to remove air pockets and result in complete adhesion of cap sheet to substrate.
- E. Apply roofing granules of same color as cap sheet to cover exuded bead at laps while bead is hot, to provide a continuous color appearance.

3.12 INSTALLATION OF BASE FLASHING AND STRIPPING

- A. Install base flashing sheet over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates in accordance with roofing system manufacturer's written installation instructions and as follows:
1. Prime substrates with asphalt primer if required by roofing system manufacturer.
 2. Backer Sheet Installation: **[Mechanically fasten backer sheet to walls or parapets. Adhere backer sheet over roofing membrane at cants][Adhere backer sheet to substrate in a uniform layer of][hot-applied asphalt][cold-applied adhesive]**.
 3. Base Flashing Sheet Installation, Hot: **[Adhere base flashing sheet to substrate in a solid mopping of hot-applied asphalt applied at asphalt temperature recommended by base flashing sheet manufacturer. Apply hot-applied asphalt to back of base flashing sheet if recommended by roofing system manufacturer][Torch-apply base flashing sheet to substrate]**.
 - a. Perform heat-welded installation in accordance with NFPA 241, including two-hour fire watch after torches have been extinguished.
 4. Base Flashing Sheet Installation, Cold: Adhere base flashing sheet to substrate in cold-applied adhesive at rate required by roofing system manufacturer.
- B. Extend base flashing sheet up walls or parapets a minimum of **8 inches (200 mm)** above roofing membrane and **4 inches (100 mm)** onto field of roofing membrane.
- C. Mechanically fasten top of base flashing sheet securely at terminations and perimeter of roof.
1. Seal top termination of base flashing sheet.

- D. Install liquid flashing system in accordance with roofing system manufacturer's written installation instructions.
 - 1. Extend liquid flashing not less than **3 inches (75 mm)** in all directions from edges of item being flashed.
 - 2. Embed granules, matching color of cap sheet, into wet compound.
- E. Install cap sheet stripping where metal flanges and edgings are set on roof in accordance with roofing system manufacturer's written installation instructions.
- F. Roof Drains: Set **[30-by-30-inch- (762-by-762-mm-)]<Insert dimensions> 4 lb (1.8 kg)** flashing in bed of adhesive on completed roofing membrane.
 - 1. Cover flashing with cap sheet stripping, and extend a minimum of **[4 inches (100 mm)][6 inches (150 mm)]** beyond edge of metal flashing onto field of roofing membrane.
 - 2. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
 - 3. Install stripping in accordance with roofing system manufacturer's written installation instructions.

3.13 INSTALLATION OF WALKWAYS

- A. Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size; secure to cap sheet in accordance with roofing system manufacturer's written installation instructions.
 - 1. Install walkways at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - f. Locations indicated on Drawings.
 - g. As required by roofing system manufacturer's warranty requirements.
 - 2. Provide **3-inch (75-mm)** clearance between adjoining pads.
- B. Walkway Cap Sheet Strips: Install walkway cap sheet strips over roofing membrane, using same installation method as that used for cap sheet.
 - 1. Install walkways strips at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.

- f. Locations indicated on Drawings.
 - g. As required by roofing membrane manufacturer's warranty requirements.
2. Provide **3-inch (76-mm)** clearance between adjoining strips.

3.14 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections of substrate conditions, surface preparation, and installation of roofing membrane, flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Tests and Inspections:
- 1. ELD Testing: Testing agency surveys entire roof area and flashings to locate discontinuities in the roofing membrane using ELD in accordance with ASTM D7877 and ASTM D8231.
 - a. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
 - 2. Flood Testing: Flood test each roof area for leaks, in accordance with recommendations in ASTM D5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - a. Flood to an average depth of **[2-1/2 inches (63 mm)]<Insert depth>** with a minimum depth of **[1 inch (25 mm)]<Insert depth>** and not exceeding a depth of **[4 inches (100 mm)]<Insert depth>**. Maintain **2 inches (50 mm)** of clearance from top of base flashing.
 - b. Flood each area for **[24][48][72]** hours.
 - c. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - d. Testing agency to prepare survey report indicating locations of initial leaks, if any, and final survey report.
 - 3. Infrared Thermography Testing: Testing agency surveys entire roof area using infrared color thermography in accordance with ASTM C1153. Perform tests before overlying construction is placed.
 - a. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing, or by nuclear hydrogen detection testing.
 - b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report of initial scan indicating locations of entrapped moisture if any.

4. Electrical Capacitance/Impedance Testing: Testing agency surveys entire roof area for entrapped water within roofing system in accordance with ASTM D7954/D7954M. Perform tests before overlying construction is placed.
 - a. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
 5. Nuclear Hydrogen Detection Testing: Testing agency surveys entire roof area for entrapped water within roofing system in accordance with ANSI/SPRI/RCI NT-1. Perform tests before overlying construction is placed.
 - a. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
 - C. Test Cuts: Remove test specimens to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:
 1. Determine approximate quantities of components within roofing membrane in accordance with ASTM D3617/D3617M.
 2. Examine test specimens for voids between plies in accordance with ASTM D3617/D3617M and to comply with criteria established in Appendix 3 of NRCA's "Quality-Control Guidelines for the Application of Polymer-Modified Bitumen Roofing."
 3. Repair areas where test cuts were made in accordance with roofing system manufacturer's written installation instructions.
 - D. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
 1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
 - E. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
 1. Roofing system will be considered defective if it does not pass tests and inspections.
 - F. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.
 - G. Prepare test and inspection reports.
- 3.15 PROTECTION AND CLEANING
- A. Protect roofing system from damage and wear during remainder of construction period.

1. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and in accordance with warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.16 ROOFING SYSTEM INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing System Installer," has performed roofing and associated Work on the following Project:
 1. Owner: **<Insert name of Owner>**.
 2. Owner Address: **<Insert address>**.
 3. Building Name/Type: **<Insert information>**.
 4. Building Address: **<Insert address>**.
 5. Area of Work: **<Insert information>**.
 6. Warranty Period: **[Two][Five]<Insert number>** years from date of Substantial Completion.
 7. Date of Substantial Completion: _____.
- B. AND WHEREAS Roofing System Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said Work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing System Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period, Roofing System Installer will, at Roofing System Installer's own cost and expense, make or cause to be made such repairs to or replacements of said Work as are necessary to correct faulty and defective Work and as are necessary to maintain said Work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
 1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding **<Insert mph (m/s)>**;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the Work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When Work has been damaged by any of foregoing causes, Warranty will be null and void until such damage has been repaired by Roofing System Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing System Installer is responsible for damage to Work covered by this Warranty but is not

Styrene-Butadiene-Styrene (SBS) Modified Bituminous

Membrane Roofing



liable for consequential damages to building or building contents resulting from leaks or faults or defects of Work.

4. During Warranty Period, if Owner allows alteration of Work by anyone other than Roofing System Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty will become null and void on date of said alterations, but only to the extent said alterations affect Work covered by this Warranty. If Owner engages Roofing System Installer to perform said alterations, Warranty will not become null and void unless Roofing System Installer, before starting said Work, will have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate Work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty will become null and void on date of said change, but only to the extent said change affects Work covered by this Warranty.
6. Owner will promptly notify Roofing System Installer of observed, known, or suspected leaks, defects, or deterioration and afford reasonable opportunity for Roofing System Installer to inspect Work to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing System Installer on said Work and will not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty will not operate to relieve Roofing System Installer of responsibility for performance of original Work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 07 52 16 00

SECTION 07 53 16 00 - CHLOROSULFONATE-POLYETHYLENE (CSPE) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Chlorosulfonate-polyethylene (CSPE) roofing.
2. Accessory roofing materials.
3. Substrate board.
4. Vapor retarder.
5. Roof insulation.
6. Insulation accessories and cover board.
7. Asphalt materials.
8. Electronic leak detection (ELD) materials.
9. Ballast.
10. Walkways.

B. Section includes the installation of sound absorbing insulation strips in ribs of roof deck. Sound absorbing insulation strips are furnished under Section 053100 "Steel Decking."

C. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking[**and for wood-based, structural-use roof deck panels**].
2. Section 061600 "Sheathing" for wood-based, structural-use roof deck panels.
3. Section 072100 "Thermal Insulation" for insulation beneath the roof deck.
4. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
5. Section 077100 "Roof Specialties" for [**premanufactured copings**][**and**][**roof edge flashings**].
6. Section 077129 "Manufactured Roof Expansion Joints" for premanufactured roof expansion-joint assemblies.
7. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
8. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at [Project site**]<Insert location>.**

1. Meet with Owner, Architect,[**Construction Manager**,] Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written

instructions.

3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

B. Preinstallation Roofing Conference: Conduct conference at **[Project site]<Insert location>**.

1. Meet with Owner, Architect, **[Construction Manager,]** Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Chlorosulfonate-polyethylene (CSPE) roofing.
2. Accessory roofing materials.
3. Substrate board.
4. Vapor retarder.
5. Roof insulation.
6. Insulation accessories and cover board.
7. Asphalt materials.
8. Electronic leak detection (ELD) materials.
9. Ballast.
10. Walkways.

B. Product Data Submittals:

1. For insulation and roof system component fasteners, include copy of **[FM Approvals' RoofNav][SPRI's Directory of Roof Assemblies]** listing.

C. Sustainable Design Submittals:

1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.

2. Health Product Declaration (HPD): Provide documentation confirming product compliance with one of the following:
 - a. Inventory or HPD to at least 0.01 percent by weight, with at least 95 percent assessed using GreenScreen Benchmark assessment.
 - b. Cradle to Cradle v3 certification with minimum Silver level of Material Health.
 - c. Living Product Challenge certification indicating achievement of Imperative 09, "Transparent Material Health."
- D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work, including the following:
 1. Layout and thickness of insulation.
 2. Base flashings and membrane terminations.
 3. Flashing details at penetrations.
 4. Tapered insulation, including slopes.
 5. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
 6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
 7. Tie-in with air barrier.
- E. Samples for Verification: For the following products:
 1. Roof membrane and flashing, of color required.
 2. Aggregate surfacing material in gradation[**and color**] required.
 3. Roof paver[, **full sized**,] in each color and texture required.
 4. Walkway pads or rolls, of color required.
- F. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Manufacturer Certificates:
 1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of complying with performance requirements.
 2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- C. Evaluation Reports: For components of roofing system, from ICC-ES.
- D. Field Test Reports:
 1. Concrete internal relative humidity test reports.
 2. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.
- E. Field quality-control reports.

- F. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.
- B. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is **[UL listed][listed in FM Approvals' RoofNav][listed in SPRI's Directory of Roof Assemblies]** for roofing system identical to that used for this Project.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes roof membrane, base flashings, **[roof insulation,][fasteners,][cover boards,][vapor retarder,][substrate board,][roof pavers,]** and other components of roofing system.
 2. Warranty Period: **[10][15][20][30]<Insert number>** years from date of Substantial Completion.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, **[roof insulation,][fasteners,][cover boards,][substrate boards,][vapor retarders,][roof pavers,]** and **[walkway products,]** for the following warranty period:
1. Warranty Period: **[Two]<Insert number>** years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings to remain watertight.
1. Accelerated Weathering: Roofing system to withstand 2000 hours of exposure when tested in accordance with ASTM G152, ASTM G154, or ASTM G155.
 2. Impact Resistance: Roofing system to resist impact damage when tested in accordance with ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- B. Material Compatibility: Roofing materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested in accordance with FM Approvals 4474, UL 580, or UL 1897:
1. Zone 1 (Roof Area Field): **<Insert lbf/sq. ft. (kPa)>**.
 2. Zone 2 (Roof Area Perimeter): **<Insert lbf/sq. ft. (kPa)>**.
 - a. Location: From roof edge to **<Insert dimension>** inside roof edge.
 3. Zone 3 (Roof Area Corners): **<Insert lbf/sq. ft. (kPa)>**.
 - a. Location: **<Insert dimension>** in each direction from building corner.
- D. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
1. Fire/Windstorm Classification: **[Class 1A-60][Class 1A-75][Class 1A-90][Class 1A-105][Class 1A-120]<Insert class>**.
 2. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 **[MH][SH][VSH]**.
- E. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in SPRI's Directory of Roof Assemblies for roof assembly identical for that specified for this

Project.

1. Wind Uplift Load Capacity: [60 psf][75 psf][90 psf][105 psf][120 psf]<Insert capacity>.

- F. Solar Reflectance Index: Not less than [78][29] when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- G. Solar Reflectance Index (SRI): Three-year-aged SRI not less than [64][32] or initial SRI not less than [82][39] when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- H. Solar Reflectance Index: Not less than [78][29] when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- I. Solar Reflectance Index (SRI): Three-year-aged SRI not less than [64][15] when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- J. Solar Reflectance Index: Not less than [78][29] when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- K. Energy Star Listing: Roofing system to be listed on the DOE's Energy Star "Roof Products Qualified Product List" for [low][steep]-slope roof products.
- L. Energy Performance: Roofing system to have an initial solar reflectance of not less than [0.70]<Insert value> and an emissivity of not less than [0.75]<Insert value> when tested in accordance with ANSI/CRRC S100.
- M. Exterior Fire-Test Exposure: ASTM E108 or UL 790, [Class A][Class B][Class C]; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- N. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 CHLOROSULFONATE-POLYETHYLENE (CSPE) ROOFING

- A. CSPE Sheet: ASTM D5019, Type 1, Grade 2, 45-mil- (1.1-mm-) thick, reinforced, flexible uncured sheet formed from CSPE, and as follows:
- B. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - 1. [Conklin Company Inc]
 - 2. [Tremco Incorporated]
 - 3. <Insert manufacturer's name>
- C. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - 1. [Conklin Company Inc]
 - 2. [Tremco Incorporated]
 - 3. <Insert manufacturer's name>

- D. Exposed Face Color: [White][Blue][Light gray][Tan]<Insert color>.
1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert value> percent.
- E. Source Limitations: Obtain components for roofing system from [manufacturer of roof membrane][or][manufacturer approved by roof membrane manufacturer].

2.3 ACCESSORY ROOFING MATERIALS

- A. General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
1. Adhesives and Sealants: Comply with VOC limits of authorities having jurisdiction.
 2. Adhesives and sealants shall comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Other Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Nonmembrane Roof Sealants: 300 g/L.
 - j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - k. Sealant Primers for Porous Substrates: 775 g/L.
 3. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 5. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 6. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 7. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- B. Sheet Flashing: **45-mil- (1.1-mm-)** thick, reinforced or **55-mil- (1.4-mm-)** thick, nonreinforced CSPE, as recommended by roofing system manufacturer for intended use, of same color as CSPE roof membrane.
- C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
- D. Roof Vents: As recommended by roof membrane manufacturer.

07 - Thermal And Moisture Protection

1. Size: Not less than **4-inch (100-mm)** diameter.
- E. Bonding Adhesive: Manufacturer's standard[, **water based**].
- F. Slip Sheet: **[ASTM D2178/D2178M, Type IV, glass fiber, asphalt-impregnated felt][Manufacturer's standard, of thickness required for application]**.
- G. Asphalt-Coated, Glass-Fiber-Mat, Venting Base Sheet: ASTM D4897/D4897M, Type II; nonperforated, asphalt-impregnated fiberglass reinforced, with mineral granular patterned surfacing on bottom surface.
- H. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately **1 by 1/8 inch (25 by 3 mm)** thick; with anchors.
- I. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately **1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick)**, prepunched.
- J. Ballast Retaining Bar: Perimeter securement system consisting of a slotted extruded-aluminum retention bar with an integrated compression fastening strip.
 1. Fasteners: **1-1/2-inch (38-mm)** stainless steel fasteners with neoprene washers.
- K. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.
- L. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.4 SUBSTRATE BOARD

- A. Gypsum Board, Type X: ASTM C1396/C1396M.
 1. Thickness: **5/8 inch (16 mm)**.
- B. Glass-Mat Gypsum Roof Substrate Board: ASTM C1177/C1177M, water-resistant gypsum board.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[USG Corporation]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**

- c. **[USG Corporation]**
- d. **<Insert manufacturer's name>**
- 3. Thickness: **[1/4 inch (6 mm)][1/2 inch (13 mm)][Type X, 5/8 inch (16 mm)]**.
- 4. Surface Finish: **[Factory primed][Unprimed]**.
- C. Fiber-Reinforced Gypsum Roof Board: ASTM C1278/C1278M, cellulosic-fiber reinforced, water-resistant gypsum board.
 - 1. Thickness: **[1/4 inch (6 mm)][3/8 inch (10 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
- D. Perlite Board: ASTM C728, seal coated.
 - 1. Thickness: **[3/4 inch (19 mm)][1 inch (25 mm)]**.
- E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

2.5 VAPOR RETARDER

- A. Polyethylene Film: ASTM D4397, **[6 mils (0.15 mm)][10 mils (0.25 mm)]** thick, minimum, with maximum permeance rating of **[0.13 perm (0.084 metric perm)][0.076 perm (0.050 metric perm)]**.
 - 1. Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.
 - 2. Adhesive: Manufacturer's standard lap adhesive, FM Approvals approved for vapor retarder application.
- B. Laminated Sheet Vapor Retarder: Two-layer, fire-retardant polyethylene laminate, reinforced with cord grid.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Reef Industries, Inc.]**
 - b. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Reef Industries, Inc.]**
 - b. **<Insert manufacturer's name>**
 - 3. Permeance Rating: Not more than **0.062 perm (3.556 ng/Pa x s x sq. m)** when tested in accordance with ASTM E96/E96M.
 - 4. Flame-Spread Index: Not more than 5 when tested in accordance with ASTM E84.
 - 5. Smoke-Developed Index: Not more than 35 when tested in accordance with ASTM E84.
 - 6. Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.
- C. Rubberized-Asphalt-Sheet Vapor Retarder, Self-Adhering: ASTM D1970/D1970M, polyethylene film

laminated to layer of rubberized asphalt adhesive, minimum **40-mil (1.0-mm)** total thickness; maximum permeance rating of **0.1 perm (6 ng/Pa x s x sq. m)**; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.

- D. Butyl-Rubber-Sheet Vapor Retarder, Self-Adhering: Polyethylene film laminated to layer of butyl rubber adhesive, minimum **30-mil (0.76-mm)** total thickness; maximum permeance rating of **0.1 perm (6 ng/Pa x s x sq. m)**; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.
- E. Glass-Fiber Felts: ASTM D2178/D2178M, Type IV, asphalt impregnated.

2.6 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured[**or approved**] by CSPE roof membrane manufacturer[, **approved for use in FM Approvals' RoofNav listed roof assemblies**][, **approved for use in SPRI's Directory of Roof Assemblies listed roof assemblies**].
- B. Extruded-Polystyrene Board Insulation: ASTM C578, [Type IV, 1.45-lb/cu. ft. (23-kg/cu. m) minimum density, 25 psi (173 kPa) minimum compressive strength][Type V, 3.00-lb/cu. ft. (48-kg/cu. m), minimum density, 100 psi (690 kPa) minimum compressive strength], square edged.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [DiversiFoam Products]
 - b. [Kingspan Insulation LLC]
 - c. [Owens Corning]
 - d. [The Dow Chemical Company]
 - e. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [DiversiFoam Products]
 - b. [Kingspan Insulation LLC]
 - c. [Owens Corning]
 - d. [The Dow Chemical Company]
 - e. <Insert manufacturer's name>
 - 3. Thermal Resistance: R-value of 5.0 per 1 inch (25.4 mm).
 - 4. Size: [48 by 48 inches (1219 by 1219 mm)][48 by 96 inches (1219 by 2438 mm)].
 - 5. Thickness:
 - a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.
 - b. Upper Layer: <Insert thickness>.
- C. Molded (Expanded) Polystyrene Board Insulation: ASTM C578, Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) minimum density, 13-psi (90-kPa) minimum compressive strength, square edge.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering

products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [Carlisle Syntec Systems]
 - c. [DiversiFoam Products]
 - d. [Dyplast Products]
 - e. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [Carlisle Syntec Systems]
 - c. [DiversiFoam Products]
 - d. [Dyplast Products]
 - e. <Insert manufacturer's name>
3. Thermal Resistance: R-value of 3.8 per 1 inch (25.4 mm).
4. Size: [48 by 48 inches (1219 by 1219 mm)][48 by 96 inches (1219 by 2438 mm)].
5. Thickness:
- a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.
 - b. Upper Layer: <Insert thickness>.
- D. Composite Molded (Expanded) Polystyrene Board Insulation: ASTM C578, [Type II, 1.35-lb/cu. ft. (22-kg/cu. m)][Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m)][Type IX, 1.8-lb/cu. ft. (29-kg/cu. m)] minimum density, with factory-applied facings, as follows:
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Cellofoam North America, Inc.]
 - b. [Insulfoam; a Carlisle Company]
 - c. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Cellofoam North America, Inc.]
 - b. [Insulfoam; a Carlisle Company]
 - c. <Insert manufacturer's name>
3. Facer: [ASTM C208, Type II, Grade 2, cellulosic-fiber insulation board, asphalt coated, 1/2 inch (13 mm) thick][DOC PS 2, Exposure 1, oriented strand board, 7/16 inch (11 mm) thick]<Insert material>.
4. Size: [48 by 48 inches (1219 by 1219 mm)][48 by 96 inches (1219 by 2438 mm)].
5. Thickness: <Insert thickness>.
- E. Polyisocyanurate Board Insulation: ASTM C1289, [Type II, Class 1, Grade 2][Type II, Class 2, Grade 2], felt or glass-fiber mat facer on both major surfaces.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Atlas Polyiso Roof and Wall Insulation]**
 - b. **[Carlisle Syntec Systems]**
 - c. **[CertainTeed; SAINT-GOBAIN]**
 - d. **[Dyplast Products]**
 - e. **[Elevate; Holcim Building Envelope]**
 - f. **[GAF]**
 - g. **[Hunter Panels; a Carlisle company]**
 - h. **[Insulfoam; a Carlisle Company]**
 - i. **[Johns Manville; a Berkshire Hathaway company]**
 - j. **[Polyglass U.S.A., Inc.]**
 - k. **[Rmax, A Business Unit of Sika Corporation]**
 - l. **<Insert manufacturer's name>**

 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Atlas Polyiso Roof and Wall Insulation]**
 - b. **[Carlisle Syntec Systems]**
 - c. **[CertainTeed; SAINT-GOBAIN]**
 - d. **[Dyplast Products]**
 - e. **[Elevate; Holcim Building Envelope]**
 - f. **[GAF]**
 - g. **[Hunter Panels; a Carlisle company]**
 - h. **[Insulfoam; a Carlisle Company]**
 - i. **[Johns Manville; a Berkshire Hathaway company]**
 - j. **[Polyglass U.S.A., Inc.]**
 - k. **[Rmax, A Business Unit of Sika Corporation]**
 - l. **<Insert manufacturer's name>**

 3. Compressive Strength: **[20 psi (138 kPa)][25 psi (172 kPa)]**.
 4. Size: **[48 by 48 inches (1219 by 1219 mm)][48 by 96 inches (1219 by 2438 mm)]**.
 5. Thickness:
 - a. Base Layer: **[1-1/2 inches (38 mm)]<Insert thickness>**.
 - b. Upper Layer: **<Insert thickness>**.
- F. Composite Polyisocyanurate Board Insulation: ASTM C1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Atlas Polyiso Roof and Wall Insulation]**
 - b. **[CertainTeed; SAINT-GOBAIN]**
 - c. **[Elevate; Holcim Building Envelope]**
 - d. **[GAF]**
 - e. **[Homasote Company]**

- f. [Hunter Panels; a Carlisle company]
 - g. [Insulfoam; a Carlisle Company]
 - h. [Johns Manville; a Berkshire Hathaway company]
 - i. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [Elevate; Holcim Building Envelope]
 - d. [GAF]
 - e. [Homasote Company]
 - f. [Hunter Panels; a Carlisle company]
 - g. [Insulfoam; a Carlisle Company]
 - h. [Johns Manville; a Berkshire Hathaway company]
 - i. <Insert manufacturer's name>
 - 3. Facer: [Type IV, cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch (13 mm) thick][Type V, oriented strand board facer, 7/16 inch (11 mm) thick][Type VII, glass-mat-faced gypsum board facer, 1/4 inch (6 mm) thick]<Insert material>.
 - 4. Size: [48 by 48 inches (1219 by 1219 mm)][48 by 96 inches (1219 by 2438 mm)].
 - 5. Thickness: <Insert thickness>.
- G. Perlite Board Insulation: ASTM C728, Type I, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.
- 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [GAF]
 - b. [Johns Manville; a Berkshire Hathaway company]
 - c. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [GAF]
 - b. [Johns Manville; a Berkshire Hathaway company]
 - c. <Insert manufacturer's name>
 - 3. Thermal Resistance: R-value of 2.78 per 1 inch (25.4 mm).
 - 4. Size: [48 by 48 inches (1219 by 1219 mm)][48 by 96 inches (1219 by 2438 mm)].
 - 5. Thickness:
 - a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.
 - b. Upper Layer: <Insert thickness>.
- H. Cellulosic-Fiber Board Insulation: ASTM C208, Type II, Grade 2, fibrous-felted, rigid insulation boards of wood fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[GAF]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Homasote Company]**
 - d. **[Huebert Fiberboard Inc]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[GAF]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Homasote Company]**
 - d. **[Huebert Fiberboard Inc]**
 - e. **<Insert manufacturer's name>**
 3. Thermal Resistance: R-value of 2.78 per 1 inch (25.4 mm).
 4. Size: **[48 by 48 inches (1219 by 1219 mm)][48 by 96 inches (1219 by 2438 mm)]**.
 5. Thickness:
 - a. Base Layer: **[1 inch (25 mm)][2 inches (51 mm)]<Insert thickness>**.
 - b. Upper Layer: **<Insert thickness>**.
- I. Cellular Glass Board Insulation: ASTM C552, Type IV, rigid, cellular glass thermal board insulation faced with manufacturer's standard kraft-paper sheets.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Pittsburgh Corning Corporation]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Pittsburgh Corning Corporation]**
 - b. **<Insert manufacturer's name>**
 3. Thermal Resistance: R-value of 3.44 per 1 inch (25.4 mm).
 4. Size: **24 by 48 inches (600 by 1219 mm)**.
 5. Thickness: **<Insert thickness>**.
- J. Mineral Wool Insulation - Multi-Density: ASTM C726, Type I, Class 1, comprising monolithic fibrous material having an upper layer of 11.2-lb/cu. ft. (180-kg/cu. m) density, and a lower layer of 7.5-lb/cu. ft. (120-kg/cu. m) density.
1. Thermal Resistance: R-value of 3.8 per 1 inch (25.4 mm).

2. Size: **48 by 48 inches (1219 mm by 1219 mm)**.
 3. Thickness:
 - a. Base Layer: **[2 inches (50 mm)]<Insert thickness>**.
 - b. Upper Layer: **<Insert thickness>**.
 4. Face Treatment: Bitumen coating.
- K. Mineral Wool Insulation - Single Density: ASTM C726, Type II, Class 1, comprising monolithic fibrous material having **12.5-lb/cu. ft. (200-kg/cu. m)** density.
1. Thermal Resistance: R-value of 4.0 per **1 inch (25.4 mm)**.
 2. Size: **48 by 48 inches (1219 by 1219 mm)**.
 3. Thickness: **1 inch (25 mm)**.
 4. Face Treatment: Bitumen coating.
- L. Tapered Insulation: Provide factory-tapered insulation boards.
1. Material: **[Match roof insulation]<Insert material>**.
 2. Minimum Thickness: **1/4 inch (6.35 mm)**.
 3. Slope:
 - a. Roof Field: **[1/4 inch per foot (1:48)]<Insert slope>** unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: **[1/2 inch per foot (1:24)]<Insert slope>** unless otherwise indicated on Drawings.

2.7 INSULATION ACCESSORIES AND COVER BOARD

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation[**and cover boards**] to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
1. Modified asphaltic, asbestos-free, cold-applied adhesive.
 2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
 3. Full-spread, spray-applied, low-rise, two-component urethane adhesive.
 4. Adhesives and sealants shall comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Other Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Nonmembrane Roof Sealants: 300 g/L.
 - j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - k. Sealant Primers for Porous Substrates: 775 g/L.

5. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 6. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 7. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 8. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 9. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- D. Cellulosic-Fiber Insulation Cover Board: ASTM C208, Type II, Grade 2, high-density cellulosic-fiber insulation board, having a minimum compressive strength of **40 psi (276 kPa)**.
1. Thickness: **[1/2 inch (13 mm)][1 inch (25 mm)]<Insert thickness>**.
 2. Surface Finish: **[Primed one side][Primed two sides with non-asphaltic primer][Integral coating, six sides][Unprimed]<Insert finish>**.
- E. Oriented Strand Board: DOC PS 2, Exposure 1, **7/16 inch (11 mm)** thick.
- F. Glass-Mat Gypsum Cover Board: ASTM C1177/C1177M, water-resistant gypsum board.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[USG Corporation]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[USG Corporation]**
 - d. **<Insert manufacturer's name>**
 3. Thickness: **[1/4 inch (6 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
 4. Surface Finish: **[Fiberglass facer][Factory primed][Unprimed]**.
- G. Fiber-Reinforced Gypsum Roof Board: ASTM C1278/C1278M, cellulosic-fiber reinforced, water-resistant gypsum board.

1. Thickness: [1/4 inch (6 mm)][3/8 inch (10 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)].
- H. Fiber-Reinforced Cementitious Cover Board: ASTM C1325, fiber-mat-reinforced cementitious board.
1. Thickness: [7/16 inch (11 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)].
- I. Fiber-Reinforced Recycled Plastic Cover Board: Cellulose fiber blended with recycled plastic board.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Continuous Materials, LLC]
 - b. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Continuous Materials, LLC]
 - b. <Insert manufacturer's name>
 3. Thickness: [1/4 inch (6 mm)][1/2 inch (13 mm)].
 4. Surface Finish: [Fiberglass facer][Paper facer].
 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert value> percent.
- J. Polyisocyanurate Insulation Cover Board: ASTM C1289 Type II, Class 4, Grade 1, 1/2 inch (13 mm) thick, having a minimum compressive strength of 80 psi (551 kPa.)
- K. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric; water permeable and resistant to UV degradation; type and weight as recommended by roofing system manufacturer for application.
- 2.8 ASPHALT MATERIALS
- A. Roofing Asphalt: [ASTM D312/D312M, Type III or Type IV][ASTM D6152/D6152M, SEBS modified].
- B. Asphalt Primer: ASTM D41/D41M.
- 2.9 ELECTRONIC LEAK DETECTION (ELD) MATERIALS
- A. Conductive Medium: Materials providing less than 104 ohms per square as determined in accordance with ASTM D4496 and approved by roof membrane manufacturer.
1. Electrically Conductive Primer: Water-based, non-flammable, nonmetallic, low-VOC primer[, UL listed and FM Global approved].
 - a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- 1) **[Detec Systems]**
 - 2) **<Insert manufacturer's name>**
- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- 1) **[Detec Systems]**
 - 2) **<Insert manufacturer's name>**
2. Grounding Screen: **[Welded, stainless steel mesh][Aluminum screen]**, for use with vector mapping system[, **FM Global approved**].
- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
- 1) **[ILD International Leak Detection]**
 - 2) **<Insert manufacturer's name>**
- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- 1) **[ILD International Leak Detection]**
 - 2) **<Insert manufacturer's name>**
3. Electrically Conductive Fabric: Non-abrasive felt.
- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
- 1) **[ILD International Leak Detection]**
 - 2) **<Insert manufacturer's name>**
- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- 1) **[ILD International Leak Detection]**
 - 2) **<Insert manufacturer's name>**
- B. Leak Detection and Moisture-Monitoring System: Permanent, embedded leak detection and moisture-monitoring system.
1. Sensors measuring moisture content[, **temperature, and vapor drive**], placed **[below roof insulation][over vapor barrier]** and connected to a monitoring program, with a notification indicating location of breach.
 2. Sensors measuring moisture content[, **temperature, and vapor drive**], in a conductive fabric placed below roof membrane and connected to a monitoring program, with a notification indicating location of breach.
 3. Manufacturers: Subject to compliance with requirements, **[provide products by the**

following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. **[Detec Systems]**
 - b. **[ILD International Leak Detection]**
 - c. **<Insert manufacturer's name>**
4. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[Detec Systems]**
 - b. **[ILD International Leak Detection]**
 - c. **<Insert manufacturer's name>**

2.10 BALLAST

- A. Aggregate Ballast: **[Smooth, washed, riverbed gravel or other acceptable smooth-faced stone][Crushed gravel or crushed stone]** that withstands weather exposure without significant deterioration and does not contribute to membrane degradation, of the following size:
1. Size: ASTM D448, **[Size 2, ranging from 1-1/2 to 2-1/2 inches (38 to 63 mm)][Size 3, ranging from 1 to 2 inches (25 to 50 mm)][Size 4, ranging from 3/4 to 1-1/2 inches (19 to 38 mm)]<Insert size>**.
- B. Lightweight Roof Pavers: Interlocking, lightweight concrete units; grooved back, with four-way drainage capability; beveled, doweled, or otherwise profiled; and as follows:
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Hanover Architectural Products]**
 - b. **[Roofblok Limited]**
 - c. **[Westile Roofing Products; an Oldcastle company]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Hanover Architectural Products]**
 - b. **[Roofblok Limited]**
 - c. **[Westile Roofing Products; an Oldcastle company]**
 - d. **<Insert manufacturer's name>**
 3. Size: **<Insert actual size(s) of pavers>**.
 4. Weight: **<Insert weight or weight range>**.
 5. Compressive Strength: **[2500 psi (17 MPa)][5000 psi (34 MPa)]<Insert value>**, minimum.
 6. Colors and Textures: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]**.
- C. Heavyweight Roof Pavers: Heavyweight, hydraulically pressed concrete units, **[square edged][with top**

edges beveled 3/16 inch (5 mm)], factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C140/C140M; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C67; and as follows:

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Flex Membrane International Corp.]**
 - b. **[Hanover Architectural Products]**
 - c. **[Roofblok Limited]**
 - d. **[Sunny Brook Pressed Concrete, Co.]**
 - e. **[Tile Tech Pavers]**
 - f. **[Wausau Tile, Inc.]**
 - g. **[Westile Roofing Products; an Oldcastle company]**
 - h. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Flex Membrane International Corp.]**
 - b. **[Hanover Architectural Products]**
 - c. **[Roofblok Limited]**
 - d. **[Sunny Brook Pressed Concrete, Co.]**
 - e. **[Tile Tech Pavers]**
 - f. **[Wausau Tile, Inc.]**
 - g. **[Westile Roofing Products; an Oldcastle company]**
 - h. **<Insert manufacturer's name>**
3. Size: **[24 by 24 inches (600 by 600 mm)]<Insert dimensions>**. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
4. Weight: **[18 lb/sq. ft. (90 kg/sq. m)][22 lb/sq. ft. (110 kg/sq. m)]<Insert value>**.
5. Compressive Strength: **[7500 psi (52 MPa)][6500 psi (45 MPa)]<Insert value>**, minimum.
6. Colors and Textures: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]**.

2.11 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway **[pads][or][rolls]**, approximately **3/16 inch (5 mm)** thick and acceptable to roofing system manufacturer.
 1. Size: Approximately **36 by 60 inches (914 by 1524 mm)**.
 2. Color: Contrasting with roof membrane.
- B. Walkway Roof Pavers: Heavyweight, hydraulically pressed concrete units, **[square edged][with top edges beveled 3/16 inch (5 mm)]**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C140/C140M; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C67; and as follows:
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the**

following]:

- a. **[Hanover Architectural Products]**
 - b. **[Roofblok Limited]**
 - c. **[Sunny Brook Pressed Concrete, Co.]**
 - d. **[Wausau Tile, Inc.]**
 - e. **[Westile Roofing Products; an Oldcastle company]**
 - f. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[Hanover Architectural Products]**
 - b. **[Roofblok Limited]**
 - c. **[Sunny Brook Pressed Concrete, Co.]**
 - d. **[Wausau Tile, Inc.]**
 - e. **[Westile Roofing Products; an Oldcastle company]**
 - f. **<Insert manufacturer's name>**
3. Size: **[24 by 24 inches (600 by 600 mm)]<Insert dimensions>**. Manufacture pavers to dimensional tolerances of plus or minus **1/16 inch (1.6 mm)** in length, height, and thickness.
 4. Weight: **[18 lb/sq. ft. (90 kg/sq. m)][22 lb/sq. ft. (110 kg/sq. m)]<Insert value>**.
 5. Compressive Strength: **[7500 psi (52 MPa)][6500 psi (45 MPa)]<Insert value>**, minimum.
 6. Colors and Textures: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 5. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than **[75]<Insert number>** percent, or as recommended by roofing system manufacturer, when tested in accordance with ASTM F2170.
 - a. Test Frequency: One test probe per each **[1000 sq. ft. (93 sq. m)]<Insert area>**, or portion thereof, of roof deck, with no fewer than three tests probes.
 - b. Submit test reports within 24 hours after performing tests.
 6. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.
 7. Verify that joints in precast concrete roof decks have been grouted flush with top of concrete.
 8. Verify that minimum curing period recommended by roofing system manufacturer for lightweight

- insulating concrete roof decks has passed.
- 9. Verify that any damaged sections of cementitious wood-fiber decks have been repaired or replaced.
- 10. Verify that adjacent cementitious wood-fiber panels are vertically aligned to within **1/8 inch (3.2 mm)** at top surface.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation in accordance with roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Perform fastener-pullout tests in accordance with roof system manufacturer's written instructions.
 - 1. Submit test result within 24 hours after performing tests.
 - a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.
- D. Install sound absorbing insulation strips in accordance with acoustical roof deck manufacturer's written instructions.

3.3 INSTALLATION OF ROOFING, GENERAL

- A. Install roofing system in accordance with roofing system manufacturer's written instructions, **[FM Approvals' RoofNav][SPRI's Directory of Roof Assemblies]** listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition **[and to not void warranty for existing roofing system]**.
- D. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under **[Section 072713 "Modified Bituminous Sheet Air Barriers."][Section 072715 "Nonbituminous Self-Adhering Sheet Air Barriers."][Section 072726 "Fluid-Applied Membrane Air Barriers."]**

3.4 INSTALLATION OF SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than **24 inches (610 mm)** in adjacent rows.

1. At steel roof decks, install substrate board at right angle to flutes of deck.
 - a. Locate end joints over crests of steel roof deck.
2. Tightly butt substrate boards together.
3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
4. Fasten substrate board to top flanges of steel deck in accordance with recommendations in **[FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity]** and FM Global Property Loss Prevention Data Sheet 1-29.
5. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof in accordance with roofing system manufacturers' written instructions.
6. Loosely lay substrate board over roof deck.

3.5 INSTALLATION OF VAPOR RETARDER

- A. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of **2 and 6 inches (50 and 150 mm)**, respectively.
 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 2. Continuously seal side and end laps with **[tape][adhesive]**.
- B. Laminate Sheet: Loosely lay laminate-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of **2 and 6 inches (50 and 150 mm)**, respectively.
 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 2. Continuously seal side and end laps with tape.
- C. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of **3-1/2 and 6 inches (90 and 150 mm)**, respectively.
 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 2. Seal laps by rolling.
- D. Built-up Vapor Retarder: Install two glass-fiber felt plies lapping each felt **19 inches (483 mm)** over preceding felt.
 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 2. Embed each felt in a solid mopping of hot roofing asphalt.
 3. Glaze coat completed surface with hot roofing asphalt.
 4. Apply hot roofing asphalt within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
- E. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.6 INSTALLATION OF INSULATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with roofing system and roof insulation manufacturer's written instructions for installing roof insulation.
- C. Installation Over Metal Decking:
 - 1. Install base layer of insulation with **joints staggered not less than 24 inches (610 mm) in adjacent rows**~~end joints staggered not less than 12 inches (305 mm) in adjacent rows~~**and with long joints continuous at right angle to flutes of decking**.
 - a. Locate end joints over crests of decking.
 - b. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 - e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus **24 inches (610 mm)**.
 - 1) Trim insulation so that water flow is unrestricted.
 - f. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 - g. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 - h. Loosely lay base layer of insulation units over substrate.
 - i. Mechanically attach base layer of insulation ~~and substrate board~~ using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
 - 1) Fasten insulation in accordance with requirements in **[FM Approvals' RoofNav for specified Windstorm Resistance Classification][SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity]**.
 - 2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
 - 2. Install upper layers of insulation ~~and tapered insulation~~ with joints of each layer offset not less than **12 inches (305 mm)** from previous layer of insulation.
 - a. Staggered end joints within each layer not less than **24 inches (610 mm)** in adjacent rows.
 - b. Install with long joints continuous and with end joints staggered not less than **12 inches (305 mm)** in adjacent rows.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 - e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus **24 inches (610 mm)**.
 - f. Trim insulation so that water flow is unrestricted.
 - g. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 - h. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 - i. Loosely lay each layer of insulation units over substrate.
 - j. Adhere each layer of insulation to substrate using adhesive in accordance with **[FM**

Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity] and FM Global Property Loss Prevention Data Sheet 1-29, as follows:

- 1) Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
- 2) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
- 3) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

D. Installation Over Wood and Wood Panel Decking:

1. Mechanically fasten slip sheet to roof deck using mechanical fasteners specifically designed and sized for fastening slip sheet to **[wood][wood panel]** decks.
 - a. Fasten slip sheet in accordance with requirements in SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity.
 - b. Fasten slip sheet to resist specified uplift pressure at corners, perimeter, and field of roof.
2. Install base layer of insulation with **[joints staggered not less than 24 inches (610 mm) in adjacent rows][end joints staggered not less than 12 inches (305 mm) in adjacent rows]**.
 - a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 - d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus **24 inches (610 mm)**.
 - 1) Trim insulation so that water flow is unrestricted.
 - e. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 - f. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 - g. Loosely lay base layer of insulation units over substrate.
 - h. Mechanically attach base layer of insulation **[and substrate board]** using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to **[wood][wood panel]** decks.
 - 1) Fasten insulation in accordance with requirements in SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity.
 - 2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
3. Install upper layers of insulation **[and tapered insulation]** with joints of each layer offset not less than **12 inches (305 mm)** from previous layer of insulation.
 - a. Staggered end joints within each layer not less than **24 inches (610 mm)** in adjacent rows.
 - b. Install with long joints continuous and with end joints staggered not less than **12 inches (305 mm)** in adjacent rows.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.

- e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus **24 inches (610 mm)**.
 - 1) Trim insulation so that water flow is unrestricted.
- f. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
- g. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
- h. Loosely lay each layer of insulation units over substrate.
- i. Adhere each layer of insulation to substrate using adhesive in accordance with SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
 - 2) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 3) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

E. Installation Over Concrete Decks:

1. Install base layer of insulation with **[joints staggered not less than 24 inches (610 mm) in adjacent rows][end joints staggered not less than 12 inches (305 mm) in adjacent rows]**.
 - a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 - d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus **24 inches (610 mm)**.
 - 1) Trim insulation so that water flow is unrestricted.
 - e. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 - f. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 - g. Loosely lay base layer of insulation units over substrate.
 - h. Adhere base layer of insulation to **[concrete roof deck][vapor retarder]** in accordance with **[FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity]** and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Prime surface of concrete deck with asphalt primer at rate of **3/4 gal./100 sq. ft. (0.3 L/sq. m)**, and allow primer to dry.
 - 2) Set insulation in a solid mopping of hot roofing asphalt, applied within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
 - 3) Set insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 4) Set insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
2. Install upper layers of insulation **[and tapered insulation]** with joints of each layer offset not less than **12 inches (305 mm)** from previous layer of insulation.

- a. Staggered end joints within each layer not less than **24 inches (610 mm)** in adjacent rows.
- b. Install with long joints continuous and with end joints staggered not less than **12 inches (305 mm)** in adjacent rows.
- c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
- d. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
- e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus **24 inches (610 mm)**.

- 1) Trim insulation so that water flow is unrestricted.

- f. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
- g. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
- h. Loosely lay each layer of insulation units over substrate.
- i. Adhere each layer of insulation to substrate using adhesive in accordance with **[FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity]** and FM Global Property Loss Prevention Data Sheet 1-29, as follows:

- 1) Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
- 2) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
- 3) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

F. Installation Over Cementitious Wood-Fiber Decks:

1. Mechanically fasten slip sheet to roof deck using mechanical fasteners specifically designed and sized for fastening slip sheet to cementitious wood-fiber decks.
 - a. Fasten slip sheet in accordance with requirements in SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity.
 - b. Fasten slip sheet to resist specified uplift pressure at corners, perimeter, and field of roof.
2. Install base layer of insulation with **[joints staggered not less than 24 inches (610 mm) in adjacent rows][end joints staggered not less than 12 inches (305 mm) in adjacent rows]**.
 - a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 - d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus **24 inches (610 mm)**.
 - 1) Trim insulation so that water flow is unrestricted.
 - e. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 - f. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 - g. Loosely lay base layer of insulation units over substrate.
 - h. Adhere base layer of insulation to slip sheet in accordance with SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:

- 1) Set insulation in a solid mopping of hot roofing asphalt, applied within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
 - 2) Set insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 3) Set insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
3. Install upper layers of insulation[**and tapered insulation**] with joints of each layer offset not less than **12 inches (305 mm)** from previous layer of insulation.
 - a. Staggered end joints within each layer not less than **24 inches (610 mm)** in adjacent rows.
 - b. Install with long joints continuous and with end joints staggered not less than **12 inches (305 mm)** in adjacent rows.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 - e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus **24 inches (610 mm)**.
 - 1) Trim insulation so that water flow is unrestricted.
 - f. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 - g. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 - h. Loosely lay each layer of insulation units over substrate.
 - i. Adhere each layer of insulation to substrate using adhesive in accordance with SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
 - 2) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 3) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

G. Installation Over Lightweight Insulating Concrete Decks:

1. Mechanically fasten vented base sheet to lightweight insulating concrete, with vented side down, using mechanical fasteners specifically designed and sized for fastening to lightweight insulating concrete decks.
 - a. Fasten vented base sheet in accordance with requirements in **[FM Approvals' RoofNav for specified Windstorm Resistance Classification][SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity][SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity]**.
 - b. Fasten vented base sheet to resist specified uplift pressure at corners, perimeter, and field of roof.
2. Install base layer of insulation with **[joints staggered not less than 24 inches (610 mm) in adjacent rows][end joints staggered not less than 12 inches (305 mm) in adjacent rows]**.
 - a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to

- intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 - d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus **24 inches (610 mm)**.
 - 1) Trim insulation so that water flow is unrestricted.
 - e. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 - f. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 - g. Loosely lay base layer of insulation units over substrate.
 - h. Adhere base layer of insulation to vented base sheet in accordance with **[FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity]** and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set insulation in a solid mopping of hot roofing asphalt, applied within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
 - 2) Set insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 3) Set insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
3. Install upper layers of insulation[**and tapered insulation**] with joints of each layer offset not less than **12 inches (305 mm)** from previous layer of insulation.
- a. Staggered end joints within each layer not less than **24 inches (610 mm)** in adjacent rows.
 - b. Install with long joints continuous and with end joints staggered not less than **12 inches (305 mm)** in adjacent rows.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 - e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus **24 inches (610 mm)**.
 - 1) Trim insulation so that water flow is unrestricted.
 - f. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 - g. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 - h. Loosely lay each layer of insulation units over substrate.
 - i. Adhere each layer of insulation to substrate using adhesive in accordance with **[FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity]** and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
 - 2) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - 3) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.7 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of **6 inches (150 mm)** in each direction.
 - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 - 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 - 4. Adhere cover board to substrate using adhesive in accordance with **[FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity]** and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - a. Set cover board in a solid mopping of hot roofing asphalt, applied within plus or minus **25 deg F (14 deg C)** of equiviscous temperature.
 - b. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
 - c. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
- B. Install slip sheet over cover board and beneath roof membrane.

3.8 INSTALLATION OF ELD COMPONENTS

- A. Install conductive medium over **[cover board][insulation][and on vertical locations to receive roof membrane]** in accordance with manufacturer's written instructions.
- B. Install sensors, **[wire loop][conductive fabric]**, connections, and accessory items required for complete system in accordance with manufacturer's written instructions.

3.9 INSTALLATION OF ADHERED ROOF MEMBRANE

- A. Adhere roof membrane over area to receive roofing, and install in accordance with roofing system manufacturer's written instructions. Unroll roof membrane and allow to relax before installing.
- B. Start installation of roofing in presence of roofing system manufacturer's technical personnel **[and Owner's testing and inspection agency]**.
- C. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.
- E. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.

- F. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- G. Seams: Clean seam areas, overlap roof membrane, and weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation. Complete welding of seams within 24 hours of exposing CSPE sheet or before curing of CSPE sheet has begun. Weld seams as follows:
 - 1. Weld Method: **[Hot air][Solvent][Hot air or solvent, as standard with membrane roofing system manufacturer]**.
 - 2. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashing.
 - 3. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 - 4. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.
- H. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.10 INSTALLATION OF MECHANICALLY FASTENED ROOF MEMBRANE

- A. Mechanically fasten roof membrane over area to receive roofing in accordance with roofing system manufacturer's written instructions.
- B. Unroll roof membrane and allow to relax before installing.
- C. For in-splice attachment, install roof membrane with long dimension perpendicular to steel roof deck flutes.
- D. Start installation of roofing in presence of roofing system manufacturer's technical personnel **[and Owner's testing and inspection agency]**.
- E. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- F. Mechanically fasten or adhere roof membrane securely at terminations, penetrations, and perimeter of roofing.
- G. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- H. In-Seam Attachment: Secure one edge of CSPE sheet using fastening plates or metal battens centered within seam, and mechanically fasten CSPE sheet to roof deck.
- I. Seams: Clean seam areas, overlap roof membrane, and weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation.
 - 1. Complete welding of seams within 24 hours of exposing CSPE sheet or before curing of CSPE sheet has begun.
 - 2. Weld seams as follows:
 - a. Weld Method: **[Hot air][Solvent][Hot air or solvent, as standard with roofing system manufacturer]**.
 - 3. Test lap edges with probe to verify seam weld continuity.
 - 4. Apply lap sealant to seal cut edges of roof membrane and flashing sheet.
 - 5. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 - 6. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

- J. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.11 INSTALLATION OF LOOSELY LAID AND BALLASTED ROOF MEMBRANE

- A. Loosely lay roof membrane over area to receive roofing, and install in accordance with roofing system manufacturer's written instructions.
- B. Unroll roof membrane and allow to relax before installing.
- C. Comply with requirements in ANSI/SPRI RP-4 for **[System 1][System 2][System 3]**.
- D. Start installation of roofing in presence of roofing system manufacturer's technical personnel **[and Owner's testing and inspection agency]**.
- E. Accurately align roof membrane, without stretching, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- F. Mechanically fasten or adhere perimeter of roof membrane in accordance with requirements in ANSI/SPRI RP-4.
- G. **[Mechanically fasten][or][adhere]** roof membrane at corners, perimeters, and transitions in accordance with requirements in ANSI/SPRI RP-4.
 - 1. At corners and perimeters, omit aggregate ballast leaving roof membrane exposed.
 - 2. At corners and perimeters, adhere a second layer of roof membrane.
- H. Apply roof membrane with side laps shingled with slope of deck where possible.
- I. Seams: Clean seam areas, overlap roof membrane, and weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation.
 - 1. Complete welding of seams within 24 hours of exposing CSPE sheet or before curing of CSPE sheet has begun.
 - 2. Weld seams as follows:
 - a. Weld Method: **[Hot air][Solvent][Hot air or solvent, as standard with roofing system manufacturer]**.
 - 3. Test lap edges with probe to verify seam weld continuity.
 - 4. Apply lap sealant to seal cut edges of roof membrane and flashing sheet.
 - 5. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 - 6. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.
- J. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.
- K. Install protection mat over roof membrane, overlapping a minimum of **6 inches (150 mm)**. Install an additional protection mat layer at projections, pipes, vents, and drains, overlapping a minimum of **12 inches (300 mm)**.
- L. Aggregate Ballast: Apply uniformly over roof membrane at the rate required by roofing system manufacturer, but not less than the following, spreading with care to minimize possibility of damage to

roofing system. Lay ballast as roof membrane is installed, leaving roof membrane ballasted at the end of the workday.

1. Ballast Weight:
 - a. Size 4 aggregate, **10 lb/sq. ft. (50 kg/sq. m).**
 - b. Size 2 aggregate, **13 lb/sq. ft. (65 kg/sq. m)**, at corners and perimeter; Size 4 aggregate, **10 lb/sq. ft. (50 kg/sq. m)**, elsewhere.
 - c. Size 2 aggregate, **13 lb/sq. ft. (65 kg/sq. m).**
 - d. Size 3 aggregate, **<Insert weight>**, at corners, **<Insert weight>** at perimeter, and **<Insert weight>**, elsewhere.
- M. Roof-Paver Ballast: Install [**lightweight**][**heavyweight**] roof-paver ballast in accordance with manufacturer's written instructions.
- N. Roof-Paver and Aggregate Ballast: Install heavyweight roof pavers in accordance with manufacturer's written instructions on roof corners and perimeter.
 1. Install Size 4 aggregate ballast elsewhere on roof membrane at a minimum rate of **10 lb/sq. ft. (50 kg/sq. m).**
 2. Install Size 2 aggregate ballast elsewhere on roof membrane at a minimum rate of **13 lb/sq. ft. (65 kg/sq. m).**

3.12 INSTALLATION OF BASE FLASHING

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates in accordance with roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation. Complete welding of seams within 24 hours of exposing CSPE sheet or before curing of CSPE sheet has begun.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.13 INSTALLATION OF WALKWAYS

- A. Flexible Walkways:
 1. Install flexible walkways at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop

- unit locations.
- f. Locations indicated on Drawings.
- g. As required by roof membrane manufacturer's warranty requirements.

- 2. Provide **6-inch (150-mm)** clearance between adjoining pads.
- 3. Heat-weld to substrate or adhere walkway products to substrate with compatible adhesive in accordance with roofing system manufacturer's written instructions.

B. Roof-Paver Walkways: Install walkway roof pavers in accordance with manufacturer's written instructions.

- 1. Install roof-paver walkways at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - f. Locations indicated on Drawings.
 - g. As required by roof membrane manufacturer's warranty requirements.
- 2. Provide **3 inches (75 mm)** of space between adjacent roof pavers.

3.14 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Perform the following tests:
 - 1. Flood Testing: Flood test each roof area for leaks, in accordance with recommendations in ASTM D5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - a. Perform tests before overlying construction is placed.
 - b. Flood to an average depth of **[2-1/2 inches (65 mm)]<Insert depth>** with a minimum depth of **[1 inch (25 mm)]<Insert depth>** and not exceeding a depth of **[4 inches (100 mm)]<Insert depth>**. Maintain **2 inches (50 mm)** of clearance from top of base flashing.
 - c. Flood each area for **[24][48][72]** hours.
 - d. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - e. Testing agency to prepare survey report indicating locations of initial leaks, if any, and final survey report.
 - 2. Infrared Thermography: Testing agency surveys entire roof area using infrared color thermography in accordance with ASTM C1153.

- a. Perform tests before overlying construction is placed.
 - b. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or nuclear hydrogen detection tests.
 - c. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - d. Testing agency to prepare survey report of initial scan indicating locations of entrapped moisture, if any.
3. Electrical Capacitance/Impedance Testing: Testing agency surveys entire roof area for entrapped water within roof assembly in accordance with ASTM D7954/D7954M.
 - a. Perform tests before overlying construction is placed.
 - b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
4. Nuclear Hydrogen Detection Testing: Testing agency surveys entire roof area for entrapped water within roof assembly in accordance with ANSI/SPRI/RCI NT-1.
 - a. Perform tests before overlying construction is placed.
 - b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
5. Low-Voltage ELD Testing: Testing agency surveys entire roof area and flashings to locate discontinuities in the roof membrane using low-voltage **[horizontal membrane scanning platform][membrane electric field vector mapping][or][vertical membrane scanning]** in accordance with ASTM D8231.
 - a. Perform tests before overlying construction is placed.
 - b. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
6. High-Voltage Membrane Testing: Testing agency surveys entire **[roof area,][flashings,][and][parapet walls]** to locate discontinuity in the roof membrane using an electrically charged metal "broom head."
 - a. Perform tests before overlying construction is placed.
 - b. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.

c. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.

- C. Test Cuts: Remove test specimens to evaluate problems observed during quality-assurance inspections of roofing system to comply with criteria established in Appendix 3 in ARMA/NRCA's "Quality Control Guidelines for the Application of Built-up Roofing."
 - 1. Repair areas where test cuts were made in accordance with roofing manufacturer's written instructions.
- D. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
- E. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- F. Roofing system will be considered defective if it does not pass tests and inspections.
 - 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.15 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and in accordance with warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.16 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 - 1. Owner: <Insert name of Owner>.
 - 2. Owner Address: <Insert address>.
 - 3. Building Name/Type: <Insert information>.
 - 4. Building Address: <Insert address>.
 - 5. Area of Work: <Insert information>.
 - 6. Acceptance Date: _____.
 - 7. Warranty Period: <Insert time>.
 - 8. Expiration Date: _____.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth,

that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding **<Insert mph (m/s)>**;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.



07 - Thermal And Moisture Protection

END OF SECTION 07 53 16 00



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 53 16 00	07 51 13 00	Built-Up Asphalt Roofing
07 53 16 00	07 01 50 81	Built-Up Coal Tar Roofing
07 53 16 00	07 53 23 00	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing



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SECTION 07 53 23 00 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ethylene-propylene-diene-terpolymer (EPDM) roofing system.
2. Accessory roofing system materials.
3. Substrate board.
4. Vapor retarder.
5. Roof insulation and accessories.
6. Cover board.
7. Electronic leak-detection (ELD) materials.
8. Ballast.
9. Walkways.

B. Section contains the installation of sound-absorbing insulation strips in ribs of acoustical steel roof deck. Sound-absorbing insulation strips are furnished under Section 053100 "Steel Decking."

C. Related Requirements:

1. Section 053100 "Steel Decking" for roof deck panels[**and sound-absorbing insulation strips**].
2. Section 061000 "Rough Carpentry for wood nailers, curbs, and blocking[**and for wood-based, structural-use roof deck panels**].
3. Section 061600 "Sheathing" for wood-based, structural-use roof deck panels.
4. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
5. Section 077100 "Roof Specialties" for [**premanufactured copings**][**and**][**roof edge fasciae**][**gravel stops**][**reglets**][**roof edge flashings**][**counterflashings**].
6. Section 077129 "Manufactured Roof Expansion Joints" for premanufactured roof expansion-joint assemblies.
7. Section 077200 "Roof Accessories" for manufactured roof curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
8. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
9. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at [**Project site**]<Insert location>.

1. Meet with Owner, Architect,[**Construction Manager**,] Owner's insurer if applicable, testing and inspecting agency representative, roofing system Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or

- affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, roofing system Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

B. Preinstallation Roofing Conference: Conduct conference at **[Project site]<Insert location>**.

1. Meet with Owner, Architect, **[Construction Manager,]** Owner's insurer if applicable, testing and inspecting agency representative, roofing system Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, roofing system Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base and sheet flashings and membrane termination details.
3. Flashing details at penetrations.
4. Tapered insulation layout, thickness, and slopes.
5. Roof plan showing orientation of roof deck and orientation of roofing membrane, fastening spacings, and pattern for corner, perimeter, and field-of-roof locations.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
7. Crickets, saddles, and tapered edge strips, including slopes.
8. Tie-in with adjoining wall system air barrier.

C. Samples for Verification: For the following products:

1. Roofing membrane and flashings of color required.
2. Aggregate surfacing material in gradation **[and color]** required.
3. Roof paver, **[full sized,]** in each color and texture required.
4. Walkways, of color required.

- D. Wind-Uplift-Resistance Submittal: For roofing system, indicating compliance with wind-uplift performance requirements.
- E. Sustainable Design Submittals:
 - 1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.
 - 2. Health Product Declaration (HPD): Provide documentation confirming product compliance with one of the following:
 - a. Inventory or HPD to at least 0.01 percent by weight, with at least 95 percent assessed using GreenScreen Benchmark assessment.
 - b. Cradle to Cradle v3 certification with minimum Silver level of Material Health.
 - c. Living Product Challenge certification indicating achievement of Imperative 09, "Transparent Material Health."

1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer Certificates:
 - 1. Performance Requirement Certificate: Signed by roofing membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of complying with specified performance requirements.
 - 2. Special Warranty Certificate: Signed by roofing membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- B. Product Test Reports: For roofing membrane and insulation, tests performed by an independent qualified testing agency, indicating compliance with specified requirements.
- C. Research Reports: For components of roofing system, from **[an agency acceptable to authorities having jurisdiction][ICC-ES]<Insert evaluation agency>** showing compliance with specified performance requirements.
- D. Field Test Reports:
 - 1. Concrete internal relative humidity test reports.
 - 2. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.
- E. Field quality control reports.
- F. Qualification Statements: For roofing system **[Installer][manufacturer][and][testing agency]**.
- G. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system.
- B. Certified statement from existing roofing system manufacturer stating that existing roof warranty has not been affected by the Work performed under this Section.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is **[UL listed][listed in FM Approvals' RoofNav][listed in SPRI's "Directory of Roof Assemblies"]** for roofing system identical to that used for this Project.
- B. Roofing System Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
 - 1. Certified Roofing System Installer: Entity that employs **[a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified EPDM system installers][a supervisor who is an NRCA ProCertified Roofing Foreman][a supervisor who is an NRCA ProCertified Roofing Foreman and not less than 20 percent of installers who are NRCA ProCertified EPDM system installers]**.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing system materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.
 - 1. Protect stored liquid material from direct sunlight.
 - 2. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources.
 - 1. Store in a dry location.
 - 2. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing system materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written installation instructions and warranty requirements.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty to include all components of roofing system, such as **[substrate board,][vapor retarder,]** roof insulation, fasteners, adhesives, **[cover board,]** roofing membrane, base flashing

- sheet, **[ballast,][walkways,]** and other components of roofing system.
2. Warranty Period: **[10][15][20][30]<Insert number>** years from date of Substantial Completion.
- B. Roofing System Installer's Warranty: Submit roofing system Installer's warranty, on warranty form at end of this Section, signed by roofing system Installer, covering the Work of this Section, including all components of roofing system, such as **[substrate board,][vapor retarder,]** roof insulation, fasteners, adhesives, **[cover board,]** roofing membrane, base flashing sheet, **[ballast,][walkways,]** and other components of roofing system.
1. Warranty Period: **[Two][Five]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain components for roofing system from **[roofing membrane manufacturer][or][manufacturer approved by roofing membrane manufacturer]**.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and base flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing system and flashings to remain watertight.
1. Accelerated Weathering: Roofing membrane to withstand 2000 hours of exposure when tested in accordance with ASTM G152, ASTM G154, or ASTM G155.
2. Impact Resistance: Roofing membrane to resist impact damage when tested in accordance with ASTM D3746/D3746M, ASTM D4272/D4272M, or the Resistance to Foot Traffic Test in FM Approvals 4470.
- B. Material Compatibility: Roofing system materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
- C. Wind-Uplift Resistance: Design roofing system to resist the following wind-uplift pressures when tested in accordance with FM Approvals 4474, UL 580, or UL 1897:
1. Zone 1' (Roof Area Interior): **<Insert lbf/sq. ft. (kPa)>**.
2. Zone 1 (Roof Area Field): **<Insert lbf/sq. ft. (kPa)>**.
3. Zone 2 (Roof Area Perimeter): **<Insert lbf/sq. ft. (kPa)>**.
- a. Location: From roof edge to **<Insert dimension>** inside roof edge.
4. Zone 3 (Roof Area Corners): **<Insert lbf/sq. ft. (kPa)>**.
- a. Location: **<Insert dimension>** in each direction from building corner.
- D. FM Approvals' RoofNav Listing: Roofing membrane, base flashings, and component materials to comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.

1. Fire/Windstorm Classification: **[Class 1A-60][Class 1A-75][Class 1A-90][Class 1A-105][Class 1A-120]<Insert class>**.
 2. Hail-Resistance Rating: FM 1-34 **[MH][SH][VSH]**.
- E. SPRI's "Directory of Roof Assemblies" Listing: Roofing membrane, base flashings, and component materials to comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and are listed in SPRI's "Directory of Roof Assemblies" for roof assembly identical for that specified for this Project.
1. Wind-Uplift Load Capacity: **[60 psf][75 psf][90 psf][105 psf][120 psf]<Insert capacity>**.
- F. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][32]** or initial SRI not less than **[82][39]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- G. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][25]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- H. Solar Reflectance Index (SRI): Not less than **[78][29]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- I. Cool Roof Rating Council (CRRC): Roofing system to be listed by the CRRC for low-slope roof products.
- J. Energy Performance: Roofing system to have an initial solar reflectance index (SRI) of not less than **[0.70]<Insert value>** and an emissivity of not less than **[0.75]<Insert value>** when tested in accordance with CRRC S100.
- K. Exterior Fire-Test Exposure: **[Class A][Class B][Class C]**; for application and roof slopes indicated; when tested by a qualified testing agency in accordance with ASTM E108 or UL 790.
1. Identify products with appropriate markings of applicable testing agency.
- L. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated.
1. Identify products with appropriate markings of applicable testing agency.
- 2.3 ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) ROOFING SYSTEM
- A. EPDM Roofing Membrane Sheet: ASTM D4637/D4637M, **[Type I, nonreinforced],[Type II, scrim or fabric internally reinforced],[self-adhering]** EPDM sheet **[with factory-applied seam tape]**.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Carlisle Syntec Systems]**
 - b. **[Elevate; Holcim Building Envelope]**
 - c. **[GenFlex Roofing Systems]**
 - d. **[Johns Manville; a Berkshire Hathaway company]**
 - e. **[Lexcan, division of Lexsuco Corporation]**
 - f. **[Mule-Hide Products Co., Inc]**

- g. [Roofing Products International, Inc]
 - h. [Versico Roofing Systems; Carlisle Construction Materials]
 - i. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Carlisle Syntec Systems]
 - b. [Elevate; Holcim Building Envelope]
 - c. [GenFlex Roofing Systems]
 - d. [Johns Manville; a Berkshire Hathaway company]
 - e. [Lexcan, division of Lexsoco Corporation]
 - f. [Mule-Hide Products Co., Inc]
 - g. [Roofing Products International, Inc]
 - h. [Versico Roofing Systems; Carlisle Construction Materials]
 - i. <Insert manufacturer's name>
 3. Thickness: [45 mils (1.1 mm)][60 mils (1.5 mm)][75 mils (1.9 mm)][90 mils (2.2 mm)]<Insert value>, nominal.
 4. Exposed Face Color: [Black][White on black]<Insert color>.
 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- B. Fabric-Backed EPDM Roofing Membrane Sheet: ASTM D4637/D4637M, Type III, nonreinforced, EPDM sheet, laminated to a nonwoven polyester fabric backing except at selvages[**with factory-applied seam tape**].
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Carlisle Syntec Systems]
 - b. [Versico Roofing Systems; Carlisle Construction Materials]
 - c. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Carlisle Syntec Systems]
 - b. [Versico Roofing Systems; Carlisle Construction Materials]
 - c. <Insert manufacturer's name>
 3. Composite Thickness: [90 mils (2.3 mm)][100 mils (2.5 mm)][105 mils (2.7 mm)][115 mils (2.9 mm)]<Insert value>, nominal.
 4. Exposed Face Color: [Black][White on black]<Insert color>.
 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.

2.4 ACCESSORY ROOFING SYSTEM MATERIALS

- A. General: Accessory materials as recommended in writing by roofing membrane manufacturer for intended use and compatible with other roofing system components.

1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
 2. Verify adhesives and sealants comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Other Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Nonmembrane Roof Sealants: 300 g/L.
 - j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - k. Sealant Primers for Porous Substrates: 775 g/L.
- B. Base and Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as roofing membrane.
- C. Protection Sheet: As recommended in writing by roofing membrane manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil.
- D. Slip Sheet: **[ASTM D2178/D2178M, Type IV; glass fiber; asphalt-impregnated felt][Manufacturer's standard, of thickness required for application]**.
- E. Asphalt-Coated, Glass-Fiber-Mat, Venting Base Sheet: ASTM D4897/D4897M, Type II; nonperforated, asphalt impregnated, fiberglass reinforced, with mineral granular patterned surfacing on bottom surface.
- F. Prefabricated Pipe Flashings: As recommended in writing by roofing membrane manufacturer.
- G. Roof Vents: As recommended in writing by roofing membrane manufacturer.
1. Size: Not less than **4-inch (100-mm)** diameter.
- H. Bonding Adhesive: Roofing membrane manufacturer's standard[, **water based**].
- I. Modified Asphaltic Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard modified asphalt, asbestos-free, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.
- J. Water-Based, Fabric-Backed Membrane Adhesive: Roofing system manufacturer's standard water-based, cold-applied adhesive formulated for compatibility and use with fabric-backed membrane roofing.
- K. Low-Rise, Urethane, Fabric-Backed Membrane Adhesive: Roof system manufacturer's standard spray-applied, low-rise, two-component urethane adhesive formulated for compatibility and use with fabric-backed membrane roofing.
- L. Seaming Material: **[Single-component, butyl splicing adhesive and splice cleaner][Manufacturer's standard, synthetic-rubber polymer primer and 3-inch- (75-mm-) wide minimum, butyl splice tape with release film][Factory-applied seam tape, width as recommended by manufacturer]**.
- M. Lap Sealant: Manufacturer's standard, single-component sealant[, **colored to match membrane roofing**].
- N. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

- O. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately **1 by 1/8 inch (25 by 3 mm)** thick; with anchors.
- P. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately **1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick)**, prepunched.
- Q. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing system components to substrate; tested for required pullout strength, and acceptable to roofing membrane manufacturer.
- R. Safety Accessories: Roofing membrane manufacturer's standard yellow seaming tape for designating safety perimeters and rooftop hazards.
- S. Miscellaneous Accessories: As recommended in writing by roofing membrane manufacturer.
- T. Liquid Roof Coating: Product specifically formulated for coating roofing membrane, as follows:
 - 1. Type: **[Acrylic emulsion complying with ASTM D6083/D6083M][Chlorosulfonated polyethylene complying with ASTM D3468/D3468M]**.
 - 2. Color: **[White][Gray][Tan][As selected by Architect from manufacturer's full range]<Insert color>**.

2.5 SUBSTRATE BOARD

- A. Glass-Mat Gypsum Roof Substrate Board: ASTM C1177/C1177M, water-resistant gypsum board.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
 - 3. Thickness: **[1/4 inch (6 mm)][1/2 inch (13 mm)][Type X, 5/8 inch (16 mm)]**.
 - 4. Surface Finish: **[Factory primed][Unprimed]**.
- B. Fiber-Reinforced Gypsum Roof Board: ASTM C1278/C1278M, cellulosic-fiber reinforced, water-resistant gypsum board.
 - 1. Thickness: **[1/4 inch (6 mm)][3/8 inch (10 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.

- C. High-Density Polyisocyanurate Cover Board: ASTM C1289, Type II, Class 4, Grade 1, 1/2 inch (13 mm) thick, having a minimum compressive strength of 80 psi (551 kPa).
- D. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate panel to roof deck.
- E. Bonding Adhesive: Manufacturer's standard, designed for adhering substrate board to roof deck.

2.6 VAPOR RETARDER

- A. Rubberized-Asphalt-Sheet Vapor Retarder, Self-Adhering: ASTM D1970/D1970M, polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 40-mil (1.0-mm) total thickness; maximum permeance rating of 0.1 perm (6 ng/Pa x s x sq. m); cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.
- B. Butyl-Rubber-Sheet Vapor Retarder, Self-Adhering: Polyethylene film laminated to layer of butyl rubber adhesive, minimum 30-mil (0.76-mm) total thickness; maximum permeance rating of 0.1 perm (6 ng/Pa x s x sq. m); cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.
- C. Laminated Sheet Vapor Retarder: Two layers; fire-retardant polyethylene laminate; reinforced with cord grid.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Reef Industries, Inc.]
 - b. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Reef Industries, Inc.]
 - b. <Insert manufacturer's name>
 - 3. Permeance Rating: Not more than 0.062 perm (3.556 ng/Pa x s x sq. m) when tested in accordance with ASTM E96/E96M.
 - 4. Flame-Spread Index: Not more than 5 when tested in accordance with ASTM E84.
 - 5. Smoke-Developed Index: Not more than 35 when tested in accordance with ASTM E84.
 - 6. Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.7 ROOF INSULATION AND ACCESSORIES

- A. General: Preformed roof insulation boards manufactured[or approved] by roofing membrane manufacturer, approved for use in [FM Approvals' RoofNav][SPRI's "Directory of Roof Assemblies"] listed roof assemblies.
- B. Extruded-Polystyrene Board Insulation: ASTM C578, [Type IV, 1.45 lb/cu. ft. (23 kg/cu. m) minimum

density, 25 psi (173 kPa) minimum compressive strength][Type V, 3.00 lb/cu. ft. (48 kg/cu. m), minimum density, 100 psi (690 kPa) minimum compressive strength] square edged.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [DuPont]
 - b. [Kingspan Insulation LLC]
 - c. [Owens Corning]
 - d. [Soprema, Inc.]
 - e. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [DuPont]
 - b. [Kingspan Insulation LLC]
 - c. [Owens Corning]
 - d. [Soprema, Inc.]
 - e. <Insert manufacturer's name>
3. Thermal Resistance: R-value of 5.0 per 1 inch (25 mm).
4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)].
5. Thickness:
 - a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.
 - b. Upper Layer: <Insert thickness>.

C. Molded (Expanded) Polystyrene Board Insulation: ASTM C578, Type VIII, 1.15 lb/cu. ft. (18 kg/cu. m) minimum density, 13 psi (90 kPa) minimum compressive strength, square edge.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [Carlisle Syntec Systems]
 - c. [Cellofoam North America, Inc.]
 - d. [Kingspan Insulation LLC]
 - e. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [Carlisle Syntec Systems]
 - c. [Cellofoam North America, Inc.]
 - d. [Kingspan Insulation LLC]
 - e. <Insert manufacturer's name>

3. Thermal Resistance: R-value of 3.8 per 1 inch (25 mm).

-
4. Size: **[48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)]**.
 5. Thickness:
 - a. Base Layer: **[1-1/2 inches (38 mm)]<Insert thickness>**.
 - b. Upper Layer: **<Insert thickness>**.
- D. Composite Molded (Expanded) Polystyrene Board Insulation: ASTM C578, **[Type II, 1.35 lb/cu. ft. (22 kg/cu. m)][Type VIII, 1.15 lb/cu. ft. (18 kg/cu. m)][Type IX, 1.8 lb/cu. ft. (29 kg/cu. m)]** minimum density, with factory-applied facings, as follows:
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Carlisle Syntec Systems]**
 - b. **[Cellofoam North America, Inc.]**
 - c. **[Insulfoam; a Carlisle Company]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Carlisle Syntec Systems]**
 - b. **[Cellofoam North America, Inc.]**
 - c. **[Insulfoam; a Carlisle Company]**
 - d. **<Insert manufacturer's name>**
 3. Facer: **[ASTM C208, Type II, Grade 2, cellulosic-fiber insulation board, asphalt coated, 1/2 inch (13 mm) thick][DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick]<Insert material>**.
 4. Size: **[48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)]**.
 5. Thickness: **<Insert thickness>**.
- E. Polyisocyanurate Board Insulation: ASTM C1289, Type II, **[Class 1 felt facer][Class 2 coated glass-fiber facer][Class 3 uncoated glass-fiber facer]** on both major surfaces.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Atlas Polyiso Roof and Wall Insulation]**
 - b. **[Carlisle Syntec Systems]**
 - c. **[CertainTeed; SAINT-GOBAIN]**
 - d. **[Elevate; Holcim Building Envelope]**
 - e. **[GAF]**
 - f. **[Hunter Panels; a Carlisle company]**
 - g. **[IKO Industries Inc.]**
 - h. **[Insulfoam; a Carlisle Company]**
 - i. **[Johns Manville; a Berkshire Hathaway company]**
 - j. **[Kingspan Insulation LLC]**
 - k. **[Polyglass U.S.A., Inc.]**
 - l. **[Rmax, A Business Unit of Sika Corporation]**

- m. <Insert manufacturer's name>
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [Carlisle Syntec Systems]
 - c. [CertainTeed; SAINT-GOBAIN]
 - d. [Elevate; Holcim Building Envelope]
 - e. [GAF]
 - f. [Hunter Panels; a Carlisle company]
 - g. [IKO Industries Inc.]
 - h. [Insulfoam; a Carlisle Company]
 - i. [Johns Manville; a Berkshire Hathaway company]
 - j. [Kingspan Insulation LLC]
 - k. [Polyglass U.S.A., Inc.]
 - l. [Rmax, A Business Unit of Sika Corporation]
 - m. <Insert manufacturer's name>
- 3. Compressive Strength: [Grade 2, 20 psi (138 kPa)][Grade 3, 25 psi (172 kPa)].
- 4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)].
- 5. Thickness:
 - a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.
 - b. Upper Layer: <Insert thickness>.
- F. Composite Polyisocyanurate Board Insulation: ASTM C1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [Carlisle Syntec Systems]
 - c. [CertainTeed; SAINT-GOBAIN]
 - d. [Elevate; Holcim Building Envelope]
 - e. [GAF]
 - f. [Hunter Panels; a Carlisle company]
 - g. [IKO Industries Inc.]
 - h. [Insulfoam; a Carlisle Company]
 - i. [Johns Manville; a Berkshire Hathaway company]
 - j. [Kingspan Insulation LLC]
 - k. [Polyglass U.S.A., Inc.]
 - l. [Rmax, A Business Unit of Sika Corporation]
 - m. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [Carlisle Syntec Systems]
 - c. [CertainTeed; SAINT-GOBAIN]

- d. [Elevate; Holcim Building Envelope]
 - e. [GAF]
 - f. [Hunter Panels; a Carlisle company]
 - g. [IKO Industries Inc.]
 - h. [Insulfoam; a Carlisle Company]
 - i. [Johns Manville; a Berkshire Hathaway company]
 - j. [Kingspan Insulation LLC]
 - k. [Polyglass U.S.A., Inc.]
 - l. [Rmax, A Business Unit of Sika Corporation]
 - m. <Insert manufacturer's name>
3. Facer: [Type IV, cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch (13 mm) thick][Type V, OSB facer, 7/16 inch (11 mm) thick][Type VII, glass-mat-faced gypsum board facer, 1/4 inch (6 mm) thick]<Insert material>.
 4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)].
 5. Thickness: <Insert thickness>.
- G. Perlite Board Insulation: ASTM C728, Type 1, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [GAF]
 - b. [Johns Manville; a Berkshire Hathaway company]
 - c. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [GAF]
 - b. [Johns Manville; a Berkshire Hathaway company]
 - c. <Insert manufacturer's name>
 3. Thermal Resistance: R-value of 2.78 per 1 inch (25 mm).
 4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)].
 5. Thickness:
 - a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.
 - b. Upper Layer: <Insert thickness>.
- H. Cellulosic-Fiber Board Insulation: ASTM C208, Type II, Grade 2, fibrous-felted, rigid insulation boards of wood-fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Blue Ridge Fiberboard]

- b. **[GAF]**
 - c. **[Georgia-Pacific Gypsum LLC]**
 - d. **[Homasote Company]**
 - e. **[Huebert Fiberboard Inc]**
 - f. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Blue Ridge Fiberboard]**
 - b. **[GAF]**
 - c. **[Georgia-Pacific Gypsum LLC]**
 - d. **[Homasote Company]**
 - e. **[Huebert Fiberboard Inc]**
 - f. **<Insert manufacturer's name>**
3. Thermal Resistance: R-value of 2.78 per 1 inch (25 mm).
4. Size: **[48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)]**.
5. Thickness:
 - a. Base Layer: **[1 inch (25 mm)][2 inches (50 mm)]<Insert thickness>**.
 - b. Upper Layer: **<Insert thickness>**.
- I. Mineral Wool Board Insulation - Multi-Density: ASTM C726, Type I, Class 1, comprising monolithic fibrous material having an upper layer of **11.2 lb/cu. ft. (180 kg/cu. m)** density, and a lower layer of **7.5 lb/cu. ft. (120 kg/cu. m)** density.
 1. Thermal Resistance: R-value of 3.8 per 1 inch (25 mm).
 2. Size: **48 by 48 inches (1200 by 1200 mm)**.
 3. Thickness:
 - a. Base Layer: **[2 inches (50 mm)]<Insert thickness>**.
 - b. Upper Layer: **<Insert thickness>**.
- J. Mineral Wool Board Insulation - Single Density: ASTM C726, Type II, Class 1, comprising monolithic fibrous material having **12.5 lb/cu. ft. (200 kg/cu. m)** density.
 1. Thermal Resistance: R-value of 4.0 per 1 inch (25 mm).
 2. Size: **48 by 48 inches (1200 by 1200 mm)**.
 3. Thickness: **1 inch (25 mm)**.
- K. Tapered Insulation: Provide factory-tapered insulation boards.
 1. Material: **[Match roof insulation]<Insert material>**.
 2. Minimum Thickness: **1/4 inch (6 mm)**.
 3. Slope:
 - a. Roof Field: **[1/4 inch per foot (1:48)]<Insert slope>** unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: **[1/2 inch per foot (1:24)]<Insert slope>** unless otherwise indicated on Drawings.
- L. General: Roof insulation accessories as recommended in writing by insulation manufacturer for intended use and compatibility with other roofing system components.

1. Insulation Adhesive: Insulation manufacturer's standard adhesive formulated to attach roof insulation **[to substrate][and]** to another insulation layer as follows:
 - a. Modified asphaltic, asbestos-free, cold-applied adhesive.
 - b. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
 - c. Full-spread, spray-applied, low-rise, two-component urethane adhesive.
2. Verify adhesives and sealants comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Other Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Nonmembrane Roof Sealants: 300 g/L.
 - j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - k. Sealant Primers for Porous Substrates: 775 g/L.
3. Insulation Fasteners: Insulation manufacturer's standard factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation **[and cover board]** to substrate, and acceptable to roofing system manufacturer.

2.8 COVER BOARD

- A. General: Cover board as recommended in writing by roofing membrane manufacturer for intended use and compatible with other roofing system components.
- B. Cellulosic-Fiber Cover Board: ASTM C208, Type II, Grade 2, high-density cellulosic-fiber insulation board, having a minimum compressive strength of **40 psi (276 kPa)**.
 1. Thickness: **[1/2 inch (13 mm)][1 inch (25 mm)]<Insert thickness>**.
 2. Surface Finish: **[Primed one side][Primed two sides with nonasphaltic primer][Integral coating, six sides][Unprimed]<Insert finish>**.
- C. Oriented Strand Board: DOC PS 2, Exposure 1, **7/16 inch (11 mm)** thick.
- D. Glass-Mat Gypsum Cover Board: ASTM C1177/C1177M, water-resistant gypsum substrate.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert**

manufacturer's name; product name or designation> or comparable product by one of the following:

- a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
3. Thickness: **[1/4 inch (6 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
 4. Surface Finish: **[Fiberglass facer][Factory primed][Unprimed]**.
- E. Fiber-Reinforced Gypsum Roof Board: ASTM C1278/C1278M, cellulosic-fiber reinforced, water-resistant gypsum board.
1. Thickness: **[1/4 inch (6 mm)][3/8 inch (10 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
- F. Fiber-Reinforced Cementitious Cover Board: ASTM C1325, fiber-mat-reinforced cementitious board.
1. Thickness: **[7/16 inch (11 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
- G. Fiber-Reinforced Recycled Plastic Cover Board: Cellulose fiber blended with recycled plastic board.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Continuous Materials, LLC]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Continuous Materials, LLC]**
 - b. **<Insert manufacturer's name>**
 3. Thickness: **[1/4 inch (6 mm)][1/2 inch (13 mm)]**.
 4. Surface Finish: **[Fiberglass facer][Paper facer]**.
 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- H. High-Density Polyisocyanurate Cover Board: ASTM C1289 Type II, Class 4, Grade 1, **1 inch (25 mm)** thick, with a minimum compressive strength of **80 psi (551 kPa)**.
- I. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric; water permeable and resistant to UV degradation; type and weight as recommended in writing by roofing system manufacturer for application.
- 2.9 ELECTRONIC LEAK-DETECTION (ELD) MATERIALS
- A. Conductive Medium: Electrically conductive material specifically designed to enable ELD testing procedures as approved in writing by roofing membrane manufacturer.

1. Conductive medium to be located directly under roofing membrane in accordance with ASTM D7877 and ASTM D8231.

B. Moisture-Monitoring System: Permanently embedded, continuously monitored moisture-detection system.

1. Sensors measuring moisture content to be placed within roofing system and connected to a monitoring program, with a notification indicating location of breach.

2.10 BALLAST

A. Aggregate Ballast: **[Smooth, washed, riverbed gravel or other acceptable smooth-faced stone][Crushed gravel or crushed stone]** that withstands weather exposure without significant deterioration and does not contribute to membrane degradation, of the following size:

1. Size: ASTM D448, **[Size 2, ranging in size from 1-1/2 to 2-1/2 inches (38 to 63 mm)][Size 3, ranging in size from 1 to 2 inches (25 to 50 mm)][Size 4, ranging in size from 3/4 to 1-1/2 inches (19 to 38 mm)]<Insert size>**.

B. Interlocking Roof Pavers: Interlocking, lightweight concrete units; grooved back, with four-way drainage capability; beveled, doweled, or otherwise profiled; and as follows:

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Hanover Architectural Products]**
 - b. **[Roofblok Limited]**
 - c. **[Westile Roofing Products; an Oldcastle company]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Hanover Architectural Products]**
 - b. **[Roofblok Limited]**
 - c. **[Westile Roofing Products; an Oldcastle company]**
 - d. **<Insert manufacturer's name>**
3. Size: **<Insert actual size(s) of pavers>**.
4. Weight: **<Insert weight or weight range>**.
5. Compressive Strength: **[2500 psi (17 MPa)][5000 psi (34 MPa)]<Insert value>**, minimum.
6. Colors and Textures: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]**.

C. Rubber Roof Pavers: Interlocking, lightweight rubber units, **24 by 24 by 2-1/4 inches (600 by 600 by 57 mm), 6 lb/sq. ft. (30 kg/sq. m)**; with grooved back for four-way drainage, beveled and doweled; and as follows:

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the**

following]:

- a. **[Carlisle Syntec Systems]**
 - b. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Carlisle Syntec Systems]**
 - b. **<Insert manufacturer's name>**
 3. Perimeter Securement Strip: Manufacturer's standard **[coated steel sheet channel][aluminum sheet channel][mill-finish aluminum sheet hold-down][coated aluminum sheet hold-down, color as selected by Architect,]** and fasteners.
 4. Color: **[Black][Gray][Terra cotta]<Insert color>**.
- D. Roof Pavers: Heavyweight, hydraulically pressed concrete units, **[square edged][with top edges beveled 3/16 inch (5 mm)]**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C140/C140M; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C67/C67M; and as follows:
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Carlisle Coatings & Waterproofing Inc]**
 - b. **[Hanover Architectural Products]**
 - c. **[Roofblok Limited]**
 - d. **[Sunny Brook Pressed Concrete, Co.]**
 - e. **[Tile Tech Pavers]**
 - f. **[Wausau Tile, Inc.]**
 - g. **[Westile Roofing Products; an Oldcastle company]**
 - h. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Carlisle Coatings & Waterproofing Inc]**
 - b. **[Hanover Architectural Products]**
 - c. **[Roofblok Limited]**
 - d. **[Sunny Brook Pressed Concrete, Co.]**
 - e. **[Tile Tech Pavers]**
 - f. **[Wausau Tile, Inc.]**
 - g. **[Westile Roofing Products; an Oldcastle company]**
 - h. **<Insert manufacturer's name>**
 3. Size: **[24 by 24 inches (600 by 600 mm)]<Insert dimensions>**. Manufacture pavers to dimensional tolerances of plus or minus **1/16 inch (1.6 mm)** in length, height, and thickness.
 4. Weight: **<Insert value>**.
 5. Compressive Strength: **[7500 psi (52 MPa)][6500 psi (45 MPa)]<Insert value>**, minimum.
 6. Colors and Textures: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]**.

- E. Ballast Retaining Bar: Perimeter securement system consisting of a slotted extruded-aluminum retention bar with an integrated compression fastening strip.

1. Fasteners: **1-1/2-inch (38-mm)** stainless steel fasteners with neoprene washers.

2.11 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway **[pads][or][rolls]**, approximately **3/16 inch (5 mm)** thick and acceptable to roofing system manufacturer.

1. Size: Approximately **36 by 60 inches (900 by 1500 mm)**.
2. Color: Contrasting with roof membrane.

- B. Walkway Roof Pavers: Heavyweight, hydraulically pressed concrete units, **[square edged][with top edges beveled 3/16 inch (5 mm)]**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C140/C140M; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C67/C67M; and as follows:

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Hanover Architectural Products]**
 - b. **[Roofblok Limited]**
 - c. **[Sunny Brook Pressed Concrete, Co.]**
 - d. **[Wausau Tile, Inc.]**
 - e. **[Westile Roofing Products; an Oldcastle company]**
 - f. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Hanover Architectural Products]**
 - b. **[Roofblok Limited]**
 - c. **[Sunny Brook Pressed Concrete, Co.]**
 - d. **[Wausau Tile, Inc.]**
 - e. **[Westile Roofing Products; an Oldcastle company]**
 - f. **<Insert manufacturer's name>**
3. Size: **[24 by 24 inches (600 by 600 mm)]<Insert dimensions>**. Manufacture pavers to dimensional tolerances of plus or minus **1/16 inch (1.6 mm)** in length, height, and thickness.
4. Weight: **<Insert value>**.
5. Compressive Strength: **[7500 psi (52 MPa)][6500 psi (45 MPa)]<Insert value>**, minimum.
6. Colors and Textures: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with roofing system Installer present, for compliance with requirements and other conditions affecting performance of the Work.
1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
 4. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of **1/16 inch (1.6 mm)** out of plane relative to adjoining deck.
 5. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 6. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than **[75]<Insert number>** percent, or as recommended by roofing system manufacturer when tested in accordance with ASTM F2170.
 - a. Test Frequency: One test probe per each **[1000 sq. ft. (93 sq. m)]<Insert area>**, or portion thereof, of roof deck, with not less than three test probes.
 - b. Submit test reports within 24 hours of performing tests.
 7. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.
 8. Verify that joints in precast concrete roof decks have been grouted flush with top of concrete.
 9. Verify that minimum curing period recommended by roof system manufacturer for lightweight insulating concrete roof decks has passed.
 10. Verify any damaged sections of cementitious wood-fiber decks have been repaired or replaced.
 11. Verify adjacent cementitious wood-fiber panels are vertically aligned to within **1/8 inch (3 mm)** at top surface.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation in accordance with roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Prime surface of concrete deck with primer in accordance with roofing system manufacturer's written installation instructions and allow primer to dry.
- D. Perform fastener-pullout tests in accordance with roofing system manufacturer's written instructions.
1. Submit test result within 24 hours of performing tests.
 - a. Include manufacturer's requirements for any revision to previously submitted fastener

patterns required to achieve specified wind uplift requirements.

- E. Install sound-absorbing insulation strips in ribs of acoustical steel roof deck in accordance with roof deck manufacturer's written instructions.

3.3 INSTALLATION OF ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING SYSTEM, GENERAL

- A. Install roofing system materials and components in accordance with roofing system manufacturer's written installation instructions, **[FM Approvals' RoofNav][SPRI's "Directory of Roof Assemblies"]** assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roofing membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition **[and to not void warranty for existing roofing system]**.
- D. Coordinate installation and transition of roofing system component serving as an air barrier with wall system air barrier specified under **[Section 072713 "Modified Bituminous Sheet Air Barriers."][Section 072715 "Nonbituminous Self-Adhering Sheet Air Barriers."][Section 072726 "Fluid-Applied Membrane Air Barriers."]**
- E. Substrate-Joint Penetrations: Prevent adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.4 INSTALLATION OF SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than **24 inches (600 mm)** in adjacent rows.
 - 1. Install substrate board at right angle to flutes of steel roof deck. Locate end joints over crests of steel roof deck.
 - 2. Tightly butt substrate boards together.
 - 3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 4. Fasten substrate board to top flanges of steel deck in accordance with manufacturer's written installation instructions and **[FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's "Directory of Roof Assemblies" listed roof assembly requirements for specified wind-uplift load capacity]** and FM Global Property Loss Prevention Data Sheet 1-29.
 - 5. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof in accordance with roofing system manufacturers' written installation instructions.
 - 6. Loosely lay substrate board over roof deck.

3.5 INSTALLATION OF VAPOR RETARDER

- A. Install vapor retarder in a single layer over roof area in accordance with manufacturer's written installation instructions, side and end lapping each sheet a minimum of **2 and 6 inches (50 and 150 mm)**, respectively.

1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 2. Continuously seal side and end laps with tape.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.6 INSTALLATION OF ROOF INSULATION AND ACCESSORIES

- A. Coordinate installation of roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written installation instructions. Install minimum of two layers of insulation under area of roofing to achieve required thickness.
- C. Install each layer of insulation with **joints staggered not less than 24 inches (600 mm) in adjacent rows**~~end joints staggered not less than 12 inches (300 mm) in adjacent rows~~ and offset not less than **12 inches (300 mm)** from previous layer.
1. Trim insulation neatly to fit around penetrations and projections, and to fit tightly to intersecting sloping roof decks.
 2. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 3. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus **24 inches (600 mm)**.
 4. Trim insulation, so that water flow is unrestricted.
 5. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 6. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 7. Secure insulation in accordance with **[FM Approvals' RoofNav for specified Windstorm Resistance Classification][SPRI's "Directory of Roof Assemblies" for specified wind-uplift load capacity]**.
 8. Secure insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
 9. Loosely lay each layer of insulation over substrate.

3.7 INSTALLATION OF COVER BOARD

- A. Install cover board over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of **6 inches (150 mm)** in each direction.
1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 4. Adhere cover board to substrate in accordance with **[FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's "Directory of Roof Assemblies" listed roof assembly requirements for specified wind-uplift load capacity]** and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Install slip sheet over cover board and beneath roofing membrane.

3.8 INSTALLATION OF ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Install conductive medium directly under roofing membrane in accordance with ASTM D7877 and ASTM D8231.
- B. Install sensors, connections, and accessory items required for complete continuously monitored moisture-detection system in accordance with manufacturer's written installation instructions.

3.9 INSTALLATION OF EPDM ROOFING MEMBRANE

- A. Install roofing membrane over roof area for **[adhered][self-adhered][mechanically attached][loose-laid, ballasted]** application method in accordance with roofing system manufacturer's written installation instructions.
- B. Unroll roofing membrane and allow it to relax before installing.
- C. Start installation in presence of roofing system manufacturer's technical personnel **[and Owner's testing and inspection agency]**.
- D. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
- E. Adhered Application: Apply bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply to splice area of roofing membrane.
 - 1. In addition to adhering, mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roof area.
- F. Mechanically Attached Application: Secure roofing membrane over area to receive roofing in accordance with roofing system manufacturer's written installation instructions.
 - 1. Mechanically fasten or adhere roof membrane securely at terminations, penetrations, and perimeter of roofing.
- G. Loose-Laid, Ballasted Application: Comply with requirements in ANSI/SPRI RP-4 for **[System 1][System 2][System 3]**.
 - 1. **[Mechanically fasten][Adhere]** roofing membrane at perimeter, corners, and transitions in accordance with requirements in ANSI/SPRI RP-4.
 - 2. At corners and perimeters, omit aggregate ballast leaving roofing membrane exposed.
 - 3. At corners and perimeters, adhere a second layer of roofing membrane.
 - 4. Install protection mat over roofing membrane, overlapping a minimum of **6 inches (150 mm)**. Install an additional protection mat layer at projections, pipes, vents, and drains, overlapping a minimum of **12 inches (300 mm)**.
 - 5. Aggregate Ballast: Apply uniformly over roofing membrane at the rate required by roofing system manufacturer, but not less than the following, spreading with care to minimize possibility of damage to roofing system. Lay ballast as roof membrane is installed, leaving roof membrane ballasted at end of workday.
 - a. Ballast Weight:

- 1) Size 4 aggregate, **10 lb/sq. ft. (50 kg/sq. m)**.
 - 2) Size 2 aggregate, **13 lb/sq. ft. (65 kg/sq. m)**, at corners and perimeter; Size 4 aggregate, **10 lb/sq. ft. (50 kg/sq. m)**, elsewhere.
 - 3) Size 2 aggregate, **13 lb/sq. ft. (65 kg/sq. m)**.
 - 4) Size 3 aggregate, **<Insert weight>**, at corners, **<Insert weight>** at perimeter, and **<Insert weight>**, elsewhere.
 6. Roof-Paver Ballast: Install **[lightweight][heavyweight]** roof-paver ballast in accordance with manufacturer's written instructions.
 7. Roof-Paver and Aggregate Ballast: Install heavyweight roof pavers in accordance with manufacturer's written instructions on roof corners and perimeter.
 - a. Install Size 4 aggregate ballast elsewhere on roof membrane at a minimum rate of **10 lb/sq. ft. (50 kg/sq. m)**.
 - b. Install Size 2 aggregate ballast elsewhere on roof membrane at a minimum rate of **13 lb/sq. ft. (65 kg/sq. m)**.
 - H. Adhesive Seam Installation: Clean both faces of splice areas and apply splicing cement.
 1. Firmly roll side and end laps of overlapping roofing membrane to ensure a watertight seam installation.
 2. Apply lap sealant and seal exposed edges of roofing terminations.
 3. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.
 - I. Tape Seam Installation: Clean and prime both faces of splice areas and apply splice tape.
 1. Firmly roll side and end laps of overlapping roofing membrane to ensure a watertight seam installation.
 2. Apply lap sealant and seal exposed edges of roofing terminations.
 - J. Factory-Applied Seam Tape Installation: Clean and prime surface to receive tape.
 1. Firmly roll side and end laps of overlapping roofing membrane to ensure a watertight seam installation.
 2. Apply lap sealant and seal exposed edges of roofing terminations.
 - K. Repair tears, voids, and lapped seams in roofing membrane that do not comply with requirements.
 - L. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roofing membrane in place with clamping ring.
 - M. Adhere protection sheet over roofing membrane at locations indicated.
- 3.10 INSTALLATION OF BASE AND SHEET FLASHINGS
- A. General: Install and adhere base and sheet flashings and preformed flashing accessories to substrates in accordance with roofing system manufacturer's written installation instructions.
 - B. Apply bonding adhesive to substrate and underside of flashings at required rate and allow to partially dry. Do not apply to seam area of flashings.
 - C. Flash penetrations and field-formed inside and outside corners.

- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping flashings to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of terminations.
- E. Terminate and seal top of flashings and mechanically anchor to substrate through termination bars.

3.11 INSTALLATION OF LIQUID ROOF COATING

- A. Apply coating to **[roof membrane][and][flashings]** in accordance with manufacturer's written recommendations, by spray, roller, or other suitable application method.

3.12 INSTALLATION OF WALKWAYS

- A. Flexible Walkways: Install walkway products in accordance with manufacturer's written installation instructions.
 - 1. Install flexible walkways at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - f. Locations indicated on Drawings.
 - g. As required by roofing membrane manufacturer's warranty requirements.
 - 2. Provide **6-inch (75-mm)** clearance between adjoining pads.
 - 3. Adhere walkway products to substrate with compatible adhesive in accordance with roofing system manufacturer's written instructions.
- B. Roof-Paver Walkways: Install walkway roof pavers in accordance with manufacturer's written installation instructions.
 - 1. Install roof-paver walkways at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - f. Locations indicated on Drawings.
 - g. As required by roofing membrane manufacturer's warranty requirements.
 - 2. Provide **3 inches (75 mm)** of space between adjacent roof pavers.

3.13 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to inspect substrate conditions, surface preparation, and installation of roofing membrane, flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Tests and Inspections:
1. ELD Testing: Testing agency surveys entire roof area and flashings to locate discontinuities in the roofing membrane using ELD in accordance with ASTM D7877 and ASTM D8231.
 - a. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
 2. Flood Testing: Flood test each roof area for leaks, in accordance with recommendations in ASTM D5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - a. Flood to an average depth of **[2-1/2 inches (63 mm)]<Insert depth>** with a minimum depth of **[1 inch (25 mm)]<Insert depth>** and not exceeding a depth of **[4 inches (100 mm)]** of clearance from top of base flashing.
 - b. Flood each area for **[24][48][72]** hours.
 - c. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - d. Testing agency to prepare survey report indicating locations initial leaks, if any, and final survey report.
 3. Infrared Thermography Testing: Testing agency surveys entire roof area using infrared color thermography in accordance with ASTM C1153. Perform tests before overlying construction is placed.
 - a. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or nuclear hydrogen detection testing.
 - b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report of initial scan indicating locations of entrapped moisture, if any.
 4. Electrical Capacitance/Impedance Testing: Testing agency surveys entire roof area for entrapped water within roof assembly in accordance with ASTM D7954/D7954M. Perform tests before overlying construction is placed.
 - a. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.



- 1) Cost of retesting is Contractor's responsibility.
- b. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
5. Nuclear Hydrogen Detection Testing: Testing agency surveys entire roof area for entrapped water within roof assembly in accordance with ANSI/SPRI/RCI NT-1. Perform tests before overlying construction is placed.
 - a. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
 1. Notify Architect[**and Owner**] 48 hours in advance of date and time of inspection.
- D. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.14 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and in accordance with warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.15 ROOFING SYSTEM INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing System Installer," has performed roofing and associated Work on the following Project:
 1. Owner: **<Insert name of Owner>**.
 2. Owner Address: **<Insert address>**.
 3. Building Name/Type: **<Insert information>**.
 4. Building Address: **<Insert address>**.
 5. Area of Work: **<Insert information>**.
 6. Warranty Period: **[Two][Five]<Insert number>** years from date of Substantial Completion.
 7. Date of Substantial Completion: _____.

- B. AND WHEREAS Roofing System Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said Work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing System Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period, Roofing System Installer will, at Roofing System Installer's own cost and expense, make or cause to be made such repairs to or replacements of said Work as are necessary to correct faulty and defective work and as are necessary to maintain said Work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to Work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding **<Insert mph (m/s)>**;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the Work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When Work has been damaged by any of foregoing causes, Warranty will be null and void until such damage has been repaired by Roofing System Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing System Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of Work.
 4. During Warranty Period, if Owner allows alteration of Work by anyone other than Roofing System Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty will become null and void on date of said alterations, but only to the extent said alterations affect Work covered by this Warranty. If Owner engages Roofing System Installer to perform said alterations, Warranty will not become null and void unless Roofing System Installer, before starting said Work, will have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate Work, thereby reasonably justifying a limitation or termination of this Warranty.
 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty will become null and void on date of said change, but only to the extent said change affects Work covered by this Warranty.
 6. Owner will promptly notify Roofing System Installer of observed, known, or suspected leaks, defects, or deterioration and will afford reasonable opportunity for Roofing System Installer to inspect Work and to examine evidence of such leaks, defects, or deterioration.
 7. This Warranty is recognized to be the only warranty of Roofing System Installer on said Work and will not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty will not operate to relieve Roofing System Installer of responsibility for performance of original Work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.
- E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of



07 - Thermal And Moisture Protection

_____, _____.

- 1. Authorized Signature: _____.
- 2. Name: _____.
- 3. Title: _____.

END OF SECTION 07 53 23 00



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 53 23 00	07 51 13 00	Built-Up Asphalt Roofing
07 53 23 00	07 01 50 81	Built-Up Coal Tar Roofing
07 53 29 00	07 51 13 00	Built-Up Asphalt Roofing
07 53 29 00	07 01 50 81	Built-Up Coal Tar Roofing
07 53 29 00	07 53 23 00	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing



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SECTION 07 54 19 00 - POLYVINYL-CHLORIDE (PVC) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polyvinyl chloride (PVC) roofing system.
2. Accessory roofing system materials.
3. Substrate board.
4. Vapor retarder.
5. Roof insulation and accessories.
6. Cover board.
7. Electronic leak-detection (ELD) materials.
8. Ballast.
9. Walkways.

B. Section contains the installation of sound-absorbing insulation strips in ribs of acoustical steel roof deck. Sound-absorbing insulation strips are furnished under Section 053100 "Steel Decking."

C. Related Requirements:

1. Section 053100 "Steel Decking" for roof deck panels[**and sound-absorbing insulation strips**].
2. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
3. Section 061600 "Sheathing" for wood-based, structural-use roof deck panels.
4. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
5. Section 077100 "Roof Specialties" for [**premanufactured copings**][**and**][**roof edge fasciae**][**gravel stops**][**reglets**][**roof edge flashings**][**counterflashings**].
6. Section 077129 "Manufactured Roof Expansion Joints" for premanufactured roof expansion-joint assemblies.
7. Section 077200 "Roof Accessories" for manufactured roof curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
8. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
9. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at [**Project site**]<Insert location>.

1. Meet with Owner, Architect,[**Construction Manager**,] Owner's insurer if applicable, testing and inspecting agency representative, roofing system Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or

- affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

B. Preinstallation Roofing Conference: Conduct conference at **[Project site]<Insert location>**.

1. Meet with Owner, Architect, **[Construction Manager,]** Owner's insurer if applicable, testing and inspecting agency representative, roofing system Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base and sheet flashings and membrane termination details.
3. Flashing details at penetrations.
4. Tapered insulation layout, thickness, and slopes.
5. Roof plan showing orientation of roof deck and orientation of roofing membrane, fastening spacings, and patterns for corner, perimeter, and field-of-roof locations.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
7. Crickets, saddles, and tapered edge strips, including slopes.
8. Tie-in with adjoining wall system air barrier.

C. Samples for Verification: For the following products:

1. Roofing membrane and flashings, of color required.
2. Aggregate surfacing ballast material in gradation **[and color]** required.
3. Roof paver, **[full sized,]** in each color and texture required.

- 4. Walkways, of color required.
- D. Wind-Uplift-Resistance Submittal: For roofing system, indicating compliance with wind-uplift performance requirements.
- E. Sustainable Design Submittals:
 - 1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.

1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer Certificates:
 - 1. Performance Requirement Certificate: Signed by roofing membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with specified performance requirements.
 - 2. Special Warranty Certificate: Signed by roofing membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- B. Product Test Reports: For roofing membrane and insulation, tests performed by an independent qualified testing agency indicating compliance with specified requirements.
- C. Research Reports: For components of roofing system, from **[an agency acceptable to authorities having jurisdiction][ICC-ES]<Insert evaluation agency>** showing compliance with specified performance requirements.
- D. Field Test Reports:
 - 1. Concrete internal relative humidity test reports.
 - 2. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.
- E. Field quality control reports.
- F. Qualification Statements: For roofing system **[Installer][manufacturer][and][testing agency]**.
- G. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system.
- B. Certified statement from existing roofing system manufacturer stating that existing roof warranty has not been affected by the Work performed under this Section.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is **[ULSE listed][listed in FM Approvals' RoofNav][listed in SPRI's "Directory of Roof Assemblies"]** for roofing system identical to that used for this Project.



- B. Roofing System Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
 - 1. Certified Roofing System Installer: Entity that employs **[a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified thermoplastic system installers][a supervisor who is an NRCA ProCertified Roofing Foreman][a supervisor who is an NRCA ProCertified Roofing Foreman and not less than 20 percent of installers who are NRCA ProCertified thermoplastic system installers]**.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing system materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.
 - 1. Protect stored liquid material from direct sunlight.
 - 2. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources.
 - 1. Store in a dry location.
 - 2. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing system materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written installation instructions and warranty requirements.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty to include all components of roofing system, such as **[substrate board,][vapor retarder,]** roof insulation, fasteners, adhesives, **[cover board,]** roofing membrane, base flashing sheet, **[ballast,][walkways,]** and other components of roofing system.
 - 2. Warranty Period: **[10][15][20][30]<Insert number>** years from date of Substantial Completion.
- B. Roofing System Installer's Warranty: Submit roofing system Installer's warranty, on warranty form at end of this Section, signed by roofing system Installer, covering the Work of this Section, including all components of roofing system, such as **[substrate board,][vapor retarder,]** roof insulation, fasteners,

adhesives,[**cover board**,] roofing membrane, base flashing sheet,[**ballast**,][**walkways**,] and other components of roofing system.

1. Warranty Period: [**Two**][**Five**]<Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain components for roofing system from [**roofing membrane manufacturer**][or][**manufacturer approved by roofing membrane manufacturer**].

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing system and flashings to remain watertight.
 1. Accelerated Weathering: Roofing membrane to withstand 2000 hours of exposure when tested in accordance with ASTM G152, ASTM G154, or ASTM G155.
 2. Impact Resistance: Roofing membrane to resist impact damage when tested in accordance with ASTM D3746/D3746M, ASTM D4272/D4272M, or the Resistance to Foot Traffic Test in FM Approvals 4470.
- B. Material Compatibility: Roofing system materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
- C. Wind-Uplift Resistance: Design roofing system to resist the following wind-uplift pressures when tested in accordance with FM Approvals 4474, UL 580, or UL 1897:
 1. Zone 1' (Roof Area Interior): <Insert lbf/sq. ft. (kPa)>.
 2. Zone 1 (Roof Area Field): <Insert lbf/sq. ft. (kPa)>.
 3. Zone 2 (Roof Area Perimeter): <Insert lbf/sq. ft. (kPa)>.
 - a. Location: From roof edge to <Insert dimension> inside roof edge.
 4. Zone 3 (Roof Area Corners): <Insert lbf/sq. ft. (kPa)>.
 - a. Location: <Insert dimension> in each direction from building corner.
- D. FM Approvals' RoofNav Listing: Roofing membrane, base flashings, and component materials to comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
 1. Fire/Windstorm Classification: [**Class 1A-60**][**Class 1A-75**][**Class 1A-90**][**Class 1A-105**][**Class 1A-120**]<Insert class>.
 2. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 [**MH**][**SH**][**VSH**].
- E. SPRI's "Directory of Roof Assemblies" Listing: Roofing membrane, base flashings, and component

materials to comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and are listed in SPRI's "Directory of Roof Assemblies" for roof assembly identical for that specified for this Project.

1. Wind-Uplift Load Capacity: **[60 psf][75 psf][90 psf][105 psf][120 psf]<Insert capacity>**.

- F. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][32]** or initial SRI not less than **[82][39]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- G. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][25]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- H. Solar Reflectance Index (SRI): Not less than **[78][29]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- I. Cool Roof Rating Council (CRRC): Roofing system to be listed by the CRRC for low-slope roof products.
- J. Energy Performance: Roofing system to have an initial solar reflectance index (SRI) of not less than **[0.70]<Insert value>** and an emissivity of not less than **[0.75]<Insert value>** when tested in accordance with CRRC S100.
- K. Exterior Fire-Test Exposure: **[Class A][Class B][Class C]**; for application and roof slopes indicated; when tested by a qualified testing agency in accordance with ASTM E108 or UL 790.
 - 1. Identify products with appropriate markings of applicable testing agency.
- L. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated.
 - 1. Identify products with appropriate markings of applicable testing agency.

2.3 POLYVINYL CHLORIDE (PVC) ROOFING SYSTEM

- A. PVC Roofing Membrane Sheet: ASTM D4434/D4434M, fabric reinforced.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Carlisle Syntec Systems]**
 - b. **[Cooley Group]**
 - c. **[Duro-Last; Holcim Solutions and Products US, LLC]**
 - d. **[Elevate; Holcim Building Envelope]**
 - e. **[Flex Membrane International Corp.]**
 - f. **[GAF]**
 - g. **[IB Roof Systems, Inc.]**
 - h. **[Johns Manville; a Berkshire Hathaway company]**
 - i. **[Mule-Hide Products Co., Inc]**
 - j. **[Sika Sarnafil]**
 - k. **[Siplast]**
 - l. **[Soprema, Inc.]**
 - m. **[Versico Roofing Systems; Carlisle Construction Materials]**

- n. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Carlisle Syntec Systems]
 - b. [Cooley Group]
 - c. [Duro-Last; Holcim Solutions and Products US, LLC]
 - d. [Elevate; Holcim Building Envelope]
 - e. [Flex Membrane International Corp.]
 - f. [GAF]
 - g. [IB Roof Systems, Inc.]
 - h. [Johns Manville; a Berkshire Hathaway company]
 - i. [Mule-Hide Products Co., Inc]
 - j. [Sika Sarnafil]
 - k. [Siplast]
 - l. [Soprema, Inc.]
 - m. [Versico Roofing Systems; Carlisle Construction Materials]
 - n. <Insert manufacturer's name>
3. Classification: [Type II][Type III][Type IV][, with fabric backing].
4. Nominal Thickness: [50 mils (1.3 mm)][60 mils (1.5 mm)][80 mils (2.0 mm)]<Insert value>.
5. Exposed Face Color: [White][Gray][Tan]<Insert color>.
6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
- B. PVC-Ketone Ethylene Ester (KEE)-Alloy Roofing Membrane Sheet: ASTM D4434/D4434M, fabric reinforced.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- a. [Carlisle Syntec Systems]
 - b. [Cooley Group]
 - c. [Duro-Last; Holcim Solutions and Products US, LLC]
 - d. [Elevate; Holcim Building Envelope]
 - e. [Flex Membrane International Corp.]
 - f. [GAF]
 - g. [IB Roof Systems, Inc.]
 - h. [Johns Manville; a Berkshire Hathaway company]
 - i. [Mule-Hide Products Co., Inc]
 - j. [Siplast]
 - k. [Soprema, Inc.]
 - l. [Versico Roofing Systems; Carlisle Construction Materials]
 - m. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Carlisle Syntec Systems]
 - b. [Cooley Group]
 - c. [Duro-Last; Holcim Solutions and Products US, LLC]

- d. [Elevate; Holcim Building Envelope]
 - e. [Flex Membrane International Corp.]
 - f. [GAF]
 - g. [IB Roof Systems, Inc.]
 - h. [Johns Manville; a Berkshire Hathaway company]
 - i. [Mule-Hide Products Co., Inc.]
 - j. [Siplast]
 - k. [Soprema, Inc.]
 - l. [Versico Roofing Systems; Carlisle Construction Materials]
 - m. <Insert manufacturer's name>
- 3. Classification: Type III[, with fabric backing].
 - 4. Nominal Thickness: [50 mils (1.3 mm)][60 mils (1.5 mm)][80 mils (2.0 mm)]<Insert value>.
 - 5. Exposed Face Color: [White][Gray][Tan]<Insert color>.
 - 6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.

2.4 ACCESSORY ROOFING SYSTEM MATERIALS

- A. General: Accessory materials as recommended in writing by roofing membrane manufacturer for intended use and compatible with other roofing system components.
 - 1. Adhesives and Sealants: Comply with VOC limits of authorities having jurisdiction.
 - 2. Verify adhesives and sealants comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Other Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Nonmembrane Roof Sealants: 300 g/L.
 - j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - k. Sealant Primers for Porous Substrates: 775 g/L.
- B. Base and Sheet Flashings: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as roofing membrane.
- C. Prefabricated Pipe Flashings: As recommended in writing by roofing membrane manufacturer.
- D. Roof Vents: As recommended in writing by roofing membrane manufacturer.
 - 1. Size: Not less than **4-inch (100-mm)** diameter.
- E. Bonding Adhesive: Roofing membrane manufacturer's standard[, **water based**].
- F. Water-Based, Fabric-Backed Membrane Adhesive: Roofing membrane manufacturer's standard water-based, cold-applied adhesive formulated for compatibility and use with fabric-backed roofing membrane.
- G. Low-Rise, Urethane, Fabric-Backed Membrane Adhesive: Roofing membrane manufacturer's standard spray-applied, low-rise, two-component urethane adhesive formulated for compatibility and use with fabric-backed roofing membrane.

- H. Slip Sheet: **[ASTM D2178/D2178M, Type IV, glass fiber, asphalt-impregnated felt][Manufacturer's standard, of thickness required for application].**
- I. Asphalt-Coated, Glass-Fiber-Mat, Venting Base Sheet: ASTM D4897/D4897M, Type II; nonperforated, asphalt impregnated fiberglass reinforced, with mineral granular patterned surfacing on bottom surface.
- J. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately **1 by 1/8 inch (25 by 3 mm)** thick; with anchors.
- K. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately **1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick)**, prepunched.
- L. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing system components to substrate, tested for required pullout strength, and acceptable to roofing membrane manufacturer.
- M. Safety Accessories: Roofing membrane manufacturer's standard yellow seaming tape for designating safety perimeters and rooftop hazards.
- N. Miscellaneous Accessories: As recommended in writing by roofing membrane manufacturer.

2.5 SUBSTRATE BOARD

- A. Glass-Mat Gypsum Roof Substrate Board: ASTM C1177/C1177M, water-resistant gypsum board.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
 - 3. Thickness: **[1/4 inch (6 mm)][1/2 inch (13 mm)][Type X, 5/8 inch (16 mm)].**
 - 4. Surface Finish: **[Factory primed][Unprimed].**
- B. Fiber-Reinforced Gypsum Roof Board: ASTM C1278/C1278M, cellulosic-fiber reinforced, water-resistant gypsum board.
 - 1. Thickness: **[1/4 inch (6 mm)][3/8 inch (10 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)].**

- C. High-Density Polyisocyanurate Cover Board: ASTM C1289, Type II, Class 4, Grade 1, 1/2 inch (13 mm) thick, having a minimum compressive strength of **80 psi (551 kPa)**.
- D. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.
- E. Bonding Adhesive: Manufacturer's standard, designed for adhering substrate board to roof deck.

2.6 VAPOR RETARDER

- A. Rubberized-Asphalt-Sheet Vapor Retarder, Self-Adhering: ASTM D1970/D1970M, polyethylene film laminated to layer of rubberized asphalt adhesive, minimum **40-mil (1.0-mm)** total thickness; maximum permeance rating of **0.1 perm (6 ng/Pa x s x sq. m)**; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.
- B. Butyl-Rubber-Sheet Vapor Retarder, Self-Adhering: Polyethylene film laminated to layer of butyl rubber adhesive, minimum **30-mil (0.76-mm)** total thickness; maximum permeance rating of **0.1 perm (6 ng/Pa x s x sq. m)**; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.
- C. Laminated Sheet Vapor Retarder: Two layers; fire-retardant polyethylene laminate; reinforced with cord grid.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Reef Industries, Inc.]**
 - b. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Reef Industries, Inc.]**
 - b. **<Insert manufacturer's name>**
 - 3. Permeance Rating: Not more than **0.062 perm (3.556 ng/Pa x s x sq. m)** when tested in accordance with ASTM E96/E96M.
 - 4. Flame-Spread Index: Not more than 5 when tested in accordance with ASTM E84.
 - 5. Smoke-Developed Index: Not more than 35 when tested in accordance with ASTM E84.
 - 6. Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.7 ROOF INSULATION AND ACCESSORIES

- A. General: Preformed roof insulation boards manufactured **[or approved]** by roofing membrane manufacturer approved for use in **[FM Approvals' RoofNav][SPRI's "Directory of Roof Assemblies"]** listed roof assemblies.
- B. Extruded-Polystyrene Board Insulation: ASTM C578, **[Type IV, 1.45 lb/cu. ft. (23 kg/cu. m) minimum**

density, 25 psi (173 kPa) minimum compressive strength][Type V, 3.00 lb/cu. ft. (48 kg/cu. m), minimum density, 100 psi (690 kPa) minimum compressive strength], square edged.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [DuPont]
 - b. [Kingspan Insulation LLC]
 - c. [Owens Corning]
 - d. [Soprema, Inc.]
 - e. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [DuPont]
 - b. [Kingspan Insulation LLC]
 - c. [Owens Corning]
 - d. [Soprema, Inc.]
 - e. <Insert manufacturer's name>
 3. Thermal Resistance: R-value of 5.0 per 1 inch (25 mm).
 4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)].
 5. Thickness:
 - a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.
 - b. Upper Layer: <Insert thickness>.
- C. Molded (Expanded) Polystyrene Board Insulation: ASTM C578, Type VIII, 1.15 lb/cu. ft. (18 kg/cu. m) minimum density, 13 psi (90 kPa) minimum compressive strength, square edge.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [Carlisle Syntec Systems]
 - c. [Cellofoam North America, Inc.]
 - d. [Kingspan Insulation LLC]
 - e. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [Carlisle Syntec Systems]
 - c. [Cellofoam North America, Inc.]
 - d. [Kingspan Insulation LLC]
 - e. <Insert manufacturer's name>
 3. Thermal Resistance: R-value of 3.8 per 1 inch (25 mm).

-
4. Size: **[48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)]**.
 5. Thickness:
 - a. Base Layer: **[1-1/2 inches (38 mm)]<Insert thickness>**.
 - b. Upper Layer: **<Insert thickness>**.
- D. Composite Molded (Expanded) Polystyrene Board Insulation: ASTM C578, **[Type II, 1.35 lb/cu. ft. (22 kg/cu. m)][Type VIII, 1.15 lb/cu. ft. (18 kg/cu. m)][Type IX, 1.8 lb/cu. ft. (29 kg/cu. m)]** minimum density, with factory-applied facings, as follows:
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Carlisle Syntec Systems]**
 - b. **[Cellofoam North America, Inc.]**
 - c. **[Insulfoam; a Carlisle Company]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Carlisle Syntec Systems]**
 - b. **[Cellofoam North America, Inc.]**
 - c. **[Insulfoam; a Carlisle Company]**
 - d. **<Insert manufacturer's name>**
 3. Facer: **[ASTM C208, Type II, Grade 2, cellulosic-fiber insulation board, asphalt coated, 1/2 inch (13 mm) thick][DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick]<Insert material>**.
 4. Size: **[48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)]**.
 5. Thickness: **<Insert thickness>**.
- E. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, **[Grade 2],[Grade 3]**, felt or glass-fiber mat facer on both major surfaces.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Atlas Polyiso Roof and Wall Insulation]**
 - b. **[Carlisle Syntec Systems]**
 - c. **[CertainTeed; SAINT-GOBAIN]**
 - d. **[Elevate; Holcim Building Envelope]**
 - e. **[GAF]**
 - f. **[Hunter Panels; a Carlisle company]**
 - g. **[IKO Industries Inc.]**
 - h. **[Insulfoam; a Carlisle Company]**
 - i. **[Johns Manville; a Berkshire Hathaway company]**
 - j. **[Kingspan Insulation LLC]**
 - k. **[Polyglass U.S.A., Inc.]**
 - l. **[Rmax, A Business Unit of Sika Corporation]**

- m. <Insert manufacturer's name>
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [Carlisle Syntec Systems]
 - c. [CertainTeed; SAINT-GOBAIN]
 - d. [Elevate; Holcim Building Envelope]
 - e. [GAF]
 - f. [Hunter Panels; a Carlisle company]
 - g. [IKO Industries Inc.]
 - h. [Insulfoam; a Carlisle Company]
 - i. [Johns Manville; a Berkshire Hathaway company]
 - j. [Kingspan Insulation LLC]
 - k. [Polyglass U.S.A., Inc.]
 - l. [Rmax, A Business Unit of Sika Corporation]
 - m. <Insert manufacturer's name>
- 3. Compressive Strength: [Grade 2, 20 psi (138 kPa)][Grade 3, 25 psi (172 kPa)].
- 4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)].
- 5. Thickness:
 - a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.
 - b. Upper Layer: <Insert thickness>.
- F. Composite Polyisocyanurate Board Insulation: ASTM C1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [Carlisle Syntec Systems]
 - c. [CertainTeed; SAINT-GOBAIN]
 - d. [Elevate; Holcim Building Envelope]
 - e. [GAF]
 - f. [Hunter Panels; a Carlisle company]
 - g. [IKO Industries Inc.]
 - h. [Insulfoam; a Carlisle Company]
 - i. [Johns Manville; a Berkshire Hathaway company]
 - j. [Kingspan Insulation LLC]
 - k. [Polyglass U.S.A., Inc.]
 - l. [Rmax, A Business Unit of Sika Corporation]
 - m. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [Carlisle Syntec Systems]
 - c. [CertainTeed; SAINT-GOBAIN]

- d. [Elevate; Holcim Building Envelope]
 - e. [GAF]
 - f. [Hunter Panels; a Carlisle company]
 - g. [IKO Industries Inc.]
 - h. [Insulfoam; a Carlisle Company]
 - i. [Johns Manville; a Berkshire Hathaway company]
 - j. [Kingspan Insulation LLC]
 - k. [Polyglass U.S.A., Inc.]
 - l. [Rmax, A Business Unit of Sika Corporation]
 - m. <Insert manufacturer's name>
3. Facer: [Type IV, cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch (13 mm) thick][Type V, OSB facer, 7/16 inch (11 mm) thick][Type VII, glass-mat-faced gypsum board facer, 1/4 inch (6 mm) thick]<Insert material>.
 4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)].
 5. Thickness: <Insert thickness>.
- G. Perlite Board Insulation: ASTM C728, Type 1, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [GAF]
 - b. [Johns Manville; a Berkshire Hathaway company]
 - c. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [GAF]
 - b. [Johns Manville; a Berkshire Hathaway company]
 - c. <Insert manufacturer's name>
 3. Thermal Resistance: R-value of 2.78 per 1 inch (25 mm).
 4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)].
 5. Thickness:
 - a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness>.
 - b. Upper Layer: <Insert thickness>.
- H. Cellulosic-Fiber Board Insulation: ASTM C208, Type II, Grade 2, fibrous-felted, rigid insulation boards of wood-fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [GAF]

- b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Homasote Company]**
 - d. **[Huebert Fiberboard Inc]**
 - e. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[GAF]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Homasote Company]**
 - d. **[Huebert Fiberboard Inc]**
 - e. **<Insert manufacturer's name>**
3. Thermal Resistance: R-value of 2.78 per 1 inch (25 mm).
4. Size: **[48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)]**.
5. Thickness:
 - a. Base Layer: **[1 inch (25 mm)][2 inches (50 mm)]<Insert thickness>**.
 - b. Upper Layer: **<Insert thickness>**.
- I. Mineral Wool Board Insulation - Multi-Density: ASTM C726, Type I, Class 1, comprising monolithic fibrous material having an upper layer of **11.2 lb/cu. ft. (180 kg/cu. m)** density, and a lower layer of **7.5 lb/cu. ft. (120 kg/cu. m)** density.
 1. Thermal Resistance: R-value of 3.8 per 1 inch (25 mm).
 2. Size: **48 by 48 inches (1200 by 1200 mm)**.
 3. Thickness:
 - a. Base Layer: **[2 inches (50 mm)]<Insert thickness>**.
 - b. Upper Layer: **<Insert thickness>**.
- J. Mineral Wool Board Insulation - Single Density: ASTM C726, Type II, Class 1, comprising monolithic fibrous material having **12.5 lb/cu. ft. (200 kg/cu. m)** density.
 1. Thermal Resistance: R-value of 4.0 per 1 inch (25 mm).
 2. Size: **48 by 48 inches (1200 by 1200 mm)**.
 3. Thickness: **1 inch (25 mm)**.
- K. Tapered Insulation: Provide factory-tapered insulation boards.
 1. Material: **[Match roof insulation]<Insert material>**.
 2. Minimum Thickness: **1/4 inch (6 mm)**.
 3. Slope:
 - a. Roof Field: **[1/4 inch per foot (1:48)]<Insert slope>** unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: **[1/2 inch per foot (1:24)]<Insert slope>** unless otherwise indicated on Drawings.
- L. General: Roof insulation accessories as recommended in writing by insulation manufacturer for intended use and compatibility with other roofing system components.
 1. Insulation Adhesive: Insulation manufacturer's standard adhesive formulated to attach roof insulation **[to substrate][and]** to another insulation layer as follows:

- a. Modified asphaltic, asbestos-free, cold-applied adhesive.
 - b. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
 - c. Full-spread, spray-applied, low-rise, two-component urethane adhesive.
2. Verify adhesives and sealants comply with the following limits for VOC content:
- a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Other Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Nonmembrane Roof Sealants: 300 g/L.
 - j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - k. Sealant Primers for Porous Substrates: 775 g/L.
3. Insulation Fasteners: Insulation manufacturer's standard factory-coated steel fasteners with metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation[**and cover board**] to substrate, and acceptable to roofing system manufacturer.
4. Induction-Welding Plates: Minimum **3-inch (75-mm)** diameter with recessed center, **0.034-inch (0.86-mm)** thick, aluminum-zinc-alloy-coated steel plates, factory coated with adhesive formulated for roof membrane, with corresponding corrosion-resistant fasteners[**and thermal isolation spacers below plates**].

2.8 COVER BOARD

- A. General: Cover board as recommended in writing by roofing membrane manufacturer for intended use and compatible with other roofing system components.
- B. Cellulosic-Fiber Insulation Cover Board: ASTM C208, Type II, Grade 2, high-density cellulosic-fiber insulation board, having a minimum compressive strength of **40 psi (276 kPa)**.
 1. Thickness: **[1/2 inch (13 mm)][1 inch (25 mm)]<Insert thickness>**.
 2. Surface Finish: **[Primed one side][Primed two sides with nonasphaltic primer][Integral coating, six sides][Unprimed]<Insert finish>**.
- C. Oriented Strand Board: DOC PS 2, Exposure 1, **7/16 inch (11 mm)** thick.
- D. Glass-Mat Gypsum Cover Board: ASTM C1177/C1177M, water-resistant gypsum board.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
 3. Thickness: **[1/4 inch (6 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
 4. Surface Finish: **[Fiberglass facer][Factory primed][Unprimed]**.
 - E. Fiber-Reinforced Gypsum Roof Board: ASTM C1278/C1278M, cellulosic-fiber-reinforced, water-resistant gypsum board.
 1. Thickness: **[1/4 inch (6 mm)][3/8 inch (10 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
 - F. Fiber-Reinforced Cementitious Cover Board: ASTM C1325, fiber-mat-reinforced cementitious board.
 1. Thickness: **[7/16 inch (11 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]**.
 - G. Fiber-Reinforced Recycled Plastic Cover Board: Cellulose fiber blended with recycled plastic board.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Continuous Materials, LLC]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Continuous Materials, LLC]**
 - b. **<Insert manufacturer's name>**
 3. Thickness: **[1/4 inch (6 mm)][1/2 inch (13 mm)]**.
 4. Surface finish: **[Fiberglass facer][Paper facer]**.
 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
 - H. High-Density Polyisocyanurate Cover Board: ASTM C1289, Type II, Class 4, Grade 1, **1/2 inch (13 mm)** thick, having a minimum compressive strength of **80 psi (551 kPa)**.
 - I. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended in writing by roofing system manufacturer for application.
- 2.9 ELECTRONIC LEAK-DETECTION (ELD) MATERIALS
- A. Conductive Medium: Electrically conductive material specifically designed to enable ELD testing

procedures as approved in writing by roofing membrane manufacturer.

1. Conductive medium to be located directly under roofing membrane in accordance with ASTM D7877 and ASTM D8231.

B. Moisture-Monitoring System: Permanently embedded, continuously monitored moisture-detection system.

1. Sensors measuring moisture content to be placed within roofing system and connected to a monitoring program, with a notification indicating location of breach.

2.10 BALLAST

A. Aggregate Ballast: **[Smooth, washed, riverbed gravel or other acceptable smooth-faced stone][Crushed gravel or crushed stone]** that withstands weather exposure without significant deterioration and does not contribute to membrane degradation, of the following size:

1. Size: ASTM D448, **[Size 2, ranging in size from 1-1/2 to 2-1/2 inches (38 to 63 mm)][Size 3, ranging in size from 1 to 2 inches (25 to 50 mm)][Size 4, ranging in size from 3/4 to 1-1/2 inches (19 to 38 mm)]<Insert size>**.

B. Interlocking Roof Pavers: Interlocking, lightweight concrete units, grooved back, with four-way drainage capability; beveled, doveled, or otherwise profiled; and as follows:

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Hanover Architectural Products]**
 - b. **[Roofblok Limited]**
 - c. **[Westile Roofing Products; an Oldcastle company]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Hanover Architectural Products]**
 - b. **[Roofblok Limited]**
 - c. **[Westile Roofing Products; an Oldcastle company]**
 - d. **<Insert manufacturer's name>**
3. Size: **<Insert actual size(s) of pavers>**.
4. Weight: **<Insert weight or weight range>**.
5. Compressive Strength: **[2500 psi (17 MPa)][5000 psi (34 MPa)]<Insert value>**, minimum.
6. Colors and Textures: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]**.

C. Roof Pavers: Heavyweight, hydraulically pressed concrete units, **[square edged][with top edges beveled 3/16 inch (5 mm)]**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C140/C140M; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C67/C67M; and as follows:

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Carlisle Coatings & Waterproofing Inc]
 - b. [Hanover Architectural Products]
 - c. [Roofblok Limited]
 - d. [Sunny Brook Pressed Concrete, Co.]
 - e. [Tile Tech Pavers]
 - f. [Wausau Tile, Inc.]
 - g. [Westile Roofing Products; an Oldcastle company]
 - h. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Carlisle Coatings & Waterproofing Inc]
 - b. [Hanover Architectural Products]
 - c. [Roofblok Limited]
 - d. [Sunny Brook Pressed Concrete, Co.]
 - e. [Tile Tech Pavers]
 - f. [Wausau Tile, Inc.]
 - g. [Westile Roofing Products; an Oldcastle company]
 - h. <Insert manufacturer's name>
 3. Size: [24 by 24 inches (600 by 600 mm)]<Insert dimensions>. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
 4. Weight: <Insert value>.
 5. Compressive Strength: [7500 psi (52 MPa)][6500 psi (45 MPa)]<Insert value>, minimum.
 6. Colors and Textures: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range].
- D. Ballast Retaining Bar: Perimeter securement system consisting of a slotted extruded-aluminum retention bar with an integrated compression fastening strip.
1. Fasteners: 1-1/2-inch (38-mm) stainless steel fasteners with neoprene washers.

2.11 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway [pads][or][rolls], approximately 3/16 inch (5 mm) thick and acceptable to roofing system manufacturer.
 1. Size: Approximately 36 by 60 inches (900 by 1500 mm).
 2. Color: Contrasting with roofing membrane.
- B. Walkway Roof Pavers: Heavyweight, hydraulically pressed concrete units, [square edged][with top edges beveled 3/16 inch (5 mm)], factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C140/C140M; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C67; and as follows:
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the

following]:

- a. [Hanover Architectural Products]
 - b. [Roofblok Limited]
 - c. [Sunny Brook Pressed Concrete, Co.]
 - d. [Wausau Tile, Inc.]
 - e. [Westile Roofing Products; an Oldcastle company]
 - f. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Hanover Architectural Products]
 - b. [Roofblok Limited]
 - c. [Sunny Brook Pressed Concrete, Co.]
 - d. [Wausau Tile, Inc.]
 - e. [Westile Roofing Products; an Oldcastle company]
 - f. <Insert manufacturer's name>
3. Size: [24 by 24 inches (600 by 600 mm)]<Insert dimensions>. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
4. Weight: <Insert value>.
5. Compressive Strength: [7500 psi (52 MPa)][6500 psi (45 MPa)]<Insert value>, minimum.
6. Colors and Textures: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range].

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with roofing system Installer present, for compliance with requirements and other conditions affecting performance of the Work.
1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
 4. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.6 mm) out of plane relative to adjoining deck.
 5. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 6. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than [75]<Insert number> percent, or as recommended by roofing system manufacturer, when tested in accordance with ASTM F2170.
 - a. Test Frequency: One test probe per each [1000 sq. ft. (93 sq. m)]<Insert area>, or portion thereof, of roof deck, with no fewer than three test probes.
 - b. Submit test reports within 24 hours of performing tests.
 7. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof

- deck have been removed.
- 8. Verify that joints in precast concrete roof decks have been grouted flush with top of concrete.
- 9. Verify that minimum curing period recommended by roofing system manufacturer for lightweight insulating concrete roof decks has passed.
- 10. Verify that any damaged sections of cementitious wood-fiber decks have been repaired or replaced.
- 11. Verify that adjacent cementitious wood-fiber panels are vertically aligned to within **1/8 inch (3 mm)** at top surface.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation in accordance with roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Prime surface of concrete deck with primer in accordance with roofing system manufacturer's written installation instructions and allow primer to dry.
- D. Perform fastener-pullout tests in accordance with roofing system manufacturer's written instructions.
 - 1. Submit test result within 24 hours of performing tests.
 - a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.
- E. Install sound-absorbing insulation strips in ribs of acoustical steel roof deck in accordance with roof deck manufacturer's written instructions.

3.3 INSTALLATION OF POLYVINYL-CHLORIDE (PVC) ROOFING SYSTEM, GENERAL

- A. Install roofing system materials and components in accordance with roofing system manufacturer's written installation instructions, **[FM Approvals' RoofNav][SPRI's "Directory of Roof Assemblies"]** listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.
- C. Install roofing membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition **[and to not void warranty for existing roofing system]**.
- D. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under **[Section 072713 "Modified Bituminous Sheet Air Barriers."][Section 072715 "Nonbituminous Self-Adhering Sheet Air Barriers."][Section 072726 "Fluid-Applied Membrane Air Barriers.]**
- E. Substrate-Joint Penetrations: Prevent adhesives from penetrating substrate joints, entering building, or

damaging roofing system components or adjacent building construction.

3.4 INSTALLATION OF SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than **24 inches (600 mm)** in adjacent rows.
 - 1. Install substrate board at right angle to flutes of steel roof deck. Locate end joints over crests of steel roof deck.
 - 2. Tightly butt substrate boards together.
 - 3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 4. Fasten substrate board to top flanges of steel deck in accordance with manufacturer's written installation instructions and **[FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's "Directory of Roof Assemblies" listed roof assembly requirements for specified wind-uplift load capacity]** and FM Global Property Loss Prevention Data Sheet 1-29.
 - 5. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof in accordance with roofing system manufacturers' written installation instructions.
 - 6. Loosely lay substrate board over roof deck.

3.5 INSTALLATION OF VAPOR RETARDER

- A. Install vapor retarder in a single layer over roof area in accordance with manufacturer's written installation instructions, side and end lapping each sheet a minimum of **2 and 6 inches (50 and 150 mm)**, respectively.
 - 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 - 2. Continuously seal side and end laps with tape.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.6 INSTALLATION OF ROOF INSULATION AND ACCESSORIES

- A. Coordinate installation of roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written installation instructions. Install minimum of two layers of insulation under area of roofing to achieve required thickness.
- C. Install each layer of insulation with **[joints staggered not less than 24 inches (600 mm) in adjacent rows][end joints staggered not less than 12 inches (300 mm) in adjacent rows]** and offset not less than **12 inches (300 mm)** from previous layer.
 - 1. Trim insulation neatly to fit around penetrations and projections, and to fit tightly to intersecting sloping roof decks.
 - 2. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 - 3. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus **24 inches (600 mm)**.
 - 4. Trim insulation, so that water flow is unrestricted.

5. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
6. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
7. Secure insulation in accordance with **[FM Approvals' RoofNav for specified Windstorm Resistance Classification][SPRI's "Directory of Roof Assemblies" for specified wind-uplift load capacity]**.
8. Secure insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
9. Place **[thermal spacers and]** plates on insulation in required fastening patterns **[to achieve FM rating]** and secure in accordance with manufacturer's instructions.
 - a. Install plates and fasteners tight and flat to substrate with no dimpling, and with fastener extending 1 inch (25 mm) minimum into roof deck; do not overdrive fasteners.
10. Loosely lay each layer of insulation over substrate.

3.7 INSTALLATION OF COVER BOARD

- A. Install cover board over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction.
 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 4. Adhere cover board to substrate in accordance with **[FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's "Directory of Roof Assemblies" listed roof assembly requirements for specified wind-uplift load capacity]** and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Install slip sheet over cover board and immediately beneath roofing membrane.
- C. Place plates on cover board in required fastening patterns **[to achieve FM rating]** and secure in accordance with roofing system manufacturer's written installation instructions.
 1. Install plates and fasteners tight and flat to substrate with no dimpling, and with fastener extending 1 inch (25 mm) minimum into roof deck; do not overdrive fasteners.

3.8 INSTALLATION OF ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Install conductive medium directly under roofing membrane in accordance with ASTM D7877 and ASTM D8231.
- B. Install sensors, connections, and accessory items required for complete continuously monitored moisture-detection system in accordance with manufacturer's written installation instructions.

3.9 INSTALLATION OF PVC ROOFING MEMBRANE

- A. Install roofing membrane over roof area for **[adhered][mechanically attached][loose-laid, ballasted]** application method in accordance with roofing system manufacturer's written installation instructions.

- B. Unroll roofing membrane and allow it to relax before installing.
- C. Start installation in presence of roofing system manufacturer's technical personnel[**Owner's testing and inspection agency**].
- D. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
- E. Adhered Application: Apply bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply to splice area of roofing membrane.
 - 1. In addition to adhering, mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.
- F. Mechanically Attached Application: Secure roofing membrane over area to receive roofing in accordance with roofing system manufacturer's written installation instructions.
 - 1. Mechanically fasten or adhere roof membrane securely at terminations, penetrations, and perimeter of roofing.
 - 2. Induction-Weld Attachment: Secure roofing membrane to plates creating 100 percent bond between underside of membrane and top of plates; a partial bond is unacceptable. Test welds to verify adhesion of roofing membrane to top of plates in accordance with manufacturer's instructions.
- G. Loose-Laid, Ballasted Application: Comply with requirements in ANSI/SPRI RP-4 for [**System 1**][**System 2**][**System 3**].
 - 1. [**Mechanically fasten**][**Adhere**] roofing membrane at perimeter, corners, and transitions in accordance with requirements in ANSI/SPRI RP-4.
 - 2. At corners and perimeters, omit aggregate ballast leaving roofing membrane exposed.
 - 3. At corners and perimeters, adhere a second layer of roofing membrane.
 - 4. Install protection mat over roofing membrane, overlapping a minimum of **6 inches (150 mm)**. Install an additional protection mat layer at projections, pipes, vents, and drains, overlapping a minimum of **12 inches (300 mm)**.
 - 5. Aggregate Ballast: Apply uniformly over roofing membrane at the rate required by roofing system manufacturer, but not less than the following, spreading with care to minimize possibility of damage to roofing system. Lay ballast as roof membrane is installed, leaving roof membrane ballasted at end of workday.
 - a. Ballast Weight:
 - 1) Size 4 aggregate, **10 lb/sq. ft. (50 kg/sq. m)**.
 - 2) Size 2 aggregate, **13 lb/sq. ft. (65 kg/sq. m)**, at corners and perimeter; Size 4 aggregate, **10 lb/sq. ft. (50 kg/sq. m)**, elsewhere.
 - 3) Size 2 aggregate, **13 lb/sq. ft. (65 kg/sq. m)**.
 - 4) Size 3 aggregate, **<Insert weight>**, at corners, **<Insert weight>** at perimeter, and **<Insert weight>**, elsewhere.
 - 6. Roof-Paver Ballast: Install [**lightweight**][**heavyweight**] roof-paver ballast in accordance with manufacturer's written instructions.
 - 7. Roof-Paver and Aggregate Ballast: Install heavyweight roof pavers in accordance with manufacturer's written instructions on roof corners and perimeter.

- a. Install Size 4 aggregate ballast elsewhere on roof membrane at a minimum rate of **10 lb/sq. ft. (50 kg/sq. m).**
 - b. Install Size 2 aggregate ballast elsewhere on roof membrane at a minimum rate of **13 lb/sq. ft. (65 kg/sq. m).**
- H. Seams and End Laps: Clean seam areas, overlap membrane, and hot-air-weld side seams and end laps of roofing membrane and sheet flashing to ensure a watertight installation.
- 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane and sheet flashings.
 - 2. Verify field strength of seams a minimum of **[twice]<Insert number of daily seam tests>** daily, and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roofing membrane that do not comply with requirements.
- I. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.10 INSTALLATION OF BASE AND SHEET FLASHINGS

- A. General: Install and adhere base and sheet flashings and preformed flashing accessories to substrates in accordance with roofing system manufacturer's written installation instructions.
- B. Apply bonding adhesive to substrate and underside of flashings at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners.
- D. Clean seam areas, overlap, and firmly roll flashings into the adhesive. Hot-air-weld side seams and end laps to ensure a watertight installation.
- E. Terminate and seal top of flashings and mechanically anchor to substrate through termination bars.

3.11 INSTALLATION OF WALKWAYS

- A. Flexible Walkways: Install walkway products in accordance with manufacturer's written instructions.
 - 1. Install flexible walkways at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - f. Locations indicated on Drawings.
 - g. As required by roofing membrane manufacturer's warranty requirements.
 - 2. Provide **6-inch (75-mm)** clearance between adjoining pads.
 - 3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive in accordance with roofing system manufacturer's written instructions.

- B. Roof-Paver Walkways: Install walkway roof pavers in accordance with manufacturer's written instructions.
1. Install roof-paver walkways at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - f. Locations indicated on Drawings.
 - g. As required by roofing membrane manufacturer's warranty requirements.
 2. Provide **3 inches (75 mm)** of space between adjacent roof pavers.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspect substrate conditions, surface preparation, and application of roofing membrane, flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Tests and Inspections:
1. ELD Testing: Testing agency surveys entire roof area and flashings to locate discontinuities in the roofing membrane using ELD in accordance with ASTM D7877 and ASTM D8231.
 - a. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
 2. Flood Testing: Flood test each roofing area for leaks, in accordance with recommendations in ASTM D5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - a. Flood to an average depth of **[2-1/2 inches (63 mm)]<Insert depth>** with a minimum depth of **[1 inch (25 mm)]<Insert depth>** and not exceeding a depth of **[4 inches (100 mm)]<Insert depth>**. Maintain **2 inches (50 mm)** of clearance from top of base flashing.
 - b. Flood each area for **[24][48][72]** hours.
 - c. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - d. Testing agency to prepare survey report indicating locations of initial leaks, if any, and final survey report.

3. Infrared Thermography Testing: Testing agency surveys entire roof area using infrared color thermography in accordance with ASTM C1153. Perform tests before overlying construction is placed.
 - a. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or nuclear hydrogen detection testing.
 - b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report of initial scan indicating locations of entrapped moisture, if any.
 4. Electrical Capacitance/Impedance Testing: Testing agency surveys entire roof area for entrapped water within roof assembly in accordance with ASTM D7954/D7954M. Perform tests before overlying construction is placed.
 - a. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
 5. Nuclear Hydrogen Detection Testing: Testing agency surveys entire roof area for entrapped water within roof assembly in accordance with ANSI/SPRI/RCI NT-1. Perform tests before overlying construction is placed.
 - a. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
 - C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
 1. Notify Architect[**and Owner**] 48 hours in advance of date and time of inspection.
 - D. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
 - E. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.
 1. Roofing system will be considered defective if it does not pass tests and inspections.
 - F. Prepare test and inspection reports.
- 3.13 PROTECTING AND CLEANING
- A. Protect roofing system from damage and wear during remainder of construction period.

1. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and in accordance with warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.14 ROOFING SYSTEM INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing System Installer," has performed roofing and associated Work on the following Project:
 1. Owner: **<Insert name of Owner>**.
 2. Owner Address: **<Insert address>**.
 3. Building Name/Type: **<Insert information>**.
 4. Building Address: **<Insert address>**.
 5. Area of Work: **<Insert information>**.
 6. Warranty Period: **[Two][Five]<Insert number>** years from date of Substantial Completion.
 7. Date of Substantial Completion: _____.
- B. AND WHEREAS Roofing System Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said Work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing System Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period, Roofing System Installer will, at Roofing System Installer's own cost and expense, make or cause to be made such repairs to or replacements of said Work as are necessary to correct faulty and defective work and as are necessary to maintain said Work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
 1. Specifically excluded from this Warranty are damages to Work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding **<Insert mph (m/s)>**;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the Work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When Work has been damaged by any of foregoing causes, Warranty will be null and void until such damage has been repaired by Roofing System Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing System Installer is responsible for damage to Work covered by this Warranty but is not

liable for consequential damages to building or building contents resulting from leaks or faults or defects of Work.

4. During Warranty Period, if Owner allows alteration of Work by anyone other than Roofing System Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty will become null and void on date of said alterations, but only to the extent said alterations affect Work covered by this Warranty. If Owner engages Roofing System Installer to perform said alterations, Warranty will not become null and void unless Roofing System Installer, before starting said Work, will have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate Work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty will become null and void on date of said change, but only to the extent said change affects Work covered by this Warranty.
6. Owner will promptly notify Roofing System Installer of observed, known, or suspected leaks, defects, or deterioration and afford reasonable opportunity for Roofing System Installer to inspect Work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing System Installer on said Work and will not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty will not operate to relieve Roofing System Installer of responsibility for performance of original Work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 07 54 19 00



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SECTION 07 54 23 00 - THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermoplastic polyolefin (TPO) roofing system.
2. Accessory roofing system materials.
3. Substrate board.
4. Vapor retarder.
5. Roof insulation and accessories.
6. Cover board.
7. Electronic leak-detection (ELD) materials.
8. Ballast.
9. Walkways.

B. Section contains the installation of sound-absorbing insulation strips in ribs of acoustical steel roof deck. Sound-absorbing insulation strips are furnished under Section 053100 "Steel Decking."

C. Related Requirements:

1. Section 053100 "Steel Decking" for roof deck panels [**and sound-absorbing insulation strips**] .
2. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
3. Section 061600 "Sheathing" for wood-based, structural-use roof deck panels.
4. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
5. Section 077100 "Roof Specialties" for [premanufactured copings][and][roof edge fasciae][gravel stops][reglets][roof edge flashings][counterflashings] .
6. Section 077129 "Manufactured Roof Expansion Joints" for premanufactured roof expansion-joint assemblies.
7. Section 077200 "Roof Accessories" for manufactured roof curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
8. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
9. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.2 DEFINITIONS

- ##### A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's " Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.3 PREINSTALLATION MEETINGS

- ##### A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at [Project site]<Insert location> .

1. Meet with Owner, Architect, [**Construction Manager,**] Owner's insurer if applicable, testing and inspecting agency representative, roofing system Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or

- affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

B. Preinstallation Roofing Conference: Conduct conference at **[Project site]<Insert location>** .

1. Meet with Owner, Architect, [**Construction Manager,**] Owner's insurer if applicable, testing and inspecting agency representative, roofing system Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base and sheet flashings and membrane termination details.
3. Flashing details at penetrations.
4. Tapered insulation layout, thickness, and slopes.
5. Roof plan showing orientation of roof deck and orientation of roofing membrane, fastening spacings, and pattern for corner, perimeter, and field-of-roof locations.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
7. Crickets, saddles, and tapered edge strips, including slopes.
8. Tie-in with adjoining wall system air barrier.

C. Samples for Verification: For the following products:

1. Roofing membrane and flashings, of color required.
2. Aggregate surfacing ballast material in gradation [**and color**] required.
3. Roof paver [, **full sized,**] in each color and texture required.

4. Walkways, of color required.
- D. Wind-Uplift-Resistance Submittal: For roofing system indicating compliance with wind-uplift performance requirements.
- E. Sustainable Design Submittals:
 1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.
 2. Health Product Declaration (HPD): Provide documentation confirming product compliance with one of the following:
 - a. Inventory or HPD to at least 0.01 percent by weight, with at least 95 percent assessed using GreenScreen Benchmark assessment.
 - b. Cradle to Cradle v3 certification with minimum Silver level of Material Health.
 - c. Living Product Challenge certification indicating achievement of Imperative 09, "Transparent Material Health."

1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer Certificates:
 1. Performance Requirement Certificate: Signed by roofing membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with specified performance requirements.
 2. Special Warranty Certificate: Signed by roofing membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- B. Product Test Reports: For roofing membrane and insulation, tests performed by an independent qualified testing agency indicating compliance with specified requirements.
- C. Research Reports: For components of roofing system, from **[an agency acceptable to authorities having jurisdiction][ICC-ES]<Insert evaluation agency>** showing compliance with specified performance requirements.
- D. Field Test Reports:
 1. Concrete internal relative humidity test reports.
 2. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.
- E. Field Quality Control Reports: For specified tests and inspections.
- F. Qualification Statements: For roofing system **[Installer][manufacturer][and][testing agency]** .
- G. Sample Warranties: For specified special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system.
- B. Existing Warranty Documentation: Certified statement from existing roofing system manufacturer stating

that existing roof warranty has not been affected by the Work performed under this Section.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is **[ULSE listed][listed in FM Approvals' RoofNav][listed in SPRI's "Directory of Roof Assemblies"]** for roofing system identical to that used for this Project.
- B. Roofing System Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
 - 1. Certified Roofing System Installer: Entity that employs **[a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified thermoplastic system installers][a supervisor who is an NRCA ProCertified Roofing Foreman][a supervisor who is an NRCA ProCertified Roofing Foreman and not less than 20 percent of installers who are NRCA ProCertified thermoplastic system installers]** .

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing system materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.
 - 1. Protect stored liquid material from direct sunlight.
 - 2. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources.
 - 1. Store in a dry location.
 - 2. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing system materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written installation instructions and warranty requirements.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty to include all components of roofing system, such as [**substrate board**,][**vapor retarder**,] roof insulation, fasteners, adhesives, [**cover board**,] roofing membrane, base flashing sheet, [**ballast**,][**walkways**,] and other components of roofing system.
 2. Warranty Period: [**10**][**15**][**20**][**30**]**<Insert number>** years from date of Substantial Completion.
- B. Roofing System Installer's Warranty: Submit roofing system Installer's warranty, on warranty form at end of this Section, signed by roofing system Installer, covering the Work of this Section, including all components of roofing system, such as [**substrate board**,][**vapor retarder**,] roof insulation, fasteners, adhesives, [**cover board**,] roofing membrane, base flashing sheet, [**ballast**,][**walkways**,] and other components of roofing system.
1. Warranty Period: [**Two**][**Five**]**<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain components for roofing system from [**roofing membrane manufacturer**][**or**][**manufacturer approved by roofing membrane manufacturer**] .

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing system and flashings to remain watertight.
1. Accelerated Weathering: Roofing membrane to withstand 2000 hours of exposure when tested in accordance with ASTM G152, ASTM G154, or ASTM G155.
 2. Impact Resistance: Roofing membrane to resist impact damage when tested in accordance with ASTM D3746/D3746M, ASTM D4272/D4272M, or the Resistance to Foot Traffic Test in FM Approvals 4470.
- B. Material Compatibility: Roofing system materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
- C. Wind-Uplift Resistance: Design roofing system to resist the following wind-uplift pressures when tested in accordance with FM Approvals 4474, UL 580, or UL 1897:
1. Zone 1' (Roof Area Interior): **<Insert lbf/sq. ft. (kPa)>** .
 2. Zone 1 (Roof Area Field): **<Insert lbf/sq. ft. (kPa)>** .
 3. Zone 2 (Roof Area Perimeter): **<Insert lbf/sq. ft. (kPa)>** .
 - a. Location: From roof edge to **<Insert dimension>** inside roof edge.
 4. Zone 3 (Roof Area Corners): **<Insert lbf/sq. ft. (kPa)>** .
 - a. Location: **<Insert dimension>** in each direction from each building corner.
- D. FM Approvals' RoofNav Listing: Roofing membrane, base flashings, and component materials to comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and are

listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.

1. Fire/Windstorm Classification: **[Class 1A-60][Class 1A-75][Class 1A-90][Class 1A-105][Class 1A-120]<Insert class>** .
 2. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 **[MH][SH][VSH]** .
- E. SPRI's "Directory of Roof Assemblies" Listing: Roofing membrane, base flashings, and component materials to comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and are listed in SPRI's "Directory of Roof Assemblies" for roof assembly identical for that specified for this Project.
1. Wind-Uplift Load Capacity: **[60 psf][75 psf][90 psf][105 psf][120 psf]<Insert capacity>** .
- F. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][32]** or initial SRI not less than **[82][39]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- G. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][25]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- H. Solar Reflectance Index (SRI): Not less than **[78][29]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- I. Cool Roof Rating Council (CRRC): Roofing system to be listed by the CRRC for low-slope roof products.
- J. Energy Performance: Roofing system to have an initial solar reflectance index (SRI) of not less than **[0.70]<Insert value>** and an emissivity of not less than **[0.75]<Insert value>** when tested in accordance with CRRC S100.
- K. Exterior Fire-Test Exposure: **[Class A][Class B][Class C]** ; for application and roof slopes indicated; when tested by a qualified testing agency in accordance with ASTM E108 or UL 790.
1. Identify products with appropriate markings of applicable testing agency.
- L. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated.
1. Identify products with appropriate markings of applicable testing agency.
- 2.3 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING SYSTEM
- A. TPO Roofing Membrane Sheet: ASTM D6878/D6878M, internally fabric- or scrim-reinforced, TPO sheet.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Carlisle SynTec Systems; a Carlisle Company]**
 - b. **[Cooley Group]**
 - c. **[Custom Seal Inc.]**

- d. **[Elevate; Amrize Building Envelope LLC]**
 - e. **[Flex Membrane International Corp.]**
 - f. **[GAF]**
 - g. **[GenFlex Roofing Systems]**
 - h. **[IKO Innovati; IKO Industries Inc.]**
 - i. **[Johns Manville; a Berkshire Hathaway company]**
 - j. **[Mule-Hide Products Co., Inc]**
 - k. **[Siplast]**
 - l. **[Versico Roofing Systems; a Carlisle Company]**
 - m. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[Carlisle SynTec Systems; a Carlisle Company]**
 - b. **[Cooley Group]**
 - c. **[Custom Seal Inc.]**
 - d. **[Elevate; Amrize Building Envelope LLC]**
 - e. **[Flex Membrane International Corp.]**
 - f. **[GAF]**
 - g. **[GenFlex Roofing Systems]**
 - h. **[IKO Innovati; IKO Industries Inc.]**
 - i. **[Johns Manville; a Berkshire Hathaway company]**
 - j. **[Mule-Hide Products Co., Inc]**
 - k. **[Siplast]**
 - l. **[Versico Roofing Systems; a Carlisle Company]**
 - m. **<Insert manufacturer's name>**
3. Membrane Option: **[Manufacturer's standard][Fabric backed][Self-adhering]** .
4. Thickness: **[45 mils (1.1 mm)][60 mils (1.5 mm)][80 mils (2.0 mm)]<Insert value>** , nominal.
5. Exposed Face Color: **[Black][Gray][Tan][White]<Insert color>** .
6. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.

2.4 ACCESSORY ROOFING SYSTEM MATERIALS

- A. General: Accessory materials as recommended in writing by roofing membrane manufacturer for intended use and compatible with other roofing system components.
- 1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
 - 2. Verify adhesives and sealants comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Other Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Nonmembrane Roof Sealants: 300 g/L.
 - j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - k. Sealant Primers for Porous Substrates: 775 g/L.

07 - Thermal And Moisture Protection

- B. Base and Sheet Flashings: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as roofing membrane.
- C. Prefabricated Pipe Flashings: As recommended in writing by roofing membrane manufacturer.
- D. Roof Vents: As recommended in writing by roofing membrane manufacturer.
 - 1. Size: Not less than **4-inch (100-mm)** diameter.
- E. Bonding Adhesive: Roofing membrane manufacturer's standard [, **water based**] .
- F. Slip Sheet: **[ASTM D2178/D2178M, Type IV; glass fiber; asphalt-impregnated felt][Manufacturer's standard, of thickness required for application]** .
- G. Asphalt-Coated, Glass-Fiber-Mat, Venting Base Sheet: ASTM D4897/D4897M, Type II; nonperforated, asphalt impregnated, fiberglass reinforced, with mineral granular patterned surfacing on bottom surface.
- H. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately **1 by 1/8 inch (25 by 3 mm)** thick; with anchors.
- I. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately **1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick)**, prepunched.
- J. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing system components to substrate; tested for required pullout strength, and acceptable to roofing membrane manufacturer.
- K. Safety Accessories: Roofing membrane manufacturer's standard yellow seaming tape for designating safety perimeters and rooftop hazards.
- L. Miscellaneous Accessories: As recommended in writing by roofing membrane manufacturer.

2.5 SUBSTRATE BOARD

- A. Glass-Mat Gypsum Roof Substrate Board: ASTM C1177/C1177M, water-resistant gypsum board.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**

- c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
- d. **[USG Corporation]**
- e. **<Insert manufacturer's name>**
- 3. Thickness: **[1/4 inch (6 mm)][1/2 inch (13 mm)][Type X, 5/8 inch (16 mm)]** .
- 4. Surface Finish: **[Factory primed][Unprimed]** .
- B. Fiber-Reinforced Gypsum Roof Board: ASTM C1278/C1278M, cellulosic-fiber reinforced, water-resistant gypsum board.
 - 1. Thickness: **[1/4 inch (6 mm)][3/8 inch (10 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]** .
- C. Perlite Board: ASTM C728, seal coated.
 - 1. Thickness: **[3/4 inch (19 mm)][1 inch (25 mm)]** .
- D. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.
- E. Bonding Adhesive: Manufacturer's standard, designed for adhering substrate board to roof deck.

2.6 VAPOR RETARDER

- A. Rubberized-Asphalt-Sheet Vapor Retarder, Self-Adhering: ASTM D1970/D1970M, polyethylene film laminated to layer of rubberized asphalt adhesive, minimum **40-mil (1.0-mm)** total thickness; maximum permeance rating of **0.1 perm (6 ng/Pa x s x sq. m)**; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.
- B. Butyl-Rubber-Sheet Vapor Retarder, Self-Adhering: Polyethylene film laminated to layer of butyl rubber adhesive, minimum **30-mil (0.76-mm)** total thickness; maximum permeance rating of **0.1 perm (6 ng/Pa x s x sq. m)**; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.
- C. Laminated Sheet Vapor Retarder: Two layers; fire-retardant polyethylene laminate; reinforced with cord grid.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Reef Industries, Inc.]**
 - b. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Reef Industries, Inc.]**
 - b. **<Insert manufacturer's name>**
 - 3. Permeance Rating: Not more than **0.062 perm (3.556 ng/Pa x s x sq. m)** when tested in accordance with ASTM E96/E96M.
 - 4. Flame-Spread Index: Not more than 5 when tested in accordance with ASTM E84.

5. Smoke-Developed Index: Not more than 35 when tested in accordance with ASTM E84.
6. Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.7 ROOF INSULATION AND ACCESSORIES

- A. General: Preformed roof insulation boards manufactured [**or approved**] by roofing membrane manufacturer, approved for use in [**FM Approvals' RoofNav**][**SPRI's "Directory of Roof Assemblies"**] listed roof assemblies.
- B. Extruded-Polystyrene Board Insulation: ASTM C578, [**Type IV, 1.45 lb/cu. ft. (23 kg/cu. m) minimum density, 25 psi (173 kPa) minimum compressive strength**][**Type V, 3.00 lb/cu. ft. (48 kg/cu. m), minimum density, 100 psi (690 kPa) minimum compressive strength**], square edged.
 1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**] :
 - a. [**DuPont**]
 - b. [**Kingspan Insulation LLC**]
 - c. [**Owens Corning**]
 - d. [**Soprema, Inc.**]
 - e. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert **manufacturer's name; product name or designation**> or comparable product by one of the following:
 - a. [**DuPont**]
 - b. [**Kingspan Insulation LLC**]
 - c. [**Owens Corning**]
 - d. [**Soprema, Inc.**]
 - e. <Insert manufacturer's name>
 3. Thermal Resistance: R-value of 5.0 per 1 inch (25 mm).
 4. Size: [**48 by 48 inches (1200 by 1200 mm)**][**48 by 96 inches (1200 by 2400 mm)**] .
 5. Thickness:
 - a. Base Layer: [**1-1/2 inches (38 mm)**] <Insert thickness> .
 - b. Upper Layer: <Insert thickness> .
- C. Molded (Expanded) Polystyrene Board Insulation: ASTM C578, Type VIII, 1.15 lb/cu. ft. (18 kg/cu. m) minimum density, **13 psi (90 kPa)** minimum compressive strength, square edge.
 1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**] :
 - a. [**Atlas Molded Products, a division of Atlas Roofing Corporation**]
 - b. [**Carlisle SynTec Systems; a Carlisle Company**]
 - c. [**Cellofoam North America, Inc.**]
 - d. [**Kingspan Insulation LLC**]

- e. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [Carlisle SynTec Systems; a Carlisle Company]
 - c. [Cellofoam North America, Inc.]
 - d. [Kingspan Insulation LLC]
 - e. <Insert manufacturer's name>
3. Thermal Resistance: R-value of 3.8 per 1 inch (25 mm).
4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)] .
5. Thickness:
 - a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness> .
 - b. Upper Layer: <Insert thickness> .
- D. Composite Molded (Expanded) Polystyrene Board Insulation: ASTM C578, [Type II, 1.35 lb/cu. ft. (22 kg/cu. m)][Type VIII, 1.15 lb/cu. ft. (18 kg/cu. m)][Type IX, 1.8 lb/cu. ft. (29 kg/cu. m)] minimum density, with factory-applied facings, as follows:
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [Carlisle SynTec Systems; a Carlisle Company]
 - b. [Cellofoam North America, Inc.]
 - c. [Insulfoam; a Carlisle Company]
 - d. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Carlisle SynTec Systems; a Carlisle Company]
 - b. [Cellofoam North America, Inc.]
 - c. [Insulfoam; a Carlisle Company]
 - d. <Insert manufacturer's name>
 3. Facer: [ASTM C208, Type II, Grade 2, cellulosic-fiber insulation board, asphalt coated, 1/2 inch (13 mm) thick][DOC PS 2, Exposure 1, OSB, 7/16 inch (11 mm) thick]<Insert material> .
 4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)] .
 5. Thickness: <Insert thickness> .
- E. Polyisocyanurate Board Insulation: ASTM C1289, Type II, [Class 1 felt facer][Class 2 coated glass-fiber facer][Class 3 uncoated glass-fiber facer] on both major surfaces.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :

- a. [Atlas Polyiso Roof and Wall Insulation]
- b. [Carlisle SynTec Systems; a Carlisle Company]
- c. [CertainTeed; SAINT-GOBAIN]
- d. [Elevate; Amrize Building Envelope LLC]
- e. [GAF]
- f. [Hunter Panels; a Carlisle Company]
- g. [IKO Innovati; IKO Industries Inc.]
- h. [Insulfoam; a Carlisle Company]
- i. [Johns Manville; a Berkshire Hathaway company]
- j. [Kingspan Insulation LLC]
- k. [Polyglass U.S.A., Inc.]
- l. [Rmax, A Business Unit of Sika Corporation]
- m. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Atlas Polyiso Roof and Wall Insulation]
- b. [Carlisle SynTec Systems; a Carlisle Company]
- c. [CertainTeed; SAINT-GOBAIN]
- d. [Elevate; Amrize Building Envelope LLC]
- e. [GAF]
- f. [Hunter Panels; a Carlisle Company]
- g. [IKO Innovati; IKO Industries Inc.]
- h. [Insulfoam; a Carlisle Company]
- i. [Johns Manville; a Berkshire Hathaway company]
- j. [Kingspan Insulation LLC]
- k. [Polyglass U.S.A., Inc.]
- l. [Rmax, A Business Unit of Sika Corporation]
- m. <Insert manufacturer's name>

3. Compressive Strength: [Grade 2, 20 psi (138 kPa)][Grade 3, 25 psi (172 kPa)] .
 4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)] .
 5. Thickness:

- a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness> .
- b. Upper Layer: <Insert thickness> .

- F. Composite Polyisocyanurate Board Insulation: ASTM C1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :

- a. [Atlas Polyiso Roof and Wall Insulation]
- b. [Carlisle SynTec Systems; a Carlisle Company]
- c. [CertainTeed; SAINT-GOBAIN]
- d. [Elevate; Amrize Building Envelope LLC]
- e. [GAF]
- f. [Hunter Panels; a Carlisle Company]
- g. [IKO Industries Inc.]
- h. [Insulfoam; a Carlisle Company]

- i. [Johns Manville; a Berkshire Hathaway company]
 - j. [Kingspan Insulation LLC]
 - k. [Polyglass U.S.A., Inc.]
 - l. [Rmax, A Business Unit of Sika Corporation]
 - m. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Atlas Polyiso Roof and Wall Insulation]
 - b. [Carlisle SynTec Systems; a Carlisle Company]
 - c. [CertainTeed; SAINT-GOBAIN]
 - d. [Elevate; Amrize Building Envelope LLC]
 - e. [GAF]
 - f. [Hunter Panels; a Carlisle Company]
 - g. [IKO Industries Inc.]
 - h. [Insulfoam; a Carlisle Company]
 - i. [Johns Manville; a Berkshire Hathaway company]
 - j. [Kingspan Insulation LLC]
 - k. [Polyglass U.S.A., Inc.]
 - l. [Rmax, A Business Unit of Sika Corporation]
 - m. <Insert manufacturer's name>
 3. Facer: [Type IV, cellulosic-fiber-insulating-board facer, Grade 2, 1/2 inch (13 mm) thick][Type V, OSB facer, 7/16 inch (11 mm) thick][Type VII, glass-mat-faced gypsum board facer, 1/4 inch (6 mm) thick]<Insert material> .
 4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)] .
 5. Thickness: <Insert thickness> .
- G. Perlite Board Insulation: ASTM C728, Type 1, rigid, mineral-aggregate thermal insulation board composed of expanded perlite, cellulosic fibers, binders, and waterproofing agents with top surface seal coated.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [GAF]
 - b. [Johns Manville; a Berkshire Hathaway company]
 - c. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [GAF]
 - b. [Johns Manville; a Berkshire Hathaway company]
 - c. <Insert manufacturer's name>
 3. Thermal Resistance: R-value of 2.78 per 1 inch (25 mm).
 4. Size: [48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)] .
 5. Thickness:
 - a. Base Layer: [1-1/2 inches (38 mm)]<Insert thickness> .

- b. Upper Layer: **<Insert thickness>** .
 - H. Cellulosic-Fiber Board Insulation: ASTM C208, Type II, Grade 2, fibrous-felted, rigid insulation boards of wood-fiber or other cellulosic-fiber and water-resistant binders, asphalt impregnated, chemically treated for deterioration.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Blue Ridge Fiberboard]**
 - b. **[GAF]**
 - c. **[Georgia-Pacific Gypsum LLC]**
 - d. **[Homasote Company]**
 - e. **[Huebert Fiberboard Inc]**
 - f. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Blue Ridge Fiberboard]**
 - b. **[GAF]**
 - c. **[Georgia-Pacific Gypsum LLC]**
 - d. **[Homasote Company]**
 - e. **[Huebert Fiberboard Inc]**
 - f. **<Insert manufacturer's name>**
 3. Thermal Resistance: R-value of 2.78 per 1 inch (25 mm).
 4. Size: **[48 by 48 inches (1200 by 1200 mm)][48 by 96 inches (1200 by 2400 mm)]** .
 5. Thickness:
 - a. Base Layer: **[1 inch (25 mm)][2 inches (50 mm)]<Insert thickness>** .
 - b. Upper Layer: **<Insert thickness>** .
 - I. Mineral Wool Board Insulation - Multi-Density: ASTM C726, Type I, Class 1, comprising monolithic fibrous material having an upper layer of **11.2 lb/cu. ft. (180 kg/cu. m)** density, and a lower layer of **7.5 lb/cu. ft. (120 kg/cu. m)** density.
 1. Thermal Resistance: R-value of 3.8 per 1 inch (25 mm).
 2. Size: **48 by 48 inches (1200 by 1200 mm)**.
 3. Thickness:
 - a. Base Layer: **[2 inches (50 mm)]<Insert thickness>** .
 - b. Upper Layer: **<Insert thickness>** .
 - J. Mineral Wool Board Insulation - Single Density: ASTM C726, Type II, Class 1, comprising monolithic fibrous material having **12.5 lb/cu. ft. (200 kg/cu. m)** density.
 1. Thermal Resistance: R-value of 4.0 per 1 inch (25 mm).
 2. Size: **48 by 48 inches (1200 by 1200 mm)**.
 3. Thickness: **1 inch (25 mm)**.
 - K. Tapered Insulation: Provide factory-tapered insulation boards.

1. Material: **[Match roof insulation]<Insert material>** .
 2. Minimum Thickness: **1/4 inch (6 mm)**.
 3. Slope:
 - a. Roof Field: **[1/4 inch per foot (1:48)]<Insert slope>** unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: **[1/2 inch per foot (1:24)]<Insert slope>** unless otherwise indicated on Drawings.
- L. Roof Insulation Accessories, General: As recommended in writing by insulation manufacturer for intended use and compatibility with other roofing system components.
1. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation **[to substrate][and]** to another insulation layer as follows:
 - a. Modified asphaltic, asbestos-free, cold-applied adhesive.
 - b. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
 - c. Full-spread, spray-applied, low-rise, two-component urethane adhesive.
 2. Verify adhesives and sealants comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Other Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Nonmembrane Roof Sealants: 300 g/L.
 - j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - k. Sealant Primers for Porous Substrates: 775 g/L.
 3. Insulation Fasteners: Insulation manufacturer's standard factory-coated steel fasteners with metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
 4. Induction-Welding Plates: Minimum **3-inch (75-mm)** diameter with recessed center, **0.034-inch (0.86-mm)** thick, aluminum-zinc-alloy-coated steel plates, factory coated with adhesive formulated for roof membrane, with corresponding corrosion-resistant fasteners **[and thermal isolation spacers below plates]** .

2.8 COVER BOARD

- A. General: Cover board as recommended in writing by roofing membrane manufacturer for intended use and compatible with other roofing system components.
- B. Cellulosic-Fiber Insulation Cover Board: ASTM C208, Type II, Grade 2, high-density cellulosic-fiber insulation board, having a minimum compressive strength of **40 psi (276 kPa)**.
 1. Thickness: **[1/2 inch (13 mm)][1 inch (25 mm)]<Insert thickness>** .
 2. Surface Finish: **[Primed one side][Primed two sides with nonasphaltic primer][Integral coating, six sides][Unprimed]<Insert finish>** .
- C. Oriented Strand Board: DOC PS 2, Exposure 1, **7/16 inch (11 mm)** thick.

- D. Glass-Mat Gypsum Cover Board: ASTM C1177/C1177M, water-resistant gypsum board.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[CertainTeed; SAINT-GOBAIN]**
 - b. **[Georgia-Pacific Gypsum LLC]**
 - c. **[Gold Bond Building Products, LLC provided by National Gypsum Company]**
 - d. **[USG Corporation]**
 - e. **<Insert manufacturer's name>**
 3. Thickness: **[1/4 inch (6 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]** .
 4. Surface Finish: **[Fiberglass facer][Factory primed][Unprimed]** .
- E. Fiber-Reinforced Gypsum Roof Board: ASTM C1278/C1278M, cellulosic-fiber-reinforced, water-resistant gypsum board.
1. Thickness: **[1/4 inch (6 mm)][3/8 inch (10 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]** .
- F. Fiber-Reinforced Cementitious Cover Board: ASTM C1325, fiber-mat-reinforced cementitious board.
1. Thickness: **[7/16 inch (11 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)]** .
- G. Fiber-Reinforced Recycled Plastic Cover Board: Cellulose fiber blended with recycled plastic board.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Continuus Materials, LLC]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Continuus Materials, LLC]**
 - b. **<Insert manufacturer's name>**
 3. Thickness: **[1/4 inch (6 mm)][1/2 inch (13 mm)]** .
 4. Surface Finish: **[Fiberglass facer][Paper facer]** .
 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content

not less than <Insert number> percent.

- H. High-Density Polyisocyanurate Cover Board: ASTM C1289 Type II, Class 4, Grade 1, 1 inch (25 mm) thick, with a minimum compressive strength of 80 psi (551 kPa).
- I. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric; water permeable and resistant to UV degradation; type and weight as recommended in writing by roofing system manufacturer for application.

2.9 ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Conductive Medium: Electrically conductive material specifically designed to enable ELD testing procedures as approved in writing by roofing membrane manufacturer.
 - 1. Conductive medium to be located directly under roofing membrane in accordance with ASTM D7877 and ASTM D8231.
- B. Moisture-Monitoring System: Permanently embedded, continuously monitored moisture-detection system.
 - 1. Sensors measuring moisture content to be placed within roofing system and connected to a monitoring program, with a notification indicating location of breach.

2.10 BALLAST

- A. Aggregate Ballast: **[Smooth, washed, riverbed gravel or other acceptable smooth-faced stone][Crushed gravel or crushed stone]** that withstands weather exposure without significant deterioration and does not contribute to membrane degradation, of the following size:
 - 1. Size: ASTM D448, **[Size 2, ranging in size from 1-1/2 to 2-1/2 inches (38 to 63 mm)][Size 3, ranging in size from 1 to 2 inches (25 to 50 mm)][Size 4, ranging in size from 3/4 to 1-1/2 inches (19 to 38 mm)]<Insert size> .**
- B. Interlocking Roof Pavers: Interlocking, lightweight concrete units; grooved back, with four-way drainage capability; beveled, doweled, or otherwise profiled; and as follows:
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Hanover Architectural Products]**
 - b. **[Roofblok Limited]**
 - c. **[Westile Roofing Products; an Oldcastle company]**
 - d. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Hanover Architectural Products]**
 - b. **[Roofblok Limited]**
 - c. **[Westile Roofing Products; an Oldcastle company]**

- d. <Insert manufacturer's name>
 3. Size: <Insert actual size of pavers> .
 4. Weight: <Insert weight or weight range> .
 5. Compressive Strength: [2500 psi (17 MPa)][5000 psi (34 MPa)]<Insert value> , minimum.
 6. Colors and Textures: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range] .
- C. Roof Pavers: Heavyweight, hydraulically pressed concrete units, [square edged][with top edges beveled 3/16 inch (5 mm)] , factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C140/C140M; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C67/C67M; and as follows:
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [Carlisle Coatings & Waterproofing Inc]
 - b. [Hanover Architectural Products]
 - c. [Roofblok Limited]
 - d. [Sunny Brook Pressed Concrete, Co.]
 - e. [Tile Tech Pavers]
 - f. [Wausau Tile, Inc.]
 - g. [Westile Roofing Products; an Oldcastle company]
 - h. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Carlisle Coatings & Waterproofing Inc]
 - b. [Hanover Architectural Products]
 - c. [Roofblok Limited]
 - d. [Sunny Brook Pressed Concrete, Co.]
 - e. [Tile Tech Pavers]
 - f. [Wausau Tile, Inc.]
 - g. [Westile Roofing Products; an Oldcastle company]
 - h. <Insert manufacturer's name>
 3. Size: [24 by 24 inches (600 by 600 mm)]<Insert dimensions> . Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
 4. Weight: <Insert value> .
 5. Compressive Strength: [7500 psi (52 MPa)][6500 psi (45 MPa)]<Insert value> , minimum.
 6. Colors and Textures: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range] .
- D. Ballast Retaining Bar: Perimeter securement system consisting of a slotted extruded-aluminum retention bar with an integrated compression fastening strip.
1. Fasteners: 1-1/2-inch (38-mm) stainless steel fasteners with neoprene washers.

2.11 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway **[pads][or][rolls]** , approximately **3/16 inch (5 mm)** thick and acceptable to roofing system manufacturer.
1. Size: Approximately **36 by 60 inches (900 by 1500 mm)**.
 2. Color: Contrasting with roofing membrane.
- B. Walkway Roof Pavers: Heavyweight, hydraulically pressed concrete units, **[square edged][with top edges beveled 3/16 inch (5 mm)]** , factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C140/C140M; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C67/C67M; and as follows:
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Hanover Architectural Products]**
 - b. **[Roofblok Limited]**
 - c. **[Sunny Brook Pressed Concrete, Co.]**
 - d. **[Wausau Tile, Inc.]**
 - e. **[Westile Roofing Products; an Oldcastle company]**
 - f. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Hanover Architectural Products]**
 - b. **[Roofblok Limited]**
 - c. **[Sunny Brook Pressed Concrete, Co.]**
 - d. **[Wausau Tile, Inc.]**
 - e. **[Westile Roofing Products; an Oldcastle company]**
 - f. **<Insert manufacturer's name>**
 3. Size: **[24 by 24 inches (600 by 600 mm)]<Insert dimensions>** . Manufacture pavers to dimensional tolerances of plus or minus **1/16 inch (1.6 mm)** in length, height, and thickness.
 4. Weight: **<Insert value>** .
 5. Compressive Strength: **[7500 psi (52 MPa)][6500 psi (45 MPa)]<Insert value>** , minimum.
 6. Colors and Textures: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]** .

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with roofing system Installer present, for compliance with requirements and other conditions affecting performance of the Work.
1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
4. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of **1/16 inch (1.6 mm)** out of plane relative to adjoining deck.
5. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
6. Verify that concrete substrate is visibly dry and free of moisture, and that minimum concrete internal relative humidity is not more than **[75]<Insert number>** percent, or as recommended by roofing system manufacturer, when tested in accordance with ASTM F2170.
 - a. Test Frequency: One test probe per each **[1000 sq. ft. (93 sq. m)]<Insert area>**, or portion thereof, of roof deck, with not less than three tests probes.
 - b. Submit test reports within 24 hours after performing tests.
7. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.
8. Verify that joints in precast concrete roof decks have been grouted flush with top of concrete.
9. Verify that minimum curing period recommended by roofing system manufacturer for lightweight insulating concrete roof decks has passed.
10. Verify any damaged sections of cementitious wood-fiber decks have been repaired or replaced.
11. Verify adjacent cementitious wood-fiber panels are vertically aligned to within **1/8 inch (3 mm)** at top surface.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation in accordance with roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Prime surface of concrete deck with primer in accordance with roofing system manufacturer's written installation instructions and allow primer to dry.
- D. Perform fastener-pullout tests in accordance with roofing system manufacturer's written instructions.
 1. Submit test result within 24 hours after performing tests.
 - a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.
- E. Install sound-absorbing insulation strips in ribs of acoustical steel roof deck in accordance with roof deck manufacturer's written instructions.

3.3 INSTALLATION OF THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING SYSTEM

- A. Install roofing system materials and components in accordance with roofing system manufacturer's written installation instructions, **[FM Approvals' RoofNav][SPRI's "Directory of Roof Assemblies"]** listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.
- C. Install roofing membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition [**and to not void warranty for existing roofing system**] .
- D. Coordinate installation and transition of roofing system component serving as an air barrier with wall system air barrier specified under [Section 072713 "**Modified Bituminous Sheet Air Barriers.**"] [Section 072715 "**Nonbituminous Self-Adhering Sheet Air Barriers.**"] [Section 072726 "**Fluid-Applied Membrane Air Barriers.**"]
- E. Substrate-Joint Penetrations: Prevent adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.4 INSTALLATION OF SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than **24 inches (600 mm)** in adjacent rows.
 - 1. Install substrate board at right angle to flutes of steel roof deck. Locate end joints over crests of steel roof deck.
 - 2. Tightly butt substrate boards together.
 - 3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 4. Fasten substrate board to top flanges of steel deck in accordance with manufacturer's written installation instructions and [FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's "Directory of Roof Assemblies" listed roof assembly requirements for specified wind-uplift load capacity] and FM Global Property Loss Prevention Data Sheet 1-29.
 - 5. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof in accordance with roofing system manufacturers' written installation instructions.
 - 6. Loosely lay substrate board over roof deck.

3.5 INSTALLATION OF VAPOR RETARDER

- A. Install vapor retarder in a single layer over roof area in accordance with manufacturer's written installation instructions, side and end lapping each sheet a minimum of **2 and 6 inches (50 and 150 mm)**, respectively.
 - 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 - 2. Continuously seal side and end laps with tape.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.6 INSTALLATION OF ROOF INSULATION AND ACCESSORIES

- A. Coordinate installation of roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written installation instructions. Install

minimum of two layers of insulation under area of roofing to achieve required thickness.

- C. Install each layer of insulation with **[joints staggered not less than 24 inches (600 mm) in adjacent rows][end joints staggered not less than 12 inches (300 mm) in adjacent rows]** and offset not less than **12 inches (300 mm)** from previous layer.
1. Trim insulation neatly to fit around penetrations and projections, and to fit tightly to intersecting sloping roof decks.
 2. Make joints between adjacent insulation boards not more than **1/4 inch (6 mm)** in width.
 3. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus **24 inches (600 mm)**.
 4. Trim insulation, so that water flow is unrestricted.
 5. Fill gaps exceeding **1/4 inch (6 mm)** with insulation.
 6. Cut and fit insulation within **1/4 inch (6 mm)** of nailers, projections, and penetrations.
 7. Secure insulation in accordance with **[FM Approvals' RoofNav for specified Windstorm Resistance Classification][SPRI's "Directory of Roof Assemblies" for specified wind-uplift load capacity]** .
 8. Secure insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
 9. Place **[thermal spacers and]** plates on insulation in required fastening patterns **[to achieve FM rating]** and secure in accordance with manufacturer's instructions.
 - a. Install plates and fasteners tight and flat to substrate with no dimpling, and with fastener extending **1 inch (25 mm)** minimum into roof deck; do not overdrive fasteners.
 10. Loosely lay each layer of insulation over substrate.

3.7 INSTALLATION OF COVER BOARD

- A. Install cover board over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of **6 inches (150 mm)** in each direction.
1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 4. Adhere cover board to substrate in accordance with **[FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification][SPRI's "Directory of Roof Assemblies" listed roof assembly requirements for specified wind-uplift load capacity]** and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Install slip sheet over cover board and beneath roofing membrane.
- C. Place plates on cover board in required fastening patterns **[to achieve FM rating]** and secure in accordance with roofing system manufacturer's written installation instructions.
1. Install plates and fasteners tight and flat to substrate with no dimpling, and with fastener extending **1 inch (25 mm)** minimum into roof deck; do not overdrive fasteners.

3.8 INSTALLATION OF ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Install conductive medium directly under roofing membrane in accordance with ASTM D7877 and ASTM D8231.
- B. Install sensors, connections, and accessory items required for complete continuously monitored moisture-detection system in accordance with manufacturer's written installation instructions.

3.9 INSTALLATION OF TPO ROOFING MEMBRANE SHEET

- A. Install roofing membrane over roof area for [**adhered**][**self-adhered**][**mechanically attached**][**loose-laid, ballasted**] application method in accordance with roofing system manufacturer's written installation instructions.
- B. Unroll roofing membrane and allow it to relax before installing.
- C. Start installation in presence of roofing system manufacturer's technical personnel [**and Owner's testing and inspection agency**] .
- D. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
- E. Adhered Application: Apply bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply to splice area of roofing membrane.
 - 1. In addition to adhering, mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roof area.
- F. Mechanically Attached Application: Secure roofing membrane over area to receive roofing in accordance with roofing system manufacturer's written installation instructions.
 - 1. Mechanically fasten or adhere roof membrane securely at terminations, penetrations, and perimeter of roofing.
 - 2. Induction-Weld Attachment: Secure roofing membrane to plates creating 100 percent bond between underside of membrane and top of plates; a partial bond is unacceptable. Test welds to verify adhesion of roofing membrane to top of plates in accordance with manufacturer's instructions.
- G. Loose-Laid, Ballasted Application: Comply with requirements in ANSI/SPRI RP-4 for [**System 1**][**System 2**][**System 3**] .
 - 1. [**Mechanically fasten**][**Adhere**] roofing membrane at perimeter, corners, and transitions in accordance with requirements in ANSI/SPRI RP-4.
 - 2. At corners and perimeters, omit aggregate ballast leaving roofing membrane exposed.
 - 3. At corners and perimeters, adhere a second layer of roofing membrane.
 - 4. Install protection mat over roofing membrane, overlapping a minimum of **6 inches (150 mm)**. Install an additional protection mat layer at projections, pipes, vents, and drains, overlapping a minimum of **12 inches (300 mm)**.
 - 5. Aggregate Ballast: Apply uniformly over roofing membrane at the rate required by roofing system manufacturer, but not less than the following, spreading with care to minimize possibility of damage to roofing system. Lay ballast as roof membrane is installed, leaving roof membrane ballasted at end of workday.

a. Ballast Weight:

- 1) Size 4 aggregate, **10 lb/sq. ft. (50 kg/sq. m)**.
- 2) Size 2 aggregate, **13 lb/sq. ft. (65 kg/sq. m)**, at corners and perimeter; Size 4 aggregate, **10 lb/sq. ft. (50 kg/sq. m)**, elsewhere.
- 3) Size 2 aggregate, **13 lb/sq. ft. (65 kg/sq. m)**.
- 4) Size 3 aggregate, **<Insert weight>** , at corners, **<Insert weight>** at perimeter, and **<Insert weight>** , elsewhere.

6. Roof-Paver Ballast: Install **[lightweight][heavyweight]** roof-paver ballast in accordance with manufacturer's written instructions.

7. Roof-Paver and Aggregate Ballast: Install heavyweight roof pavers in accordance with manufacturer's written instructions on roof corners and perimeter.

- a. Install Size 4 aggregate ballast elsewhere on roof membrane at a minimum rate of **10 lb/sq. ft. (50 kg/sq. m)**.
- b. Install Size 2 aggregate ballast elsewhere on roof membrane at a minimum rate of **13 lb/sq. ft. (65 kg/sq. m)**.

H. Seams and End Laps: Clean seam areas, overlap membrane, and hot-air-weld side seams and end laps of roofing membrane and sheet flashings to ensure a watertight installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane and sheet flashings.
2. Verify field strength of seams a minimum of **[twice]<Insert number of daily seam tests>** daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing membrane that do not comply with requirements.

I. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing membrane in place with clamping ring.

3.10 INSTALLATION OF BASE AND SHEET FLASHINGS

- A. General: Install and adhere base and sheet flashing and preformed flashing accessories to substrates in accordance with roofing system manufacturer's written installation instructions.
- B. Apply bonding adhesive to substrate and underside of flashings at required rate and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners.
- D. Clean seam areas, overlap, and firmly roll flashings into the adhesive. Hot-air-weld side seams and end laps to ensure a watertight installation.
- E. Terminate and seal top of flashings and mechanically anchor to substrate through termination bars.

3.11 INSTALLATION OF WALKWAYS

- A. Flexible Walkways: Install walkway products in accordance with manufacturer's written installation instructions.

1. Install flexible walkways at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - f. Locations indicated on Drawings.
 - g. As required by roofing membrane manufacturer's warranty requirements.
2. Provide **6-inch (75-mm)** clearance between adjoining pads.
3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive in accordance with roofing system manufacturer's written instructions.

B. Roof-Paver Walkways: Install walkway roof pavers in accordance with manufacturer's written installation instructions.

1. Install roof-paver walkways at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - f. Locations indicated on Drawings.
 - g. As required by roofing membrane manufacturer's warranty requirements.
2. Provide **3 inches (75 mm)** of space between adjacent roof pavers.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspect substrate conditions, surface preparation, and installation of roofing membrane, flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Tests and Inspections:
 1. ELD Testing: Testing agency surveys entire roof area and flashings to locate discontinuities in the roofing membrane using ELD in accordance with ASTM D7877 and ASTM D8231.
 - a. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
 2. Flood Testing: Flood test each roof area for leaks, in accordance with recommendations in ASTM D5957, after completing roofing and flashing but before overlying construction is placed. Install

temporary containment assemblies, plug or dam drains, and flood with potable water.

- a. Flood to an average depth of [2-1/2 inches (63 mm)]<Insert depth> with a minimum depth of [1 inch (25 mm)]<Insert depth> and not exceeding a depth of [4 inches (100 mm)]<Insert depth> . Maintain 2 inches (50 mm) of clearance from top of base flashing.
 - b. Flood each area for [24][48][72] hours.
 - c. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - d. Testing agency to prepare survey report indicating locations of initial leaks, if any, and final survey report.
3. Infrared Thermography Testing: Testing agency surveys entire roof area using infrared color thermography in accordance with ASTM C1153. Perform tests before overlying construction is placed.
- a. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or nuclear hydrogen detection testing.
 - b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report of initial scan indicating locations of entrapped moisture, if any.
4. Electrical Capacitance/Impedance Testing: Testing agency surveys entire roof area for entrapped water within roof assembly in accordance with ASTM D7954/D7954M. Perform tests before overlying construction is placed.
- a. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
5. Nuclear Hydrogen Detection Testing: Testing agency surveys entire roof area for entrapped water within roof assembly in accordance with ANSI/SPRI/RCI NT-1. Perform tests before overlying construction is placed.
- a. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

1. Notify Architect [**and Owner**] 48 hours in advance of date and time of inspection.
 - D. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
 - E. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.
 1. Roofing system will be considered defective if it does not pass tests and inspections.
 - F. Prepare test and inspection reports.
- 3.13 CLEANING
- A. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.
- 3.14 PROTECTION
- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
 - B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- 3.15 ROOFING SYSTEM INSTALLER'S WARRANTY
- A. WHEREAS _____ of _____, herein called the "Roofing System Installer," has performed roofing and associated Work on the following Project:
 1. Owner: **<Insert name of Owner>** .
 2. Owner Address: **<Insert address>** .
 3. Building Name/Type: **<Insert information>** .
 4. Building Address: **<Insert address>** .
 5. Area of Work: **<Insert information>** .
 6. Warranty Period: **[Two][Five]<Insert number>** years from date of Substantial Completion.
 7. Date of Substantial Completion: _____.
 - B. AND WHEREAS Roofing System Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said Work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
 - C. NOW THEREFORE Roofing System Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period, Roofing System Installer will, at Roofing System Installer's own cost and expense, make or cause to be made such repairs to or replacements of said Work as are necessary to correct faulty and defective work and as are necessary to maintain said Work in a watertight condition.
 - D. This Warranty is made subject to the following terms and conditions:



1. Specifically excluded from this Warranty are damages to Work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding <Insert mph (m/s)> ;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the Work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When Work has been damaged by any of foregoing causes, Warranty will be null and void until such damage has been repaired by Roofing System Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing System Installer is responsible for damage to Work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of Work.
4. During Warranty Period, if Owner allows alteration of Work by anyone other than Roofing System Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty will become null and void on date of said alterations, but only to the extent said alterations affect Work covered by this Warranty. If Owner engages Roofing System Installer to perform said alterations, Warranty will not become null and void unless Roofing System Installer, before starting said Work, will have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate Work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty will become null and void on date of said change, but only to the extent said change affects Work covered by this Warranty.
6. Owner will promptly notify Roofing System Installer of observed, known, or suspected leaks, defects, or deterioration and afford reasonable opportunity for Roofing System Installer to inspect Work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing System Installer on said Work and will not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty will not operate to relieve Roofing System Installer of responsibility for performance of original Work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 07 54 23 00

SECTION 07 55 52 13 - ATACTIC-POLYPROPYLENE (APP) MODIFIED BITUMINOUS PROTECTED MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Atactic-polypropylene (APP)-modified bituminous protected membrane roofing.
2. Base sheet materials.
3. Interply sheets.
4. Atactic-polypropylene (APP)-modified bituminous cap sheet.
5. Base flashing sheet materials.
6. Asphalt materials.
7. Accessory roofing materials.
8. Insulation accessories.
9. Coating materials.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 072100 "Thermal Insulation" for insulation beneath the roof deck.
3. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
4. Section 077100 "Roof Specialties" for **[premanufactured metal copings][fasciae][gravel stops][reglets][roof edge flashings][and][counterflashings]**.
5. Section 077129 "Manufactured Roof Expansion Joints" for premanufactured roof expansion-joint assemblies.
6. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
7. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.2 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at **[Project site]<Insert location>**.

1. Meet with Owner, Architect, **[Construction Manager,]** Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

**Atactic-Polypropylene (APP) Modified Bituminous
Protected Membrane Roofing**

- B. Preinstallation Roofing Conference: Conduct conference at **[Project site]<Insert location>**.
1. Meet with Owner, Architect, **[Construction Manager,]** Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness.
 5. Review structural loading limitations of roof deck during and after roofing.
 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
 7. Review governing regulations and requirements for insurance and certificates if applicable.
 8. Review temporary protection requirements for roofing system during and after installation.
 9. Review roof observation and repair procedures after roofing installation.

1.3 ACTION SUBMITTALS

- A. Product Data:
1. Atactic-polypropylene (APP)-modified bituminous protected membrane roofing.
 2. Base sheet materials.
 3. Interply sheets.
 4. Atactic-polypropylene (APP)-modified bituminous cap sheet.
 5. Base flashing sheet materials.
 6. Asphalt materials.
 7. Accessory roofing materials.
 8. Roof insulation.
 9. Insulation accessories.
 10. Electronic leak detection (ELD) materials.
 11. Coating materials.
 12. Ballast.
 13. For insulation, include copy of **[FM Approvals' RoofNav][SPRI's Directory of Roof Assemblies]** listing.
- B. Sustainable Design Submittals:
- C. Shop Drawings: Include plans, sections, details, and attachments to other work, including the following:
1. Layout and thickness of insulation.
 2. Base flashings and membrane terminations.
 3. Flashing details at penetrations.
 4. Tie-in with adjoining air barrier.
- D. Samples for Verification: For the following products:
1. Ballast in gradation **[and color]** indicated.
 2. Roof paver **[, full sized,]** in each color and texture required.
- E. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift

performance requirements.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For [Installer][manufacturer][and][testing agency].
- B. Manufacturer Certificates:
 - 1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.
 - 2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- C. Product Test Reports: For roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.
- D. Evaluation Reports: For components of roofing system, from ICC-ES.
- E. Field Test Reports:
 - 1. Concrete internal relative humidity test reports.
- F. Field quality-control reports.
- G. Sample Warranties: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.
- B. Certified statement from existing roof membrane manufacturer, stating that existing roof warranty has not been affected by Work performed under this Section.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is [UL listed][listed in FM Approvals' RoofNav][listed in SPRI's Directory of Roof Assemblies] for roofing system identical to that used for this Project.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
 - 1. Installer to employ on Project installers and supervisors certified through the NRCA/MRCA Certified Roofing Torch Applicator (CERTA) program.

1.7 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes roof membrane, base flashings, **[roof insulation,][vapor retarder,][roof pavers,]** and other components of roofing system.
 - 2. Warranty Period: **[10][15][20]<Insert number>** years from date of Substantial Completion.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system, such as roof membrane, base flashing, **[roof insulation,][vapor retarders,][and][roof pavers,]** for the following warranty period:
 - 1. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings to remain watertight.
 - 1. Accelerated Weathering: Roof membrane to withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
 - 2. Impact Resistance: Roof membrane to resist impact damage when tested according to ASTM D3746/D3746M, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- B. Material Compatibility: Roofing materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:
 - 1. Zone 1 (Roof Area Field): **<Insert lbf/sq. ft.>**.
 - 2. Zone 2 (Roof Area Perimeter): **<Insert lbf/sq. ft.>**.
 - a. Location: From roof edge to **<Insert dimension>** inside roof edge.
 - 3. Zone 3 (Roof Area Corners): **<Insert lbf/sq. ft.>**.

- a. Location: **<Insert dimension>** in each direction from each building corner.
 - D. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
 1. Fire/Windstorm Classification: **[Class 1A-60][Class 1A-75][Class 1A-90][Class 1A-105][Class 1A-120]<Insert class>**.
 2. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 **[MH][SH][VSH]**.
 - E. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in SPRI's Directory of Roof Assemblies for roof assembly identical for that specified for this Project.
 1. Wind Uplift Load Capacity: **[60 psf][75 psf][90 psf][105 psf][120 psf]<Insert capacity>**.
 - F. Energy Star Listing: Roofing pavers to be listed on the DOE's Energy Star "Roof Products Qualified Product List" for roof paver products.
 - G. Energy Performance: Roof pavers to have an initial solar reflectance of not less than **[0.70]<Insert value>** and an emissivity of not less than **[0.75]<Insert value>** when tested in accordance with ANSI/CRRC S100.
 - H. Exterior Fire-Test Exposure: ASTM E108 or UL 790, **[Class A][Class B][Class C]**; for application and roof slopes indicated; testing by a qualified testing agency.
 1. Identify products with appropriate markings of applicable testing agency.
 - I. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated.
 1. Identify products with appropriate markings of applicable testing agency.
- 2.2 ATACTIC-POLYPROPYLENE (APP)-MODIFIED BITUMINOUS PROTECTED MEMBRANE ROOFING
- A. Atactic-Polypropylene (APP)-Modified Bituminous Protected Membrane Roof System: See the following articles for individual roof materials required.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Bitec, Inc]**
 - b. **[CertainTeed; SAINT-GOBAIN]**
 - c. **[Elevate; Holcim Building Envelope]**
 - d. **[GAF]**
 - e. **[IKO Industries Inc.]**
 - f. **[Johns Manville; a Berkshire Hathaway company]**
 - g. **[Polyglass U.S.A., Inc.]**
 - h. **[Tremco Incorporated]**
 - i. **<Insert manufacturer's name>**

2.3 BASE SHEET MATERIALS

- A. APP-Modified Bitumen, Polyester-Mat Base Sheet: ASTM D6222/D6222M, Type I or II, Grade S, APP-modified asphalt sheet, reinforced with polyester fabric; smooth surfaced; suitable for cold adhesive application method.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Elevate; Holcim Building Envelope]**
 - b. **<Insert manufacturer's name>**
- B. APP-Modified Bitumen, Polyester-Mat Base Sheet, Torch: ASTM D6222/D6222M, Type I or II, Grade S, APP-modified asphalt sheet, reinforced with polyester fabric; smooth surfaced; suitable for torch application method.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Bitec, Inc]**
 - b. **[CertainTeed; SAINT-GOBAIN]**
 - c. **[Elevate; Holcim Building Envelope]**
 - d. **[GAF]**
 - e. **[IKO Industries Inc.]**
 - f. **[Johns Manville; a Berkshire Hathaway company]**
 - g. **[Polyglass U.S.A., Inc.]**
 - h. **[Tremco Incorporated]**
 - i. **<Insert manufacturer's name>**
- C. APP-Modified Bitumen Type I, Polyester- and Glass-Fiber-Mat Base Sheet: ASTM D6223/D6223M, Type I, Grade S, APP-modified asphalt sheet, reinforced with a combination of polyester fabric and glass fibers; smooth surfaced; suitable for cold adhesive application.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **[Performance Roof Systems]**
 - c. **<Insert manufacturer's name>**
- D. APP-Modified Bitumen Type I, Polyester- and Glass-Fiber-Mat Base Sheet, Torch: ASTM D6223/D6223M, Type I, Grade S, APP-modified asphalt sheet, reinforced with a combination of polyester fabric and glass fibers; smooth surfaced; suitable for torch application.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. **[Performance Roof Systems]**
 - b. **<Insert manufacturer's name>**
- E. APP-Modified Bitumen Type II, Polyester- and Glass-Fiber-Mat Base Sheet: ASTM D6223/D6223M, Type II, Grade S, APP-modified asphalt sheet, reinforced with a combination of polyester fabric and glass fibers; smooth surfaced; suitable for cold adhesive application method.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **[Performance Roof Systems]**
 - c. **<Insert manufacturer's name>**
- F. APP-Modified Bitumen Type II, Polyester- and Glass-Fiber-Mat Base Sheet, Torch: ASTM D6223/D6223M, Type II, Grade S, APP-modified asphalt sheet, reinforced with a combination of polyester fabric and glass fibers; smooth surfaced; suitable for torch application method.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **[Performance Roof Systems]**
 - c. **<Insert manufacturer's name>**
- G. APP-Modified Bitumen, Glass-Fiber-Mat Base Sheet: ASTM D6509/D6509M, APP-modified asphalt sheet, reinforced with glass fibers; suitable for cold adhesive application method.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Elevate; Holcim Building Envelope]**
 - b. **[Johns Manville; a Berkshire Hathaway company]**
 - c. **[Performance Roof Systems]**
 - d. **<Insert manufacturer's name>**
- H. APP-Modified Bitumen, Glass-Fiber-Mat Base Sheet, Torch: ASTM D6509/D6509M, APP-modified asphalt sheet, reinforced with glass fibers; suitable for torch application method.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Bitec, Inc]**
 - b. **[CertainTeed; SAINT-GOBAIN]**
 - c. **[Elevate; Holcim Building Envelope]**
 - d. **[Performance Roof Systems]**
 - e. **[Tremco Incorporated]**

f. <Insert manufacturer's name>

- I. Asphalt-Coated, Glass-Fiber-Mat, Venting Base Sheet: ASTM D4897/D4897M, Type II, venting, nonperforated, asphalt-impregnated and -coated, glass-fiber base sheet with mineral granule surfacing on bottom surface.

2.4 ATACTIC-POLYPROPYLENE (APP)-MODIFIED BITUMINOUS CAP SHEET

- A. APP-Modified Bitumen, Polyester-Mat, Smooth-Surfaced Cap Sheet: ASTM D6222/D6222M, Type I or II, Grade S, APP-modified asphalt sheet, reinforced with polyester fabric; suitable for cold adhesive application method.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. **[Elevate; Holcim Building Envelope]**
- b. **[Tremco Incorporated]**
- c. **<Insert manufacturer's name>**

- B. APP-Modified Bitumen, Polyester-Mat, Smooth-Surfaced Cap Sheet, Torch: ASTM D6222/D6222M, Type I or II, Grade S, APP-modified asphalt sheet, reinforced with polyester fabric; suitable for torch application method.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. **[Bitec, Inc]**
- b. **[CertainTeed; SAINT-GOBAIN]**
- c. **[Elevate; Holcim Building Envelope]**
- d. **[GAF]**
- e. **[IKO Industries Inc.]**
- f. **[Johns Manville; a Berkshire Hathaway company]**
- g. **[Polyglass U.S.A., Inc.]**
- h. **[Tremco Incorporated]**
- i. **<Insert manufacturer's name>**

- C. APP-Modified Bitumen Type I, Polyester- and Glass-Fiber-Mat, Smooth-Surfaced Cap Sheet: ASTM D6223/D6223M, Type I, Grade S, APP-modified asphalt sheet, reinforced with a combination of polyester fabric and glass fibers; suitable for cold adhesive application method.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. **[Johns Manville; a Berkshire Hathaway company]**
- b. **[Performance Roof Systems]**
- c. **<Insert manufacturer's name>**

- D. APP-Modified Bitumen Type I, Polyester- and Glass-Fiber-Mat, Smooth-Surfaced Cap Sheet, Torch: ASTM D6223/D6223M, Type I, Grade S, APP-modified asphalt sheet, reinforced with a combination of polyester fabric and glass fibers; suitable for torch application method.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Elevate; Holcim Building Envelope]**
 - b. **[Performance Roof Systems]**
 - c. **<Insert manufacturer's name>**
- E. APP-Modified Bitumen Type II, Polyester- and Glass-Fiber-Mat, Smooth-Surfaced Cap Sheet: ASTM D6223/D6223M, Type II, Grade S, APP-modified asphalt sheet, reinforced with a combination of polyester fabric and glass fibers; suitable for cold adhesive application method.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Elevate; Holcim Building Envelope]**
 - b. **[Performance Roof Systems]**
 - c. **<Insert manufacturer's name>**
- F. APP-Modified Bitumen Type II, Polyester- and Glass-Fiber-Mat, Smooth-Surfaced Cap Sheet, Torch: ASTM D6223/D6223M, Type II, Grade S, APP-modified asphalt sheet, reinforced with a combination of polyester fabric and glass fibers; suitable for torch application method.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Performance Roof Systems]**
 - b. **<Insert manufacturer's name>**
- G. APP-Modified Bitumen, Polyester-Mat, Granule-Surfaced Cap Sheet: ASTM D6222/D6222M, Type I or II, Grade G, APP-modified asphalt sheet, reinforced with polyester fabric; suitable for cold adhesive application method.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Elevate; Holcim Building Envelope]**
 - b. **[Tremco Incorporated]**
 - c. **<Insert manufacturer's name>**
 2. Granule Material: Mineral **[ceramic coated][slate]**.
 3. Granule Color: **[White][Gray][Tan]<Insert color>**.

2.5 BASE FLASHING SHEET MATERIALS

- A. Asphalt-Coated, Glass-Fiber-Mat Backer Sheet: ASTM D4601/D4601M, **[Type I][Type II]**, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.
- B. Asphalt-Coated, Organic-Felt Backer Sheet: ASTM D2626/D2626M, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides.
- C. APP-Modified Bitumen Backer Sheet: **[ASTM D6222/D6222M, Type I or II, Grade S, reinforced with polyester fabric][ASTM D6223/D6223M, Type I or II, Grade S, reinforced with a combination of polyester fabric and glass fibers]**; smooth surfaced; suitable for application method specified.
- D. APP-Modified Bitumen, Smooth-Surfaced Flashing Sheet: **[ASTM D6222/D6222M, Type I or II, Grade S, reinforced with polyester fabric][ASTM D6223/D6223M, Type I, Grade S, reinforced with a combination of polyester fabric and glass fibers][ASTM D6223/D6223M, Type II, Grade S, reinforced with a combination of polyester fabric and glass fibers]**; smooth surfaced; suitable for application method specified.
- E. APP-Modified Bitumen, Granule-Surfaced Flashing Sheet: **[ASTM D6222/D6222M, Type I or II, Grade G, reinforced with polyester fabric][ASTM D6223/D6223M, Type I, Grade G, reinforced with a combination of polyester fabric and glass fibers][ASTM D6223/D6223M, Type II, Grade G, reinforced with a combination of polyester fabric and glass fibers]**; granule surfaced; suitable for application method specified, and as follows:
 - 1. Granule Color: **[White][Gray][Tan]<Insert color>**.
- F. Glass-Fiber Fabric: Woven glass-fiber cloth, treated with asphalt, complying with ASTM D1668/D1668M, Type I.
- G. Liquid Flashing System: Roof membrane manufacturer's standard one- or two-part moisture curing resin with low solvent content, consisting of a primer, flashing cement, and scrim.

2.6 ASPHALT MATERIALS

- A. Asphalt Primer: ASTM D41/D41M.
- B. Roofing Asphalt: ASTM D312/D312M, **[Type III][Type IV][Type III or IV as recommended by roofing system manufacturer for application]**.
- C. SEBS-Modified Roofing Asphalt: ASTM D6152/D6152M.

2.7 ACCESSORY ROOFING MATERIALS

- A. General: Accessory materials recommended by roofing manufacturer for intended use and compatible with other roofing components.
 - 1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
- B. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
- C. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars,

approximately 1 by 1/8 inch thick; with anchors.

1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- D. Cold-Applied Trichloroethylene Asphalt Adhesive: ASTM D3019, Type III, roof membrane manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with **[roofing membrane][and][base flashings]**.
- E. Cold-Applied Polymer-Modified Asphalt Adhesive: Roof membrane manufacturer's standard solvent-and asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with roofing components.
- F. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required by roofing system manufacturer for application.
- G. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying.
- H. Insulation Cant Strips: **[ASTM C728, perlite insulation board][ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board]**.
- I. Metal Flashing Sheet: As specified in Section 076200 "Sheet Metal Flashing and Trim."
- J. Separator Sheet: Polyethylene sheet, **4 mils** thick, minimum.
- K. Miscellaneous Accessories: Provide accessories recommended by roofing system manufacturer.

2.8 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured **[or approved]** by roof membrane manufacturer, **[approved for use in FM Approvals' RoofNav listed roof assemblies][, approved for use in SPRI's Directory of Roof Assemblies listed roof assemblies]**.

2.9 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with other roofing system components.
- B. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation; type and weight as recommended by roofing system manufacturer for application.
- C. Metal Securement System: Perimeter securement flashing and strapping fabricated from **3-inch-** wide stainless steel, a minimum of **0.031 inch** thick. Provide fasteners as recommended by mortar-faced insulation manufacturer.

2.10 ELECTRONIC LEAK DETECTION (ELD) MATERIALS

2.11 COATING MATERIALS

- A. Roof Coating:

1. ASTM D1227, Type II, **[Class 1, mineral-colloid-emulsified, fibered][Class 2, chemically emulsified, filled or fibered]** asphalt emulsion, asbestos free.
2. ASTM D1227, Type III, **[Class 1, mineral-colloid-emulsified][Class 2, chemically emulsified]** asphalt emulsion, nonfibered.
3. ASTM D2824/D2824M, **[Type I, nonfibered][Type III, fibered, asbestos-free]**, aluminum-pigmented asphaltic coating.
4. ASTM D6083, acrylic elastomer emulsion coating, formulated for use on bituminous roof surfaces.
 - a. Color: **[White][Gray][Tan]<Insert color>**.

2.12 BALLAST

- A. Aggregate Ballast: **[Smooth, washed riverbed gravel or other acceptable smooth-faced stone][Crushed, washed gravel or crushed stone]** that withstands weather exposure without significant deterioration and does not contribute to membrane degradation; of the following size:
 1. Size: ASTM D448, **[Size 2, ranging in size from 1-1/2 to 2-1/2 inches][Size 4, ranging in size from 3/4 to 1-1/2 inches][Size 5, ranging in size from 1/2 to 1 inch]**.

PART 3 - EXECUTION**3.1 INSTALLATION OF ROOFING, GENERAL**

- A. Install roofing system according to roofing system manufacturer's written instructions, applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing," **[FM Approvals' RoofNav][SPRI's Directory of Roof Assemblies]** listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast.
 1. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roof membrane and accessory materials to tie in to existing roofing to maintain weathertightness of transition **[and to not void warranty for existing roofing system]**.
- D. Coordinate installation and transition of roofing system component serving as an air barrier, with air barrier specified in **[Section 072713 "Modified Bituminous Sheet Air Barriers."][Section 072715 "Nonbituminous Self-Adhering Sheet Air Barriers."][Section 072726 "Fluid-Applied Membrane Air Barriers."]**
- E. Start installation of roofing in presence of manufacturer's technical personnel **[and Owner's testing and inspection agency]**.
- F. Where roof slope exceeds **[1/2 inch per 12 inches][3/4 inch per 12 inches]<Insert slope>**, install roofing sheets parallel with slope.
- G. Coordinate installation of roofing system, so components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is

forecast.

1. Provide tie-offs at end of each day's work to cover exposed roofing sheets with a course of coated felt set in roofing cement[**or hot roofing asphalt**], with joints and edges sealed.
 2. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system.
 3. Remove and discard temporary seals before beginning work on adjoining roofing.
- H. Asphalt Heating: Heat asphalt to its equiviscous temperature, measured at the mop cart or mechanical spreader immediately before application.
1. Circulate asphalt during heating.
 2. Do not raise roofing asphalt temperature above equiviscous temperature range more than one hour before time of application.
 3. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating.
 4. Do not heat roofing asphalt within **25 deg F** of flash point.
 5. Discard roofing asphalt maintained at a temperature exceeding finished blowing temperature for more than four hours.
 6. Apply hot roofing asphalt within plus or minus **25 deg F** of equiviscous temperature.
- I. SEBS-Modified Asphalt Heating: Heat and apply roofing asphalt according to roofing system manufacturer's written instructions.
- J. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.2 INSTALLATION OF ELD COMPONENTS

- A. Install conductive medium over [**cover board**][**insulation**][**and on vertical locations to receive roof membrane**] in accordance with manufacturer's written instructions.
- B. Install sensors, [**wire loop**][**conductive fabric**], connections, and accessory items required for complete system in accordance with manufacturer's written instructions.

3.3 INSTALLATION OF BASE SHEET

- A. Before installing, unroll base sheet, cut into workable lengths, and allow to lie flat for a time period recommended by manufacturer for the ambient temperature.
- B. Install lapped base-sheet course, extending sheet over and terminating above cants.
1. Install base sheet in a shingle fashion.
 2. Adhere to substrate in a uniform coating of cold-applied adhesive.
 3. Torch-apply to substrate.
 - a. Perform torch application according to NFPA 241, including two-hour fire watch after torches have been extinguished.
 4. Install base sheet without wrinkles, tears, or air pockets.
 5. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps.

- a. Lap side laps as recommended by roof membrane manufacturer but not less than **3 inches**.
 - b. Lap end laps as recommended by roof membrane manufacturer but not less than **12 inches**.
 - c. Stagger end laps not less than **18 inches**.
 - d. **[Heat-weld end laps,][Completely bond and seal laps,]** leaving no voids.
 - e. Roll laps with a **20-pound** roller.
6. Repair tears and voids in laps and lapped seams not completely sealed.
 7. Apply pressure to the body of the base sheet according to manufacturer's instructions, to remove air pockets and to result in complete adhesion of base sheet to substrate.

C. Installation of Vented Base Sheet:

1. Spot or strip mop to substrate with hot roofing asphalt vented base sheet, with vented side down.
 - a. Fasten vented base sheet according to requirements in **[FM Approvals' RoofNav for specified Windstorm Resistance Classification][SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity]**.
 - b. Fasten vented base sheet to resist uplift pressure at corners, perimeter, and field of roof.

3.4 INSTALLATION OF INTERPLY SHEETS

- A. Install **[two][three]** ply sheets, starting at low point of roofing.
1. Align ply sheets without stretching.
 2. Shingle side laps of ply sheets uniformly to achieve required number of plies throughout thickness of roofing membrane.
 - a. Shingle in direction to shed water.
 3. Extend ply sheets over and terminate above cants.
 4. Embed each ply sheet in a solid mopping of hot roofing asphalt applied at rate required by roofing manufacturer, to form a uniform membrane without ply sheets touching.

3.5 INSTALLATION OF ATACTIC-POLYPROPYLENE (APP)-MODIFIED BITUMINOUS CAP SHEET

- A. Before installing, unroll cap sheet, cut into workable lengths, and allow to lie flat for a time period recommended by manufacturer for the ambient temperature at which cap sheet will be installed.
- B. Install modified bituminous roofing cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system.
1. Extend cap sheet over and terminate above cants.
 2. Install cap sheet in a shingle fashion.
 3. Install cap sheet as follows:
 - a. Adhere to substrate in a uniform coating of cold-applied adhesive.
 - b. Torch-apply to substrate.
 - 1) Perform torch application according to NFPA 241, including two-hour fire watch after

torches have been extinguished.

4. Install cap sheet without wrinkles tears, or air pockets.
 5. Install cap sheet, so side and end laps shed water.
- C. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps.
1. Lap side laps as recommended by roof membrane manufacturer but not less than **3 inches**.
 2. Lap end laps as recommended by roof membrane manufacturer but not less than **12 inches**.
 3. Stagger end laps not less than **18 inches**.
 4. **[Heat-weld end laps,][Completely bond and seal laps,]** leaving no voids.
 5. Roll laps with a **20-pound** roller.
 6. Repair tears and voids in laps and lapped seams not completely sealed.
- D. Apply pressure to the body of the cap sheet according to manufacturer's instructions, to remove air pockets and to result in complete adhesion of base sheet to substrate.

3.6 INSTALLATION OF FLASHING AND STRIPPING

- A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof; secure to substrates according to roofing system manufacturer's written instructions and as follows:
1. Prime substrates with asphalt primer if required by roofing system manufacturer.
 2. Backer Sheet Application: **[Mechanically fasten backer sheet to walls or parapets. Adhere backer sheet over roofing membrane at cants][Adhere backer sheet to substrate]** in **[a solid mopping of hot roofing asphalt][cold-applied adhesive][cold-applied polymer-modified adhesive]**.
 - a. Seal all laps.
 3. Flashing Sheet Application, Cold: Adhere flashing sheet to substrate in **[cold-applied adhesive][asphalt roofing cement]**.
 4. Flashing Sheet Application, Hot: Torch-apply flashing sheet to substrate.
 - a. Perform torch application according to NFPA 241, including two-hour fire watch after torches have been extinguished.
- B. Extend base flashing up walls or parapets a minimum of **8 inches** above roofing membrane and **4 inches** onto field of roofing membrane.
- C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
1. Seal top termination of base flashing **[with a strip of glass-fiber fabric set in asphalt roofing cement]**.
- D. Install liquid flashing system according to manufacturer's recommendations.
1. Extend liquid flashing not less than **3 inches** in all directions from edges of item being flashed.
 2. Embed granules, matching color of roof membrane, into wet compound.
- E. Install roofing cap sheet stripping where metal flanges and edgings are set on roofing according to roofing system manufacturer's written instructions.

- F. Roof Drains: Set **[30-by-30-inch]<Insert dimensions> 4-pound** lead flashing in bed of asphaltic adhesive on roofing.

1. Cover lead flashing with roofing cap sheet stripping, and extend a minimum of **[4 inches][6 inches]** beyond edge of metal flashing onto field of roofing.
2. Clamp roofing, metal flashing, and stripping into roof-drain clamping ring.
3. Install stripping according to roofing system manufacturer's written instructions.

3.7 INSTALLATION OF COATINGS

- A. Apply coating to base flashings according to manufacturer's written instructions, by spray, roller, or other suitable application method.

3.8 INSTALLATION OF INSULATION

- A. Loosely lay separator sheet over cooled roofing membrane, with minimum **2-inch** side laps and **4-inch** end laps.
- B. Loosely lay insulation over roof membrane, with long joints of insulation in continuous straight lines and with end joints staggered not less than **12 inches** between rows.

1. Make joints between adjacent insulation boards not more than **1/4 inch** in width.
2. Fill gaps exceeding **1/4 inch** with insulation.
3. Cut and fit insulation within **1/4 inch** of nailers, projections, and penetrations.

- C. Install upper layer of insulation with joints of each layer offset not less than **12 inches** from previous layer of insulation.

1. Install with long joints continuous and with end joints staggered not less than **12 inches** in adjacent rows.
2. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
3. Make joints between adjacent insulation boards not more than **1/4 inch** in width.
4. Fill gaps exceeding **1/4 inch** with insulation.
5. Cut and fit insulation within **1/4 inch** of nailers, projections, and penetrations.

- D. Install protection layer over insulation, overlapping edges and ends at least **12 inches**.

1. Do not lap ends of fabric sheets within **72 inches** of roof perimeter.
2. Extend fabric **2 to 3 inches** above ballast at perimeter and penetrations.
3. Apply additional layer of fabric around penetrations to prevent aggregate from getting between penetration and insulation.
4. Do not cover drains or restrict water flow to drains.

3.9 INSTALLATION OF ROOF PAVERS

- A. Interlocking Roof Pavers: Install interlocking roof pavers over roofed area according to manufacturer's written instructions.
- B. Install roof pavers over roofed area according to insulation manufacturer's written instructions.

1. Mechanically fasten securement strapping to center of first two perimeter rows and first two perimeter corner rows of roof pavers in each direction from corner, closest to edge of roof, using straps running parallel to parapet wall or roof edge.
- C. Install roof pavers on pedestals set according to pedestal manufacturer's written instructions.

3.10 INSTALLATION OF MORTAR-FACED BOARD INSULATION

- A. Install mortar-faced board insulation loosely laid, according to manufacturer's written instructions, with tongue-and-groove joints nested.
 1. Stagger end joints of adjoining rows and abut insulation.
 2. Mechanically fasten metal securement strapping at penetrations and at perimeter edges of mortar-faced board insulation.
 3. Over mortar-faced board insulation, install roof pavers on roof perimeter and corners according to manufacturer's written instructions.
- B. Install **[one row][two rows]** of **24-inch-** wide roof pavers to roof perimeter, corners, and penetrations according to mortar-faced board insulation manufacturer's written instructions.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Perform the following tests:
 1. Flood Testing: Flood test each roofing area for leaks, according to recommendations in ASTM D5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - a. Perform tests before overlying construction is placed.
 - b. Flood to an average depth of **[2-1/2 inches]<Insert depth>** with a minimum depth of **[1 inch]<Insert depth>** and not exceeding a depth of **[4 inches]<Insert depth>**. Maintain **2 inches** of clearance from top of base flashing.
 - c. Flood each area for **[24][48][72]** hours.
 - d. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is the responsibility of the Contractor.
 - e. Testing agency to prepare survey report indicating locations of initial leaks, if any, and final survey report.
 2. Infrared Thermography: Testing agency surveys entire roof area using infrared color thermography in accordance with ASTM C1153.
 - a. Perform tests before overlying construction is placed.
 - b. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or nuclear hydrogen detection tests.
 - c. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing

installations are watertight.

- 1) Cost of retesting is Contractor's responsibility.
- d. Testing agency to prepare survey report of initial scan indicating locations of entrapped moisture, if any.
3. Electrical Capacitance/Impedance Testing: Testing agency surveys entire roof area for entrapped water within roof assembly according to ASTM D7954/D7954M.
 - a. Perform tests before overlying construction is placed.
 - b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
4. Nuclear Hydrogen Detection Testing: Testing agency surveys entire roof area for entrapped water within roof assembly according to ANSI/SPRI/RCI NT-1.
 - a. Perform tests before overlying construction is placed.
 - b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
5. Low-Voltage Electrical Conductance Testing: Testing agency surveys entire roof area and flashings to locate discontinuities in the roof membrane using low-voltage **[horizontal membrane scanning platform][membrane electric field vector mapping][or][vertical membrane scanning]** in accordance with ASTM D8231.
 - a. Perform tests before overlying construction is placed.
 - b. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
6. High-Voltage Membrane Testing: Testing agency surveys entire **[roof area,][flashings,][and][parapet walls]** to locate discontinuity in the roof membrane using an electrically charged metal "broom head."
 - a. Perform tests before overlying construction is placed.
 - b. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.

- C. Test Cuts: Test specimens will be removed to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:
 - 1. Determine approximate quantities of components within roofing membrane according to ASTM D3617/D3617M.
 - 2. Examine test specimens for interply voids according to ASTM D3617/D3617M and to comply with criteria established in Appendix 3 in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
 - 3. Repair areas where test cuts were made according to roofing system manufacturer's written instructions.
- D. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
 - 1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
- E. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- F. Roofing system will be considered defective if it does not pass tests and inspections.
 - 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

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SECTION 07 55 52 16 - STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS PROTECTED MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Styrene-butadiene-styrene (SBS)-modified bituminous protected membrane roofing.
2. Base sheet materials.
3. Interply sheets.
4. Styrene-butadiene-styrene (SBS)-modified bituminous cap sheet.
5. Base flashing sheet materials.
6. Asphalt materials.
7. Accessory roofing materials.
8. Insulation accessories.
9. Coating materials.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 072100 "Thermal Insulation" for insulation beneath the roof deck.
3. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
4. Section 077100 "Roof Specialties" for **[premanufactured metal copings][fasciae][gravel stops][reglets][roof edge flashings][and][counterflashings]**.
5. Section 077129 "Manufactured Roof Expansion Joints" for premanufactured roof expansion-joint assemblies.
6. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
7. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.2 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at **[Project site]<Insert location>**.

1. Meet with Owner, Architect, **[Construction Manager,]** Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

**Styrene-Butadiene-Styrene (SBS) Modified Bituminous
Protected Membrane Roofing**

- B. Preinstallation Roofing Conference: Conduct conference at **[Project site]<Insert location>**.
1. Meet with Owner, Architect, **[Construction Manager,]** Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness.
 5. Review structural loading limitations of roof deck during and after roofing.
 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
 7. Review governing regulations and requirements for insurance and certificates if applicable.
 8. Review temporary protection requirements for roofing system during and after installation.
 9. Review roof observation and repair procedures after roofing installation.

1.3 ACTION SUBMITTALS

- A. Product Data:
1. Styrene-butadiene-styrene (SBS)-modified bituminous protected membrane roofing.
 2. Base sheet materials.
 3. Interply sheets.
 4. Styrene-butadiene-styrene (SBS)-modified bituminous cap sheet.
 5. Base flashing sheet materials.
 6. Asphalt materials.
 7. Accessory roofing materials.
 8. Roof insulation.
 9. Insulation accessories.
 10. Electronic leak detection (ELD) materials.
 11. Coating materials.
 12. Ballast.
 13. For insulation, include copy of **[FM Approvals' RoofNav][SPRI's Directory of Roof Assemblies]** listing.
- B. Sustainable Design Submittals:
1. Third-Party Certifications: For each product.
 2. Third-Party Certified Life Cycle Assessment: For each product.
- C. Shop Drawings: Include plans, sections, details, and attachments to other work, including the following:
1. Layout and thickness of insulation.
 2. Base flashings and membrane terminations.
 3. Flashing details at penetrations.
 4. Tie-in with adjoining air barrier.
- D. Samples for Verification: For the following products:
1. Ballast in gradation **[and color]** indicated.

2. Roof paver[, **full sized,**] in each color and texture required.

E. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For [Installer][manufacturer][and][testing agency].

B. Manufacturer Certificates:

1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.
2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

C. Product Test Reports: For roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.

D. Evaluation Reports: For components of roofing system, from ICC-ES.

E. Field Test Reports:

1. Concrete internal relative humidity test reports.

F. Field quality-control reports.

G. Sample Warranties: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

B. Certified statement from existing roof membrane manufacturer, stating that existing roof warranty has not been affected by Work performed under this Section.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is [UL listed][listed in FM Approvals' RoofNav][listed in SPRI's Directory of Roof Assemblies] for roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1. Installer to employ on Project installers and supervisors certified through the NRCA/MRCA Certified Roofing Torch Applicator (CERTA) program.

1.7 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes roof membrane, base flashings, **[roof insulation,][vapor retarder,][roof pavers,]** and other components of roofing system.
 - 2. Warranty Period: **[10][15][20]<Insert number>** years from date of Substantial Completion.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system, such as roof membrane, base flashing, **[roof insulation,][vapor retarders,][and][roof pavers,]** for the following warranty period:
 - 1. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings to remain watertight.
 - 1. Accelerated Weathering: Roof membrane to withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
 - 2. Impact Resistance: Roof membrane to resist impact damage when tested according to ASTM D3746/D3746M, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- B. Material Compatibility: Roofing materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:
 - 1. Zone 1 (Roof Area Field): **<Insert lbf/sq. ft.>**.
 - 2. Zone 2 (Roof Area Perimeter): **<Insert lbf/sq. ft.>**.
 - a. Location: From roof edge to **<Insert dimension>** inside roof edge.
 - 3. Zone 3 (Roof Area Corners): **<Insert lbf/sq. ft.>**.

- a. Location: **<Insert dimension>** in each direction from each building corner.
- D. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
1. Fire/Windstorm Classification: **[Class 1A-60][Class 1A-75][Class 1A-90][Class 1A-105][Class 1A-120]<Insert class>**.
 2. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 **[MH][SH][VSH]**.
- E. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in SPRI's Directory of Roof Assemblies for roof assembly identical for that specified for this Project.
1. Wind Uplift Load Capacity: **[60 psf][75 psf][90 psf][105 psf][120 psf]<Insert capacity>**.
- F. Energy Star Listing: Roof pavers to be listed on the DOE's Energy Star "Roof Products Qualified Product List" for roof paver products.
- G. Energy Performance: Roof pavers to have an initial solar reflectance of not less than **[0.70]<Insert value>** and an emissivity of not less than **[0.75]<Insert value>** when tested in accordance with ANSI/CRRC S100.
- H. Exterior Fire-Test Exposure: ASTM E108 or UL 790, **[Class A][Class B][Class C]**; for application and roof slopes indicated; testing by a qualified testing agency.
1. Identify products with appropriate markings of applicable testing agency.
- I. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated.
1. Identify products with appropriate markings of applicable testing agency.
- 2.2 STYRENE-BUTADIENE-STYRENE (SBS)-MODIFIED BITUMINOUS PROTECTED MEMBRANE ROOFING
- A. Styrene-Butadiene-Styrene (SBS)-Modified Bituminous Protected Membrane Roof System: See the following articles for individual roof materials required.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Bitec, Inc]**
 - b. **[Elevate; Holcim Building Envelope]**
 - c. **[GAF]**
 - d. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - e. **[IKO Industries Inc.]**
 - f. **[Johns Manville; a Berkshire Hathaway company]**
 - g. **[Polyglass U.S.A., Inc.]**

- h. **[Tremco Incorporated]**
- i. **<Insert manufacturer's name>**

2.3 BASE SHEET MATERIALS

- A. SBS-Modified Bitumen Type I, Polyester-Mat Base Sheet: ASTM D6164/D6164M, Type I, Grade S, SBS-modified asphalt sheet, reinforced with polyester fabric; smooth surfaced; suitable for cold adhesive or hot asphalt application method.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Bitec, Inc]**
 - b. **[Elevate; Holcim Building Envelope]**
 - c. **[GAF]**
 - d. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - e. **[IKO Industries Inc.]**
 - f. **[Johns Manville; a Berkshire Hathaway company]**
 - g. **[Polyglass U.S.A., Inc.]**
 - h. **[Tremco Incorporated]**
 - i. **<Insert manufacturer's name>**
- B. SBS-Modified Bitumen Type I, Polyester-Mat Base Sheet, Torch: ASTM D6164/D6164M, Type I, Grade S, SBS-modified asphalt sheet, reinforced with polyester fabric; smooth surfaced; suitable for torch application method.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Elevate; Holcim Building Envelope]**
 - b. **[GAF]**
 - c. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - d. **[IKO Industries Inc.]**
 - e. **[Johns Manville; a Berkshire Hathaway company]**
 - f. **[Polyglass U.S.A., Inc.]**
 - g. **<Insert manufacturer's name>**
- C. SBS-Modified Bitumen Type II, Polyester-Mat Base Sheet: ASTM D6164/D6164M, Type II, Grade S, SBS-modified asphalt sheet, reinforced with polyester fabric; smooth surfaced; suitable for cold adhesive or hot asphalt application method.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Elevate; Holcim Building Envelope]**

- b. [GAF]
 - c. [Polyglass U.S.A., Inc.]
 - d. <Insert manufacturer's name>
- D. SBS-Modified Bitumen Type II, Polyester-Mat Base Sheet, Torch: ASTM D6164/D6164M, Type II, Grade S, SBS-modified asphalt sheet, reinforced with polyester fabric; smooth surfaced; suitable for torch application method.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. [Johns Manville; a Berkshire Hathaway company]
 - b. [Polyglass U.S.A., Inc.]
 - c. <Insert manufacturer's name>
- E. SBS-Modified Bitumen Type I, Glass-Fiber-Mat Base Sheet: ASTM D6163/D6163M, Type I, Grade S, SBS-modified asphalt sheet, reinforced with glass fibers fabric; smooth surfaced; suitable for cold adhesive or hot asphalt application method.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. [Bitec, Inc]
 - b. [CertainTeed; SAINT-GOBAIN]
 - c. [Elevate; Holcim Building Envelope]
 - d. [GAF]
 - e. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
 - f. [IKO Industries Inc.]
 - g. [Johns Manville; a Berkshire Hathaway company]
 - h. [Polyglass U.S.A., Inc.]
 - i. [Siplast]
 - j. <Insert manufacturer's name>
- F. SBS-Modified Bitumen Type I, Glass-Fiber-Mat Base Sheet, Torch: ASTM D6163/D6163M, Type I, Grade S, SBS-modified asphalt sheet, reinforced with glass fibers; smooth surfaced; suitable for torch application method.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. [CertainTeed; SAINT-GOBAIN]
 - b. [Elevate; Holcim Building Envelope]
 - c. [GAF]
 - d. [IKO Industries Inc.]
 - e. [Johns Manville; a Berkshire Hathaway company]
 - f. [Polyglass U.S.A., Inc.]
 - g. [Siplast]
 - h. <Insert manufacturer's name>



- G. SBS-Modified Bitumen Type II, Glass-Fiber-Mat Base Sheet: ASTM D6163/D6163M, Type II, Grade S, SBS-modified asphalt sheet, reinforced with glass fibers; smooth surfaced; suitable for cold adhesive or hot asphalt application method.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Elevate; Holcim Building Envelope]**
 - b. **[Siplast]**
 - c. **<Insert manufacturer's name>**
- H. SBS-Modified Bitumen Type II, Glass-Fiber-Mat Base Sheet, Torch: ASTM D6163/D6163M, Type II, Grade S, SBS-modified asphalt sheet, reinforced with glass fibers, smooth surfaced, suitable for torch application method.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Siplast]**
 - b. **<Insert manufacturer's name>**
- I. SBS-Modified Bitumen Type I, Polyester- and Glass-Fiber-Mat Base Sheet: ASTM D6162/D6162M, Type I, Grade S, SBS-modified asphalt sheet, reinforced with a combination of polyester fabric and glass fibers; smooth surfaced; suitable for cold adhesive or hot asphalt application method.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Johns Manville; a Berkshire Hathaway company]**
 - b. **<Insert manufacturer's name>**
- J. SBS-Modified Bitumen Type I, Polyester- and Glass-Fiber-Mat Base Sheet, Torch: ASTM D6162/D6162M, Type I, Grade S, SBS-modified asphalt sheet, reinforced with a combination of polyester fabric and glass fibers, smooth surfaced, suitable for torch application method.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[IKO Industries Inc.]**
 - b. **<Insert manufacturer's name>**
- K. SBS-Modified Bitumen Type III, Polyester- and Glass-Fiber-Mat Base Sheet: ASTM D6162/D6162M, Type III, Grade S, SBS-modified asphalt sheet, reinforced with a combination of polyester fabric and glass fibers, smooth surfaced, suitable for cold adhesive or hot asphalt application method.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Soprema, Inc.]**
 - b. **<Insert manufacturer's name>**
 - L. SBS-Modified Bitumen Type III, Polyester- and Glass-Fiber-Mat Base Sheet, Torch: ASTM D6162/D6162M, Type III, Grade S, SBS-modified asphalt sheet, reinforced with a combination of polyester fabric and glass fibers; smooth surfaced; suitable for torch application method.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Tremco Incorporated]**
 - b. **<Insert manufacturer's name>**
 - M. Asphalt-Coated, Glass-Fiber-Mat, Venting Base Sheet: ASTM D4897/D4897M, Type II, venting, nonperforated, asphalt-impregnated and -coated, glass-fiber base sheet with mineral granule surfacing on bottom surface.
- 2.4 STYRENE-BUTADIENE-STYRENE (SBS)-MODIFIED BITUMINOUS CAP SHEET
- A. SBS-Modified Bitumen Type I, Polyester-Mat, Granule-Surfaced Cap Sheet: ASTM D6164/D6164M, Type I, Grade G, SBS-modified asphalt sheet, reinforced with polyester fabric; suitable for cold adhesive or hot asphalt application method.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Bitec, Inc]**
 - b. **[CertainTeed; SAINT-GOBAIN]**
 - c. **[Elevate; Holcim Building Envelope]**
 - d. **[GAF]**
 - e. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - f. **[IKO Industries Inc.]**
 - g. **[Johns Manville; a Berkshire Hathaway company]**
 - h. **[Polyglass U.S.A., Inc.]**
 - i. **[Tamko Building Products LLC]**
 - j. **[Tremco Incorporated]**
 - k. **<Insert manufacturer's name>**
 2. Granule Color: **[White][Gray][Tan]<Insert color>**.
 - B. SBS-Modified Bitumen Type I, Polyester-Mat, Granule-Surfaced Cap Sheet, Torch: ASTM D6164/D6164M, Type I, Grade G, SBS-modified asphalt sheet, reinforced with polyester fabric; suitable for torch application method.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Bitec, Inc]
 - b. [Elevate; Holcim Building Envelope]
 - c. [GAF]
 - d. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
 - e. [IKO Industries Inc.]
 - f. [Johns Manville; a Berkshire Hathaway company]
 - g. [Polyglass U.S.A., Inc.]
 - h. <Insert manufacturer's name>
2. Granule Color: [White][Gray][Tan]<Insert color>.

2.5 BASE FLASHING SHEET MATERIALS

- A. Asphalt-Coated, Glass-Fiber-Mat Backer Sheet: ASTM D4601/D4601M, [Type I][Type II], asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.
- B. Asphalt-Coated, Organic-Felt Backer Sheet: ASTM D2626/D2626M, asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides.
- C. SBS-Modified Bitumen Backer Sheet: [ASTM D6164/D6164M, Type I or II, Grade S, reinforced with polyester fabric][ASTM D6163/D6163M, Type I or II, Grade S, reinforced with glass fibers][ASTM D6162/D6162M, Type I or II, Grade S, reinforced with a combination of polyester fabric and glass fibers]; smooth surfaced; suitable for application method specified.
- D. SBS-Modified Bitumen, Granule-Surfaced Flashing Sheet: [ASTM D6164/D6164M, Type I or II, Grade G, reinforced with polyester fabric][ASTM D6163/D6163M, Type I or II, Grade G, reinforced with glass fibers][ASTM D6162/D6162M, Type I or II, Grade G, reinforced with a combination of polyester fabric and glass fibers]; granule surfaced; suitable for application method specified, and as follows:
 1. Granule Color: [White][Gray][Tan]<Insert color>.
- E. SBS-Modified Bitumen, Metal-Surfaced Flashing Sheet: ASTM D6298, metal-foil-surfaced SBS-modified asphalt sheet, reinforced with glass fibers, suitable for application method specified, and as follows:
 1. Metal Surfacing: [Aluminum][Copper][Stainless steel][Aluminum, fluoropolymer-coated finish, of color and gloss selected by Architect from manufacturer's full range].
- F. Glass-Fiber Fabric: Woven glass-fiber cloth, treated with asphalt, complying with ASTM D1668/D1668M, Type I.
- G. Liquid Flashing System: Roof membrane manufacturer's standard one- or two-part moisture curing resin with low solvent content, consisting of a primer, flashing cement, and scrim.

2.6 ASPHALT MATERIALS

- A. Asphalt Primer: ASTM D41/D41M.
- B. Roofing Asphalt: ASTM D312/D312M, **[Type III][Type IV][Type III or IV as recommended by roofing system manufacturer for application]**.
- C. SEBS-Modified Roofing Asphalt: ASTM D6152/D6152M.

2.7 ACCESSORY ROOFING MATERIALS

- A. General: Accessory materials recommended by roofing manufacturer for intended use and compatible with other roofing components.
 - 1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
- B. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
- C. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately **1 by 1/8 inch** thick; with anchors.
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- D. Cold-Applied Trichloroethylene Asphalt Adhesive: ASTM D3019, Type III, roof membrane manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with **[roofing membrane][and][base flashings]**.
- E. Cold-Applied Polymer-Modified Asphalt Adhesive: Roof membrane manufacturer's standard solvent-and asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with roofing components.
- F. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required by roofing system manufacturer for application.
- G. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying.
- H. Insulation Cant Strips: **[ASTM C728, perlite insulation board][ASTM C208, Type II, Grade 1, cellulosic-fiber insulation board]**.
- I. Metal Flashing Sheet: As specified in Section 076200 "Sheet Metal Flashing and Trim."
- J. Separator Sheet: Polyethylene sheet, **4 mils** thick, minimum.
- K. Miscellaneous Accessories: Provide accessories recommended by roofing system manufacturer.

2.8 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured **[or approved]** by roof membrane manufacturer, **[approved for use in FM Approvals' RoofNav listed roofing assemblies][, approved for use in SPRI's Directory of Roof Assemblies listed roof assemblies]**.

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2.9 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with other roofing system components.
- B. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation; type and weight as recommended by roofing system manufacturer for application.
- C. Metal Securement System: Perimeter securement flashing and strapping fabricated from **3-inch-** wide stainless steel, a minimum of **0.031 inch** thick. Provide fasteners as recommended by mortar-faced insulation manufacturer.

2.10 ELECTRONIC LEAK DETECTION (ELD) MATERIALS 2.11 COATING MATERIALS

- A. Roof Coating:
 - 1. ASTM D1227, Type II, **[Class 1, mineral-colloid-emulsified, fibered][Class 2, chemically emulsified, filled or fibered]** asphalt emulsion, asbestos free.
 - 2. ASTM D1227, Type III, **[Class 1, mineral-colloid-emulsified][Class 2, chemically emulsified]** asphalt emulsion, nonfibered.
 - 3. ASTM D2824/D2824M, **[Type I, nonfibered][Type III, fibered, asbestos-free]**, aluminum-pigmented asphaltic coating.
 - 4. ASTM D6083, acrylic elastomer emulsion coating, formulated for use on bituminous roof surfaces.
 - a. Color: **[White][Gray][Tan]<Insert color>**.

2.12 BALLAST

- A. Aggregate Ballast: **[Smooth, washed riverbed gravel or other acceptable smooth-faced stone][Crushed, washed gravel or crushed stone]** that withstands weather exposure without significant deterioration and does not contribute to membrane degradation; of the following size:
 - 1. Size: ASTM D448, **[Size 2, ranging in size from 1-1/2 to 2-1/2 inches][Size 4, ranging in size from 3/4 to 1-1/2 inches][Size 5, ranging in size from 1/2 to 1 inch]**.

PART 3 - EXECUTION

3.1 INSTALLATION OF ROOFING, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions, applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing," **[FM Approvals' RoofNav][SPRI's Directory of Roof Assemblies]** listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast.

1. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install roof membrane and accessory materials to tie in to existing roofing to maintain weathertightness of transition[**and to not void warranty for existing roofing system**].
- D. Coordinate installation and transition of roofing system component serving as an air barrier, with air barrier specified in [**Section 072713 "Modified Bituminous Sheet Air Barriers."**][**Section 072715 "Nonbituminous Self-Adhering Sheet Air Barriers."**][**Section 072726 "Fluid-Applied Membrane Air Barriers."**]
- E. Start installation of roofing in presence of manufacturer's technical personnel[**and Owner's testing and inspection agency**].
- F. Where roof slope exceeds [**1/2 inch per 12 inches**][**3/4 inch per 12 inches**]**<Insert slope>**, install roofing sheets parallel with slope.
- G. Coordinate installation of roofing system, so components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
 1. Provide tie-offs at end of each day's work to cover exposed roofing sheets with a course of coated felt set in roofing cement[**or hot roofing asphalt**], with joints and edges sealed.
 2. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system.
 3. Remove and discard temporary seals before beginning work on adjoining roofing.
- H. Asphalt Heating:
 1. Heat asphalt to its equiviscous temperature, measured at the mop cart or mechanical spreader immediately before application.
 - a. For cap sheets, heat asphalt according to cap sheet manufacturer's recommendations.
 2. Circulate asphalt during heating.
 3. Do not raise roofing asphalt temperature above equiviscous temperature range more than one hour before time of application.
 - a. For cap sheets, comply with cap sheet manufacturer's recommendations.
 4. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating.
 5. Do not heat roofing asphalt within **25 deg F** of flash point.
 6. Discard roofing asphalt maintained at a temperature exceeding finished blowing temperature for more than four hours.
 7. Apply hot roofing asphalt within plus or minus **25 deg F** of equiviscous temperature.
 - a. For cap sheets, comply with cap sheet manufacturer's recommendations.
- I. SEBS-Modified Asphalt Heating: Heat and apply roofing asphalt according to roofing system manufacturer's written instructions.
- J. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.2 INSTALLATION OF ELD COMPONENTS

- A. Install conductive medium over roof deck[**and on vertical locations to receive roof membrane**] in accordance with manufacturer's written instructions.
- B. Install sensors, [**wire loop**][**conductive fabric**], connections, and accessory items required for complete system in accordance with manufacturer's written instructions.

3.3 INSTALLATION OF BASE-SHEET

- A. Before installing, unroll base sheet, cut into workable lengths, and allow to lie flat for a time period recommended by manufacturer for the ambient temperature.
- B. Installation of SBS-Modified Bitumen Polyester-Mat, SBS-Modified Fiberglass-Mat, SBS-Modified Bitumen Polyester and Fiberglass-Mat Base Sheet:
 - 1. Install base sheet according to roofing manufacturer's written instructions, starting at low point of roofing system.
 - 2. Extend roofing sheets over and terminate above cants.
 - 3. Install base sheet in a shingle fashion.
 - 4. Adhere to substrate in a uniform coating of cold-applied adhesive.
 - 5. Torch-apply to substrate.
 - a. Perform torch application according to NFPA 241, including two-hour fire watch after torches have been extinguished.
 - 6. Install base sheet without wrinkles, tears, or air pockets.
 - 7. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps.
 - a. Lap side laps as recommended by roof membrane manufacturer but not less than **3 inches**.
 - b. Lap end laps as recommended by roof membrane manufacturer but not less than **12 inches**.
 - c. Stagger end laps not less than **18 inches**.
 - d. [**Heat-weld end laps,**][**Completely bond and seal laps,**] leaving no voids.
 - e. Roll laps with a **20-pound** roller.
 - 8. Repair tears and voids in laps and lapped seams not completely sealed.
 - 9. Apply pressure to the body of the base sheet according to manufacturer's instructions, to remove air pockets and to result in complete adhesion of base sheet to substrate.
- C. Installation of Asphalt-Coated Glass-Fiber-Mat Base Sheet:
 - 1. Install base sheet according to roofing manufacturer's written instructions, starting at low point of roofing system.
 - 2. Extend roofing sheets over and terminate above cants.
 - 3. Install base sheet in a shingle fashion.
 - 4. Adhere to substrate in a [**solid mopping of hot roofing asphalt**][**uniform coating of cold-applied adhesive**]
 - 5. Install base sheet without wrinkles, tears, or air pockets.
 - 6. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps.

- a. Lap side laps as recommended by roof membrane manufacturer but not less than **3 inches**.
 - b. Lap end laps as recommended by roof membrane manufacturer but not less than **12 inches**.
 - c. Stagger end laps not less than **18 inches**.
 - d. Completely bond and seal laps, leaving no voids.
7. Repair tears and voids in laps and lapped seams not completely sealed.

D. Installation of Vented Base Sheet:

1. Spot or strip mop to substrate with hot roofing asphalt vented base sheet with vented side down.
 - a. Fasten vented base sheet according to requirements in **[FM Approvals' RoofNav for specified Windstorm Resistance Classification][SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity]**.
 - b. Fasten vented base sheet to resist uplift pressure at corners, perimeter, and field of roof.

3.4 INSTALLATION OF INTERPLY SHEETS

- A. Install **[two][three]** ply sheets, starting at low point of roofing.
1. Align ply sheets without stretching.
 2. Shingle side laps of ply sheets uniformly to achieve required number of plies throughout thickness of roofing membrane.
 - a. Shingle in direction to shed water.
 3. Extend ply sheets over and terminate above cants.
 4. Embed each ply sheet in a solid mopping of hot roofing asphalt applied at rate required by roofing manufacturer, to form a uniform membrane without ply sheets touching.

3.5 INSTALLATION OF STYRENE-BUTADIENE-STYRENE (SBS)-MODIFIED BITUMINOUS CAP SHEET

- A. Before installing, unroll cap sheet, cut into workable lengths, and allow to lie flat for a time period recommended by manufacturer for the ambient temperature at which cap sheet will be installed.
- B. Install modified bituminous roofing cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system.
1. Extend cap sheet over and terminate above cants.
 2. Install cap sheet in a shingle fashion.
 3. Install cap sheet as follows:
 - a. Adhere to substrate in a solid mopping of hot roofing asphalt applied at asphalt temperature recommended by cap sheet manufacturer.
 - b. Adhere to substrate in a uniform coating of cold-applied adhesive.
 - c. Torch-apply to substrate.
 - 1) Perform torch application according to NFPA 241, including two-hour fire watch after torches have been extinguished.

4. Install cap sheet without wrinkles, tears, or air pockets.
5. Install cap sheet, so side and end laps shed water.

C. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps.

1. Lap side laps as recommended by roof membrane manufacturer but not less than **3 inches**.
2. Lap end laps as recommended by roof membrane manufacturer but not less than **12 inches**.
3. Stagger end laps not less than **18 inches**.
4. **[Heat-weld end laps,][Completely bond and seal laps,]** leaving no voids.
5. Roll laps with a **20-pound** roller.
6. Repair tears and voids in laps and lapped seams not completely sealed.

D. Apply pressure to the body of the cap sheet according to manufacturer's instructions, to remove air pockets and to result in complete adhesion of base sheet to substrate.

3.6 INSTALLATION OF FLASHING AND STRIPPING

A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof; secure to substrates according to roofing system manufacturer's written instructions and as follows:

1. Prime substrates with asphalt primer if required by roofing system manufacturer.
2. Backer Sheet Application: **[Mechanically fasten backer sheet to walls or parapets. Adhere backer sheet over roofing membrane at cants][Adhere backer sheet to substrate]** in **[a solid mopping of hot roofing asphalt][cold-applied adhesive][cold-applied polymer-modified adhesive]**.

a. Seal all laps.

3. Flashing Sheet Application, Hot: **[Adhere flashing sheet to substrate in a solid mopping of hot roofing asphalt applied at asphalt temperature recommended by flashing sheet manufacturer. Apply hot roofing asphalt to back of flashing sheet if recommended by roofing system manufacturer][Torch-apply flashing sheet to substrate]**.

a. Perform torch application according to NFPA 241, including two-hour fire watch after torches have been extinguished.

4. Flashing Sheet Application, Cold: Adhere flashing sheet to substrate in **[cold-applied adhesive][asphalt roofing cement]** at rate required by roofing system manufacturer.

B. Extend base flashing up walls or parapets a minimum of **8 inches** above roofing membrane and **4 inches** onto field of roofing membrane.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

1. Seal top termination of base flashing **[with a strip of glass-fiber fabric set in asphalt roofing cement]**.

D. Install liquid flashing system according to manufacturer's recommendations.

1. Extend liquid flashing not less than **3 inches** in all directions from edges of item being flashed.
2. Embed granules, matching color of roof membrane, into wet compound.

- E. Install roofing cap sheet stripping where metal flanges and edgings are set on roofing according to roofing system manufacturer's written instructions.
- F. Roof Drains: Set **[30-by-30-inch]<Insert dimensions> 4-pound** lead flashing in bed of asphaltic adhesive on roofing.
 - 1. Cover lead flashing with roofing cap sheet stripping, and extend a minimum of **[4 inches][6 inches]** beyond edge of metal flashing onto field of roofing.
 - 2. Clamp roofing, metal flashing, and stripping into roof-drain clamping ring.
 - 3. Install stripping according to roofing system manufacturer's written instructions.

3.7 INSTALLATION OF COATINGS

- A. Apply coating to base flashings according to manufacturer's written instructions, by spray, roller, or other suitable application method.

3.8 INSTALLATION OF INSULATION

- A. Loosely lay separator sheet over cooled roofing membrane, with minimum **2-inch** side laps and **4-inch** end laps.
- B. Loosely lay insulation over roof membrane, with long joints of insulation in continuous straight lines and with end joints staggered not less than **12 inches** between rows.
 - 1. Make joints between adjacent insulation boards not more than **1/4 inch** in width.
 - 2. Fill gaps exceeding **1/4 inch** with insulation.
 - 3. Cut and fit insulation within **1/4 inch** of nailers, projections, and penetrations.
- C. Install upper layer of insulation with joints of each layer offset not less than **12 inches** from previous layer of insulation.
 - 1. Install with long joints continuous and with end joints staggered not less than **12 inches** in adjacent rows.
 - 2. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 3. Make joints between adjacent insulation boards not more than **1/4 inch** in width.
 - 4. Fill gaps exceeding **1/4 inch** with insulation.
 - 5. Cut and fit insulation within **1/4 inch** of nailers, projections, and penetrations.
- D. Install protection layer over insulation, overlapping edges and ends at least **12 inches**.
 - 1. Do not lap ends of fabric sheets within **72 inches** of roof perimeter.
 - 2. Extend fabric **2 to 3 inches** above ballast at perimeter and penetrations.
 - 3. Apply additional layer of fabric around penetrations to prevent aggregate from getting between penetration and insulation.
 - 4. Do not cover drains or restrict water flow to drains.

3.9 INSTALLATION OF ROOF PAVERS

- A. Interlocking Roof Pavers: Install interlocking roof pavers over roofed area according to manufacturer's written instructions.

- B. Install roof pavers over roofed area according to insulation manufacturer's written instructions.
 - 1. Mechanically fasten securement strapping to center of first two perimeter rows and first two perimeter corner rows of roof pavers in each direction from corner, closest to edge of roof, using straps running parallel to parapet wall or roof edge.

- C. Install roof pavers on pedestals set according to pedestal manufacturer's written instructions.

3.10 INSTALLATION OF MORTAR-FACED BOARD INSULATION

- A. Install mortar-faced board insulation loosely laid, according to manufacturer's written instructions, with tongue-and-groove joints nested.
 - 1. Stagger end joints of adjoining rows and abut insulation.
 - 2. Mechanically fasten metal securement strapping at penetrations and at perimeter edges of mortar-faced board insulation.
 - 3. Over mortar-faced board insulation, install roof pavers on roof perimeter and corners according to manufacturer's written instructions.
- B. Install **[one row][two rows]** of **24-inch-** wide roof pavers to roof perimeter, corners, and penetrations according to mortar-faced board insulation manufacturer's written instructions.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Perform the following tests:
 - 1. Flood Testing: Flood test each roofing area for leaks, according to recommendations in ASTM D5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - a. Perform tests before overlying construction is placed.
 - b. Flood to an average depth of **[2-1/2 inches]<Insert depth>** with a minimum depth of **[1 inch]<Insert depth>** and not exceeding a depth of **[4 inches]<Insert depth>**. Maintain **2 inches** of clearance from top of base flashing.
 - c. Flood each area for **[24][48][72]** hours.
 - d. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is the responsibility of the Contractor.
 - e. Testing agency to prepare survey report indicating locations of initial leaks, if any, and final survey report.
 - 2. Infrared Thermography: Testing agency surveys entire roof area using infrared color thermography in accordance with ASTM C1153.
 - a. Perform tests before overlying construction is placed.

- b. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or nuclear hydrogen detection tests.
 - c. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - d. Testing agency to prepare survey report of initial scan indicating locations of entrapped moisture, if any.
- 3. Electrical Capacitance/Impedance Testing: Testing agency surveys entire roof area for entrapped water within roof assembly according to ASTM D7954/D7954M.
 - a. Perform tests before overlying construction is placed.
 - b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
- 4. Nuclear Hydrogen Detection Testing: Testing agency surveys entire roof area for entrapped water within roof assembly according to ANSI/SPRI/RCI NT-1.
 - a. Perform tests before overlying construction is placed.
 - b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
- 5. Low-Voltage ELD Testing: Testing agency surveys entire roof area and flashings to locate discontinuities in the roof membrane using low-voltage **[horizontal membrane scanning platform][membrane electric field vector mapping][or][vertical membrane scanning]** in accordance with ASTM D8231.
 - a. Perform tests before overlying construction is placed.
 - b. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
- 6. High-Voltage Membrane Testing: Testing agency surveys entire **[roof area,][flashings,][and][parapet walls]** to locate discontinuity in the roof membrane using an electrically charged metal "broom head."
 - a. Perform tests before overlying construction is placed.
 - b. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.

- c. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
- C. Test Cuts: Test specimens will be removed to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:
 - 1. Determine approximate quantities of components within roofing membrane according to ASTM D3617/D3617M.
 - 2. Examine test specimens for interply voids according to ASTM D3617/D3617M and to comply with criteria established in Appendix 3 in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
 - 3. Repair areas where test cuts were made according to roofing system manufacturer's written instructions.
- D. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
 - 1. Notify Architect and Owner 48 hours in advance of date and time of inspection.
- E. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- F. Roofing system will be considered defective if it does not pass tests and inspections.
- G. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

END OF SECTION 07 55 52 16

SECTION 07 56 00 00 - FLUID-APPLIED PROTECTED MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hot fluid-applied rubberized-asphalt roofing system.
2. Base flashing sheet.
3. Accessory roofing system materials.
4. Roof insulation and accessories.
5. Electronic leak-detection (ELD) materials.
6. Ballast.
7. Roof pavers.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for compressive strength, curing methods, and finishes for roof decks.
2. Section 034100 "Precast Structural Concrete" for grouting between units, erection tolerances, and finishes for roof decks.
3. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
4. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
5. Section 077100 "Roof Specialties" for **[premanufactured metal copings][roof edge fasciae][gravel stops][reglets][roof edge flashings][counterflashings]**.
6. Section 077129 "Manufactured Roof Expansion Joints" for premanufactured roof expansion-joint assemblies.
7. Section 077200 "Roof Accessories" for manufactured roof curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
8. Section 077273 "Vegetated Roof Systems" for vegetated roof assemblies and components.
9. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
10. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.2 DEFINITIONS

- ##### A. Roofing Terminology:
- Definitions in ASTM D1079 and glossary of NRCA's "Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.3 COORDINATION

- ##### A. Coordinate Work under this Section with adjacent work, including wood blocking, flashing, joints and overburden materials.
- ##### B. Coordinate requirements for concrete finishing to provide suitable substrate for roofing membrane and to minimize penetrations through membrane.

1.4 PREINSTALLATION MEETINGS

- A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at **[Project site]<Insert location>**.
1. Meet with Owner, **[Construction Manager,]** Architect, Owner's insurer if applicable, testing and inspecting agency representative, Roofing System Installer, roofing system manufacturer's representative, and other installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 2. Review methods and procedures related to roofing system installation, including manufacturer's written instructions.
 3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
 5. Review structural loading limitations of roof deck during and after roofing.
 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
 7. Review governing regulations and requirements for insurance and certificates if applicable.
 8. Review temporary protection requirements for roofing system during and after installation.
 9. Review roof observation and repair procedures after roofing installation.
- B. Preinstallation Roofing Conference: Conduct conference at **[Project site]<Insert location>**.
1. Meet with Owner, **[Construction Manager,]** Architect, Owner's insurer if applicable, testing and inspecting agency representative, Roofing System Installer, roofing system manufacturer's representative, and other installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 2. Review methods and procedures related to roofing system installation, including manufacturer's written instructions.
 3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 5. Review structural loading limitations of roof deck during and after roofing.
 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
 7. Review governing regulations and requirements for insurance and certificates if applicable.
 8. Review temporary protection requirements for roofing system during and after installation.
 9. Review roof observation and repair procedures after roofing installation.
 10. Review delivery, storage, handling, and protection procedures.
 11. Review manufacturer's warranty requirements and installation instructions.
 12. Review coordination requirements for other portions of the Work including, but not limited to, the following:
 - a. Structural Decks: Review curing methods, attachment, surface finishing, slope requirements, moisture and vapor control, and other requirements.
 - b. Other Building Envelope Systems: Review transitions, interfaces, material compatibility, and other requirements.

1.5 ACTION SUBMITTALS

- A. Product Data:
1. For each type of product, including the following:

- a. Construction details, material descriptions, and tested physical and performance properties of roofing system components.
 - b. Manufacturer's written instructions for evaluating, preparing, and treating substrate.
 - B. Shop Drawings: Include plans, sections, and attachment details to other Work, including the following:
 - 1. Layout and thickness of insulation.
 - 2. Base and sheet flashings and membrane terminations.
 - 3. Flashing details at penetrations.
 - 4. Tapered insulation, including slopes.
 - 5. Roof plan showing orientation of roof deck and orientation of roofing membrane, and fastener spacings and pattern for corner, perimeter, and field-of-roof locations.
 - 6. Crickets, saddles, and tapered edge strips, including slopes.
 - 7. Tie-in with adjoining wall system air barrier.
 - 8. Locations, extent, and details of roof pavers.
 - C. Samples for Verification: For the following products:
 - 1. Base flashing sheet.
 - 2. Aggregate ballast in gradation[**and color**] indicated.
 - 3. Roof paver[, **full sized**,] in each color and texture required.
 - D. Wind-Uplift Resistance Submittal: For roofing system indicating compliance with wind-uplift performance requirements.
 - E. Sustainable Design Submittals:
 - 1. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][32]** or initial SRI not less than **[82][39]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
 - 2. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][25]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
 - 3. Solar Reflectance Index (SRI): Not less than **[78][29]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- 1.6 INFORMATIONAL SUBMITTALS
- A. Manufacturer Certificates:
 - 1. Performance Requirement Certificate: Signed by roofing membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.
 - 2. Special Warranty Certificate: Signed by roofing membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
 - B. Product Test Reports: For roofing membrane and insulation, for tests performed by an independent, qualified testing agency indicating compliance with specified requirements.
 - C. Research Reports: For components of roofing system, from **[an agency acceptable to authorities having jurisdiction][ICC-ES]<Insert evaluation agency>** showing compliance with specified performance requirements.
 - D. Field Test Reports:

1. Concrete internal relative humidity test reports.

E. Field quality-control reports.

F. Qualification Statements: For roofing system [Installer][manufacturer][and][testing agency].

G. Sample warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system.

B. Certified statement from existing roofing system manufacturer, stating that existing roof warranty has not been affected by Work performed under this Section.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is [UL listed][listed in FM Approvals' RoofNav][listed in SPRI's "Directory of Roof Assemblies"] for roofing system identical to that used for this Project.

B. Installer Qualifications: Entity that employs installers and supervisors who are trained and [certified][approved] by roofing system manufacturer to install manufacturer's product and product is eligible to receive manufacturer's special warranty.

1.9 MOCKUPS

A. Build mockups to verify selections made under Sample submittals and to set quality standards for installation.

1. Build mockup of typical roofing system installation to demonstrate surface preparation, joint and crack treatment, and thickness of roofing system.

a. Size: [100 sq. ft. (9.3 sq. m) in area][As indicated on Drawings].

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing system materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

1. Protect stored liquid material from direct sunlight.

2. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
 - C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources.
 1. Store in a dry location.
 2. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
 - D. Handle and store roofing system materials, and place equipment in a manner to avoid permanent deflection of deck.
- 1.11 FIELD CONDITIONS
- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written installation instructions and warranty requirements.
- 1.12 WARRANTY
- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or remove and replace components of roofing system that fail in materials or workmanship to remain watertight within specified warranty period.
 1. Warranty includes leak remediation, including repair, removal, and replacement of base flashings[, **insulation**] and other components of roofing system.
 2. Pavers Warranty: Pavers must not dish or warp, nor crack, split, or disintegrate in freeze-thaw conditions.
 3. Warranty Period: [**10**][**15**][**20**]**<Insert number>** years from date of Substantial Completion.
 - B. Roofing System Installer's Warranty: Submit Roofing System Installer's warranty, on warranty form at end of this Section, signed by Roofing System Installer, covering Work of this Section, including all components of roofing system, such as roof insulation, fasteners, adhesives, roofing membranes, base flashing sheet, [**walkway products**],and other components of roofing system.
 1. Warranty Period: [**Two**][**Five**]**<Insert number>** years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain components for roofing system from [**roofing membrane manufacturer**][or][**manufacturer approved by roofing membrane manufacturer**].
- B. Roof Pavers: Obtain pavers[**and paver pedestal assembly**] from single source from single manufacturer for consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and flashings to withstand specified uplift pressures,

thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and flashings to remain watertight.

- B. Material Compatibility: Roofing system materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
- C. Roof Edge: Design and install roof edge in accordance with ANSI/SPRI/FM 4435/ES-1 tested to specified design pressure.
- D. Wind-Uplift Resistance: Tested by a qualified testing agency to resist the following uplift pressures. Values below to comply with ANSI/SPRI RP-4, ACSE/SEI 7 or determined by Structural Engineer:
 - 1. Zone 1' (Roof Area Interior): <Insert lbf/sq. ft. (kPa)>.
 - 2. Zone 1 (Roof Area Field) Uplift Pressure: <Insert lbf/sq. ft. (kPa)>.
 - 3. Zone 2 (Roof Area Perimeter) Uplift Pressure: <Insert lbf/sq. ft. (kPa)>.
 - a. Location: From roof edge to <Insert dimension> inside roof edge.
 - 4. Zone 3 (Roof Area Corner) Uplift Pressure: <Insert lbf/sq. ft. (kPa)>.
 - a. Location: <Insert dimension> in each direction from each building corner.
- E. FM Approvals' RoofNav Listing: Roofing membrane, base flashings, and component materials comply with requirements in FM Approvals 4470 as part of a roofing system, and are to be listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
 - 1. Fire/Windstorm Classification: [Class 1A-60][Class 1A-75][Class 1A-90][Class 1A-105][Class 1A-120]<Insert class>.
 - 2. Hail Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34, [MH][SH][VSH].
- F. Solar Reflectance Index (SRI): Three-year-aged SRI not less than [64][32] or initial SRI not less than [82][39] when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- G. Solar Reflectance Index (SRI): Three-year-aged SRI not less than [64][25] when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- H. Solar Reflectance Index (SRI): Not less than [78][29] when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- I. Cool Roof Rating Council (CRRC): Roofing system to be listed by CRRC for low-slope roof products.
- J. Energy Performance: Roofing system to have an initial solar reflectance of not less than [0.70]<Insert value> and an emissivity of not less than [0.75]<Insert value> when tested in accordance with CRRC S100.

2.3 HOT FLUID-APPLIED RUBBERIZED-ASPHALT ROOFING SYSTEM

- A. Single-Component Roofing Membrane: [Reinforced][Unreinforced]; 100 percent solids; rubberized-asphalt membrane.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[American Hydrotech, Inc.]**
 - b. **[Barrett Company]**
 - c. **[Carlisle Coatings & Waterproofing Inc]**
 - d. **[CETCO is a subsidiary of Minerals Technologies Inc.]**
 - e. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - f. **[Siplast]**
 - g. **[Soprema, Inc.]**
 - h. **[Tremco Incorporated]**
 - i. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[American Hydrotech, Inc.]**
 - b. **[Barrett Company]**
 - c. **[Carlisle Coatings & Waterproofing Inc]**
 - d. **[CETCO is a subsidiary of Minerals Technologies Inc.]**
 - e. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - f. **[Siplast]**
 - g. **[Soprema, Inc.]**
 - h. **[Tremco Incorporated]**
 - i. **<Insert manufacturer's name>**
3. Flow: **1/8 inch (3 mm)** maximum at **140 deg F (60 deg C)** in accordance with ASTM D5329.
4. Flash Point: Not less than **500 deg F (260 deg C)** and not less than **77 deg F (25 deg C)** above manufacturer's maximum recommended application temperature in accordance with ASTM D92.
5. Water-Vapor Permeance: 0.027 perm in accordance with ASTM E96/E96M, Procedure E.
6. Crack Bridging Capability: No cracking, splitting, or loss of adhesion in accordance with ASTM C1305.
7. **<Insert requirements>**.

2.4 BASE FLASHING SHEET

- A. Elastomeric Flashing Sheet: Manufacturer's standard uncured sheet neoprene flashing sheet.
 1. Adhesive: Manufacturer's standard contact adhesive.
- B. SBS-Modified Bituminous, Granule-Surfaced Base Flashing Sheet: **[ASTM D6164/D6164M, Type I or Type II, Grade G, polyester-reinforced][ASTM D6163/D6163M, Type I or Type II, Grade G, glass-fiber reinforced][ASTM D6162/D6162M, Type I or Type II, Grade G, reinforced with a combination of polyester fabric and glass fibers]**; suitable for application method specified.
 1. Granule Color: **[White][Gray][Tan]<Insert color>**.
 2. Backer Sheet: Matching base flashing sheet, except smooth surfaced; suitable for application method specified.
- C. APP-Modified Bituminous Base Flashing Sheet: **[ASTM D6222/D6222M, Type I or Type II, Grade S,**

polyester-reinforced][ASTM D6223/D6223M, Type I or Type II, Grade S, reinforced with a combination of polyester fabric and glass fibers], smooth surfaced; suitable for application method specified.

- D. Liquid Base Flashing System: Roofing membrane manufacturer's standard moisture-curing resin with low solvent content, consisting of a primer, flashing cement, and reinforcing scrim; suitable for installation method specified.

2.5 ACCESSORY ROOFING SYSTEM MATERIALS

- A. General: Accessory materials as recommended in writing by roofing system manufacturer for intended use, compatible with other roofing system components, and suitable for installation method specified.
- B. Asphalt Primer: ASTM D41/D41M.
- C. Reinforcing Fabric: Manufacturer's standard fiberglass-mesh or spun-bonded polyester fabric.
- D. Metal Termination Bars: Manufacturer's standard, predrilled, stainless steel or aluminum bars; approximately **1 by 1/8 inch (25 by 3 mm)** thick; with stainless steel anchors.
- E. Prefabricated Pipe Flashings: As recommended in writing by roofing membrane manufacturer.
- F. Aggregate Surfacing: ASTM D1863/D1863M, No. 6 or No. 67, clean, dry, opaque, water-worn gravel or crushed stone, free of sharp edges crushed slag, free of sharp edges.
- G. Miscellaneous Accessories: As recommended in writing by roofing membrane manufacturer.

2.6 ROOF INSULATION AND ACCESSORIES

- A. General: Preformed roof insulation boards manufactured[**or approved**] by roofing membrane manufacturer,[**approved for use in FM Approvals' RoofNav-listed roof assemblies**] selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.
- B. Extruded-Polystyrene Board Insulation: ASTM C578, [**Type VII, 2.2 lb/cu. ft. (35 kg/cu. m), minimum density, 60 psi (414 kPa) minimum compressive strength**][**Type V, 3.0 lb/cu. ft. (48 kg/cu. m), minimum density, 100 psi (690 kPa) minimum compressive strength**], fabricated with shiplapped, channel, or tongue-and-groove edges and with one side having ribbed drainage channels.
 - 1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
 - a. **[DuPont de Nemours, Inc.]**
 - b. **[Kingspan Insulation LLC]**
 - c. **[Owens Corning]**
 - d. **[Soprema, Inc.]**
 - e. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[DuPont de Nemours, Inc.]**
 - b. **[Kingspan Insulation LLC]**
 - c. **[Owens Corning]**
 - d. **[Soprema, Inc.]**
 - e. **<Insert manufacturer's name>**
 3. Thermal Resistance: R-value of 5.0 per 1 inch (25 mm).
 4. Size: **[48 by 48 inches (1219 by 1219 mm)][48 by 96 inches (1219 by 2438 mm)]**.
 5. Thickness:
 - a. Base Layer: **[1-1/2 inches (38 mm)]<Insert thickness>**.
 - b. Upper Layer: **<Insert thickness>**.
 - C. Mortar-Faced, Extruded-Polystyrene Board Insulation: ASTM C578, Type VI, **1.8-lb/cu. ft. (29-kg/cu. m)** minimum density, **40 psi (276 kPa)** minimum compressive strength, with tongue-and-groove edges on long dimension, and latex-modified cement mortar topping, **[3/8 inch (9 mm) thick, 4.5 lb/sq. ft. (19.5 kg/sq. m)][15/16 inch (23 mm) thick, 11 lb/sq. ft. (53.7 kg/sq. m)]**.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[T. Clear Corporation, a subsidiary of Fin Pan Inc]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[T. Clear Corporation, a subsidiary of Fin Pan Inc]**
 - b. **<Insert manufacturer's name>**
 - D. Roof Insulation Accessories, General: As recommended in writing by insulation manufacturer for intended use and compatible with other roofing system and with roofing membrane.
 - E. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, of type and weight as recommended in writing by roofing system manufacturer for application.
 - F. Metal Securement System: Perimeter securement flashing and strapping fabricated from stainless steel, a minimum of **0.031 inch (0.8 mm)** thick. Provide fasteners as recommended in writing by mortar-faced insulation manufacturer.
- 2.7 COVER BOARD**
- A. General: Cover board as recommended in writing by roofing membrane manufacturer for intended use and compatible with other roofing system components.
 - B. Glass-Mat Gypsum Cover Board: ASTM C1177/C1177M, water-resistant gypsum board.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. [CertainTeed; SAINT-GOBAIN]
 - b. [Georgia-Pacific Gypsum LLC]
 - c. [Gold Bond Building Products, LLC provided by National Gypsum Company]
 - d. [USG Corporation]
 - e. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [CertainTeed; SAINT-GOBAIN]
 - b. [Georgia-Pacific Gypsum LLC]
 - c. [Gold Bond Building Products, LLC provided by National Gypsum Company]
 - d. [USG Corporation]
 - e. <Insert manufacturer's name>
3. Thickness: [1/4 inch (6 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)].
4. Surface Finish: [Fiberglass facer][Factory primed][Unprimed].
- C. Fiber-Reinforced Gypsum Cover Board: ASTM C1278/C1278M, cellulosic-fiber-reinforced, water-resistant gypsum board.
 1. Thickness: [1/4 inch (6 mm)][3/8 inch (10 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)].
- D. Fiber-Reinforced Cementitious Cover Board: ASTM C1325, fiber-mat-reinforced cementitious board.
 1. Thickness: [7/16 inch (11 mm)][1/2 inch (13 mm)][5/8 inch (16 mm)].
- E. Fiber-Reinforced Recycled Plastic Cover Board: Cellulose fiber blended with recycled plastic board.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Continuus Materials, LLC]
 - b. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Continuus Materials, LLC]
 - b. <Insert manufacturer's name>
 3. Thickness: [1/4 inch (6 mm)][1/2 inch (13 mm)].
 4. Surface Finish: [Fiberglass facer][Paper facer].

2.8 ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Conductive Medium: Electrically conductive material specifically designed to enable ELD testing procedures as approved in writing by roofing membrane manufacturer.

1. Conductive medium to be located directly under roofing membrane in accordance with ASTM D7877 and ASTM D8231.
- B. Moisture-Monitoring System: Permanently embedded, continuously monitored moisture-detection system.
 1. Sensors measuring moisture content to be placed within roofing system and connected to a monitoring program, with a notification indicating location of breach.

2.9 BALLAST

- A. Aggregate Ballast: Washed, crushed stone or smooth stone that withstands weather exposure without significant deterioration and does not contribute to membrane degradation; of the following size:
 1. Size: ASTM D448, **[Size 5, ranging in size from 1/2 to 1 inch (13 to 25 mm)][Size 4, ranging in size from 3/4 to 1-1/2 inches (19 to 38 mm)][Size 2, ranging in size from 1-1/2 to 2-1/2 inches (38 to 63 mm)].**

2.10 ROOF PAVERS

- A. Interlocking Roof Pavers: Interlocking, lightweight concrete units; grooved back, with four-way drainage capability; beveled, doveled, or otherwise profiled; and as follows:
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Hanover Architectural Products]**
 - b. **[Roofblok Limited]**
 - c. **[Westile Roofing Products; an Oldcastle company]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Hanover Architectural Products]**
 - b. **[Roofblok Limited]**
 - c. **[Westile Roofing Products; an Oldcastle company]**
 - d. **<Insert manufacturer's name>**
 3. Size: **<Insert actual size(s) of pavers>**.
 4. Weight: **<Insert weight or weight range>**.
 5. Compressive Strength: **[2500 psi (17 MPa)][5000 psi (34 MPa)]<Insert value>**, minimum.
 6. Colors and Textures: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range].**
- B. Roof Pavers: Heavyweight, hydraulically pressed, concrete units, **[square edged][with top edges beveled 3/16 inch (5 mm)]**, factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C140/C140M; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C67/C67M; and as follows:
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the**

following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Carlisle Coatings & Waterproofing Inc]
- b. [Hanover Architectural Products]
- c. [Roofblok Limited]
- d. [Sunny Brook Pressed Concrete, Co.]
- e. [Tile Tech Pavers]
- f. [Wausau Tile, Inc.]
- g. [Westile Roofing Products; an Oldcastle company]
- h. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Carlisle Coatings & Waterproofing Inc]
- b. [Hanover Architectural Products]
- c. [Roofblok Limited]
- d. [Sunny Brook Pressed Concrete, Co.]
- e. [Tile Tech Pavers]
- f. [Wausau Tile, Inc.]
- g. [Westile Roofing Products; an Oldcastle company]
- h. <Insert manufacturer's name>

3. Size: [24 by 24 inches (610 by 610 mm)]<Insert dimensions>. Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.

4. Weight: <Insert value>.

5. Compressive Strength: [7500 psi (52 MPa)][6500 psi (45 MPa)]<Insert value>, minimum; ASTM C140/C140M.

6. Colors and Textures: [As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range].

7. Paver Supports:

- a. Integral Paver Supports: Integral corner pedestals creating a minimum 3/16-inch- (5-mm-) high, ventilation airspace.
- b. Paver Support Assembly: Paver manufacturer's standard SBR rubber, high-density polyethylene, or polyurethane paver support assembly, including [fixed-height][adjustable or stackable] pedestals, shims, and spacer tabs for joint spacing of [1/8 inch (3 mm)][3/16 inch (5 mm)][1/8 to 3/16 inch (3 to 5 mm)].

- C. Roof-Paver Metal Straps: Securement strapping fabricated from stainless steel, a minimum of 3 inches (75 mm) wide by 0.031 inch (0.8 mm) thick with stainless steel anchors.

- D. Paver Pedestals: Paver-support assembly, [standard with paver manufacturer][or][as named below], including [fixed-height][adjustable or stackable] pedestals, shims, and spacer tabs for joint spacing of [1/8 inch (3 mm)][3/16 inch (5 mm)][1/8 to 3/16 inch (3 to 5 mm)].

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Buzon USA]

- b. [Envirospec, Inc.]
 - c. [Hanover Architectural Products]
 - d. [Roofblok Limited]
 - e. [Soprema, Inc.]
 - f. [Sunny Brook Pressed Concrete, Co.]
 - g. [Tile Tech Pavers]
 - h. [Wausau Tile, Inc.]
 - i. [Westile Roofing Products; an Oldcastle company]
 - j. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Buzon USA]
 - b. [Envirospec, Inc.]
 - c. [Hanover Architectural Products]
 - d. [Roofblok Limited]
 - e. [Soprema, Inc.]
 - f. [Sunny Brook Pressed Concrete, Co.]
 - g. [Tile Tech Pavers]
 - h. [Wausau Tile, Inc.]
 - i. [Westile Roofing Products; an Oldcastle company]
 - j. <Insert manufacturer's name>
3. Fill: As recommended in writing by pedestal manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Roofing System Installer present, for compliance with requirements and other conditions affecting performance of the Work:
- 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof drain bodies are securely clamped in place.
 - 2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations.
 - 3. Verify that minimum concrete drying period recommended in writing by roofing system manufacturer has passed.
 - 4. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method in accordance with ASTM D4263.
 - 5. Verify that concrete-curing compounds that will impair adhesion of roofing components to roof deck have been removed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing system manufacturer's written instructions.
- B. Mask off adjoining surfaces not receiving roofing to prevent spillage from affecting other construction.

- C. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- D. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
 - 1. Abrasive blast clean concrete surfaces uniformly to expose top surface of fine aggregate in accordance with ASTM D4259 with a self-contained, recirculating, blast-cleaning apparatus. Remove material to provide a sound surface free of laitance, glaze, efflorescence, curing compounds, concrete hardeners, or form-release agents. Remove remaining loose material and clean surfaces in accordance with ASTM D4258.
- E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, and other voids.
- F. Coordinate with Owner for impact to air-intake equipment in the vicinity of the Work. Cover or filter air-intake louvers before proceeding with work that could affect indoor air quality or that could activate smoke detectors in the ductwork.

3.3 JOINTS, CRACKS, AND TERMINATIONS

- A. Prepare and treat substrates to receive roofing, including joints and cracks, roof drains, and penetrations, in accordance with roofing system manufacturer's written instructions.
 - 1. Rout and fill joints and cracks in substrate. Before filling, remove dust and dirt in accordance with ASTM D4258.
 - 2. Adhere strip of elastomeric sheet to substrate in a layer of hot fluid-applied, rubberized asphalt. Extend elastomeric sheet a minimum of **6 inches (150 mm)** on each side of moving joints and cracks or joints and cracks exceeding **1/8 inch (3 mm)** thick, and beyond roof drains and penetrations. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric sheet.
 - 3. Embed strip of reinforcing fabric into a layer of hot fluid-applied, rubberized asphalt. Extend reinforcing fabric a minimum of **6 inches (150 mm)** on each side of nonmoving joints and cracks not exceeding **1/8 inch (3 mm)** thick, and beyond roof drains and penetrations.
 - a. Apply second layer of hot fluid-applied, rubberized asphalt over reinforcing fabric.
- B. At expansion joints and discontinuous deck-to-wall or deck-to-deck joints, bridge joints with elastomeric sheet extended a minimum of **6 inches (150 mm)** on each side of joints, and adhere to substrates in a layer of hot fluid-applied, rubberized asphalt. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric sheet.

3.4 INSTALLATION OF ELECTRONIC LEAK-DETECTION (ELD) MATERIALS

- A. Install conductive medium directly under roofing membrane in accordance with ASTM D7877 and ASTM D8231.
- B. Install sensors, connections, and accessory items required for complete continuously monitored moisture-detection system in accordance with manufacturer's written installation instructions.

3.5 INSTALLATION OF BASE FLASHING SHEET

- A. Install sheet flashing at terminations of roofing membrane in accordance with manufacturer's written instructions.
- B. Prime substrate with asphalt primer if required by manufacturer.
- C. Bond elastomeric flashing sheet in contact adhesive against wall substrate to within **3 inches (75 mm)** of deck. Adhere remaining vertical leg and horizontal leg of flashing sheet in a layer of hot fluid-applied, rubberized asphalt.
- D. Bond modified bituminous flashing sheet to substrate as follows:
 - 1. Adhere SBS-modified bituminous[**backer sheet and**] flashing sheet to substrate in a layer of hot fluid-applied, rubberized asphalt.
 - 2. Torch apply APP-modified bituminous flashing sheet to substrate.
 - 3. Adhere SBS-modified bituminous[**backer sheet and**] flashing sheet to substrate in a layer of hot fluid-applied, rubberized asphalt, or torch apply APP-modified bituminous flashing sheet to substrate as standard with manufacturer.
- E. Extend flashing sheet up walls or parapets a minimum of **8 inches (200 mm)** above insulation and **6 inches (150 mm)** onto roof deck.
- F. Install termination bars and mechanically fasten to top of flashing sheet at terminations and perimeter of roofing membrane.
- G. Install metal counter flashing over flashing sheet where providing a substrate for sealant joints at curtain wall, wall cladding materials, and other locations where meeting adjacent portions of the Work. Provide metal flashing receivers where sequencing requires installation of metal counter flashing prior to roof base flashing installation.

3.6 INSTALLATION OF FLUID-APPLIED ROOFING MEMBRANE

- A. Apply primer, at manufacturer's recommended rate, over prepared substrate and allow to dry.
- B. Heat and apply rubberized asphalt in accordance with manufacturer's written instructions.
 - 1. Heat rubberized asphalt in an oil- or air-jacketed melter with mechanical agitator specifically designed for heating rubberized asphalt.
- C. Start installation in presence of roofing system manufacturer's technical personnel[**and Owner's testing and inspection agency**].
- D. Unreinforced Membrane: Apply hot fluid-applied, rubberized asphalt to area to receive roofing. Spread hot fluid-applied, rubberized asphalt to form a uniform, unreinforced, seamless membrane, [**180-mil (4.5-mm) minimum thickness**][**180-mil (4.5-mm) average thickness, but not less than 125 mils (3.2 mm) thick**].
- E. Reinforced Membrane: Apply hot fluid-applied, rubberized asphalt to area to receive roofing. Spread a **90-mil- (2.3-mm-)** thick layer of hot fluid-applied, rubberized asphalt; embed reinforcing fabric, overlapping sheets **2 inches (50 mm)**; spread another **125-mil- (3.2-mm-)** thick layer of hot fluid-applied, rubberized asphalt to form a uniform, reinforced, seamless membrane, **215 mils (5.5 mm)** thick.

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- F. Apply hot fluid-applied, rubberized asphalt over prepared joints and up wall terminations and vertical surfaces to heights indicated or required by manufacturer.
- G. Cover membrane with protection course with overlapped joints before membrane is subject to construction traffic.

3.7 INSTALLATION OF ROOF INSULATION

- A. Install one or more layers of insulation to achieve required thickness over roofing membrane. Cut and fit to within **3/4 inch (19 mm)** of projections and penetrations.
 - 1. Where overall insulation thickness is **2 inches (50 mm)** or more, install required thickness in two or more layers with joints of each succeeding layer staggered over joints of previous layer a minimum of **6 inches (150 mm)** in each direction.
- B. Installation of Mortar-Faced Board Insulation:
 - 1. Install mortar-faced board insulation loosely laid, in accordance with manufacturer's written instructions, with tongue-and-groove joints nested. Stagger end joints of adjoining rows and abut insulation.
 - a. Mechanically fasten metal securement strapping at penetrations and at perimeter edges of mortar-faced board insulation.
 - b. Over mortar-faced board insulation, install roof pavers on roof perimeter and corners in accordance with manufacturer's written instructions.
 - 2. Install **[one row][two rows]** of roof pavers to roof perimeter, corners, and penetrations in accordance with mortar-faced board insulation manufacturer's written instructions.
- C. Installation of Roof Cover Board: Install over insulation in accordance with roofing system manufacturer's written instructions.

3.8 INSTALLATION OF BALLAST

- A. Install aggregate ballast[**and roof paver ballast**] uniformly over protection layer.
- B. Spread aggregate to not damage roofing membrane or base flashings.
- C. Apply ballast as insulation is installed, leaving roof insulated and ballasted at end of workday.
- D. Install aggregate ballast at rate required in writing by roofing system manufacturer, but not less than the following:
 - 1. Zone 1 (Roof Area Field): **[10 lb/sq. ft. (50 kg/sq. m) of Size 5 aggregate][12 lb/sq. ft. (60 kg/sq. m) of Size 5 aggregate][13 lb/sq. ft. (65 kg/sq. m) of Size 2 aggregate]<Insert value>**.
 - 2. Zone 2 (Roof Area Perimeter): **[15 lb/sq. ft. (75 kg/sq. m)][20 lb/sq. ft. (100 kg/sq. m)][One row of roof pavers][Two rows of roof pavers][Three rows of roof pavers][Four rows of roof pavers]** a distance of **<Insert dimension>** inside roof edge, but not less than **96 inches (2438 mm)**.
 - a. Aggregate: **[Size 5][Size 4][Size 2]**.

- b. Mechanically fasten securement strapping to center of first perimeter row of roof pavers closest to edge of roof, using straps running parallel to parapet wall or roof edge.
3. Zone 3 (Roof Area Corners): **[15 lb/sq. ft. (75 kg/sq. m)][20 lb/sq. ft. (100 kg/sq. m)][One row of roof pavers][Two rows of roof pavers][Three rows of roof pavers][Four rows of roof pavers]** a distance of **<Insert dimension>** in each direction from a building corner, but not less than **96 inches (2438 mm)**.
 - a. Aggregate: **[Size 5][Size 4][Size 2]**.
 - b. Mechanically fasten securement strapping to center of first perimeter row of roof pavers closest to edge of roof, using straps running parallel to parapet wall or roof edge.
4. Within 48 Inches (1219 mm) of Roof Penetrations: **[15 lb/sq. ft. (75 kg/sq. m)][20 lb/sq. ft. (100 kg/sq. m)][Two rows of roof pavers around perimeter of penetration]**. A "penetration" is defined as any object projecting above the roof insulation that measures **48 inches (1219 mm)** or more on any side.
 - a. Aggregate: **[Size 5][Size 4][Size 2]**.
5. Walkway Pavers: Install walkways formed from **[one row][two rows]** of roof pavers, loosely laid and butted.
6. Install roof paver walkways at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - f. Locations indicated on Drawings.

3.9 INSTALLATION OF ROOF PAVERS

- A. Interlocking Roof Pavers: Install interlocking roof pavers over roofed area in accordance with manufacturer's written instructions.
- B. Install roof pavers over roofed area in accordance with roofing system manufacturer's written instructions.
- C. Mechanically securement strapping to center of first perimeter and first perimeter corner row of roof pavers.
- D. Install roof pavers over roofed area in accordance with insulation manufacturer's written instructions.
- E. Mechanically fasten securement strapping to center of first two perimeter rows and first two perimeter corner rows of roof pavers in each direction from corner, closest to edge of, using straps running parallel to parapet wall or roof edge.
- F. Install roof pavers on pedestals set in accordance with pedestal manufacturer's written instructions.

3.10 FIELD QUALITY CONTROL

- A. Engage a full-time site representative qualified by roofing membrane manufacturer to inspect substrate conditions; surface preparation; and application of membrane, base flashings, protection, insulation, and ballast; furnish daily reports.
- B. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to inspect substrate conditions, surface preparation, and application of roofing membrane, flashings, protection, and drainage components, and to furnish reports to Architect.
- C. Perform the following tests:
 - 1. ELD Testing: Testing agency surveys entire roof area and flashings to locate discontinuities in the roofing membrane using ELD in accordance with ASTM D7877 and ASTM D8231.
 - a. After testing, repair areas of discontinuities, repeat tests, and make further repairs until roofing and flashing installations are contiguous.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of initial discontinuities, if any.
 - 2. Flood Testing: Flood test each roofing area for leaks, in accordance with recommendations in ASTM D5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - a. Flood to an average depth of **[2-1/2 inches (63 mm)]<Insert depth>** with a minimum depth of **[1 inch (25 mm)]<Insert depth>** and not exceeding a depth of **[4 inches (100 mm)]<Insert depth>**. Maintain **2 inches (50 mm)** of clearance from top of base flashing.
 - b. Flood each area for **[24][48][72]** hours.
 - c. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installation are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - d. Testing agency will prepare survey report indicating locations of initial leaks, if any, and final survey report.
 - 3. Infrared Thermography Testing: Testing agency surveys entire roof area using infrared color thermography in accordance with ASTM C1153. Perform tests before overlying construction is placed.
 - a. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or by nuclear hydrogen detection testing.
 - b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - c. Testing agency to prepare survey report of initial scan indicating locations of entrapped moisture, if any.
 - 4. Electrical Capacitance/Impedance Testing: Testing agency surveys entire roof area for entrapped

water within roof assembly in accordance with ASTM D7954/D7954M. Perform tests before overlying construction is placed.

- a. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
5. Nuclear Hydrogen Detection Testing: Testing agency surveys entire roof area for entrapped water within roof assembly in accordance with ANSI/SPRI/RCI NT-1. Perform tests before overlying construction is placed.
- a. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - b. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.
- D. Test Cuts: Remove test specimens to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:
1. Determine approximate quantities of components within roofing membrane in accordance with ASTM D3617/D3617M.
 2. Examine test specimens for voids between plies in accordance with ASTM D3617/D3617M and to comply with criteria established in Appendix 3 in NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
 3. Repair areas where test cuts were made in accordance with roofing system manufacturer's written installation instructions.
- E. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
1. Notify Architect[**and Owner**] 48 hours in advance of date and time of inspection.
- F. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- G. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.
1. Roofing system will be considered defective if it does not pass tests and inspections.
- H. Prepare test and inspection reports.
- 3.11 PROTECTING AND CLEANING
- A. Protect roofing system from damage and wear during remainder of construction period.
1. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and in accordance with warranty requirements.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.12 ROOFING SYSTEM INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called the "Roofing System Installer," has performed roofing and associated Work on the following project:
 - 1. Owner: **<Insert name of Owner>**.
 - 2. Owner Address: **<Insert address>**.
 - 3. Building Name/Type: **<Insert information>**.
 - 4. Building Address: **<Insert address>**.
 - 5. Area of Work: **<Insert information>**.
 - 6. Acceptance Date: _____.
 - 7. Warranty Period: **[Two][Five]<Insert number>** years from date of Substantial Completion.
 - 8. Date of Substantial Completion: _____.
- B. AND WHEREAS Roofing System Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said Work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing System Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing System Installer will, at Roofing System Installer's own cost and expense, make or cause to be made such repairs to or replacements of said Work as are necessary to correct faulty and defective work and as are necessary to maintain said Work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
 - 1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding **<Insert mph (m/sec)>**;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the Work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 - 2. When work has been damaged by any of foregoing causes, Warranty will be null and void until such damage has been repaired by Roofing System Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 - 3. Roofing System Installer is responsible for damage to Work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of Work.
 - 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing System



Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty will become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing System Installer to perform said alterations, Warranty will not become null and void unless Roofing System Installer, before starting said Work, will have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate Work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty will become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner will promptly notify Roofing System Installer of observed, known, or suspected leaks, defects, or deterioration and afford reasonable opportunity for Roofing System Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing System Installer on said Work and will not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty will not operate to relieve Roofing System Installer of responsibility for performance of original Work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

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07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 56 00 00	07 51 13 00	Built-Up Asphalt Roofing
07 56 00 00	07 01 50 81	Built-Up Coal Tar Roofing
07 56 00 00	07 53 23 00	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing
07 56 00 00	07 57 00 00	Coated Foamed Roofing



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SECTION 07 57 00 00 - COATED FOAMED ROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Spray-applied, coated, polyurethane foam roofing.
 - 1. Polyurethane foam.
 - 2. Urethane coatings.
 - 3. Silicone coatings.
 - 4. Acrylic coatings.
 - 5. Substrate board.
 - 6. Accessory materials.
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for wood blocking, curbs, cants, and nailers.
 - 2. Section 072119 "Foamed-In-Place Insulation" for spray-applied polyurethane foam specified as general building insulation within walls and rafter spaces.
 - 3. Section 076200 "Sheet Metal Flashing and Trim" for foam stops, roof penetration flashings, and counterflashings.
 - 4. Section 079200 "Joint Sealants" for joint sealants, fillers, and preparation.

1.2 DEFINITIONS

- A. Applicator: A qualified person employed to apply spray-applied, coated, polyurethane foam roofing.
- B. Installer: A qualified firm contracted to install spray-applied, coated, polyurethane foam roofing.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.
 - 1. Review methods and procedures related to coated foamed roofing, including, but not limited to, the following:
 - a. Load limitations on in-place roofing.
 - b. Construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - c. Surface preparation specified in other Sections.
 - d. Minimum curing period.
 - e. Forecasted weather conditions.
 - f. Special details and sheet flashings.
 - g. Repairs.
 - h. **<Insert agenda items>**.

1.4 ACTION SUBMITTALS

- A. Product Data:[**Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties.**]
 - 1. Polyurethane foam.
 - 2. Urethane coatings.
 - 3. Silicone coatings.
 - 4. Acrylic coatings.
 - 5. Substrate board.
 - 6. Accessory materials.
- B. Sustainable Design Submittals:
 - 1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.
- C. Samples for Initial Selection: For each type of exposed product, finish, and color.
 - 1. Include Samples of accessory materials and accessories involving color and finish selection.
- D. Samples for Verification: For coated foamed roofing, prepared on Samples of size indicated below:
 - 1. Samples, **24 by 24 inches (600 by 600 mm)**, on rigid backing, showing polyurethane foam of thickness required and stepped coatings in colors required to illustrate buildup of coated foamed roofing.
 - 2. Include Samples of accessories to verify color and finish selected.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For SPFA-qualified [**Installer**][and][**applicators**].
- B. Product Certificates: For each type of coated foam roofing.
- C. Evaluation Reports: For coated foamed roofing, from ICC-ES.
- D. Field quality-control reports.
- E. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For coated foamed roofing to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified coated-foamed-roofing installer who is approved, authorized, or licensed by coating manufacturer for installation of coating manufacturer's product over polyurethane foam.
 - 1. Engage an installer who participates in and who has fulfilled requirements of the SPFA program

for company accreditation as "SPFA PCP Accredited Company Roofing," with individual applicator certification for personnel assigned to work on Project.

- B. Comply with recommendations in SPFA AY-104.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof area as shown on Drawings.
 - a. Size: **[10 feet (3 m) by 10 feet (3 m)]<Insert dimensions>**.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site with manufacturer's name, product brand name and type, date of manufacture, shelf life, and directions for storing and mixing with other components.
- B. Store materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by manufacturer.
- C. Remove and replace material that cannot be applied within its stated shelf life.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing work to be performed in accordance with manufacturer's written instructions and warranty requirements.
 - 1. Apply materials within the range of ambient and substrate temperatures recommended in writing by material manufacturers, but not below **50 deg F (10 deg C)**.
 - 2. Apply materials within range of relative humidity recommended in writing by manufacturer of each component, but not when relative humidity exceeds 85 percent, or when temperatures are less than **5 deg F (3 deg C)** above dew point.
 - 3. Do not apply materials to damp or wet surfaces.
 - 4. Do not apply primers, polyurethane foam, or coatings in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period.
 - 5. Do not apply polyurethane foam when wind conditions result in surface finish textures not complying with requirements.
 - 6. Do not apply coatings when wind conditions prevent uniform coating application.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace coated foamed roofing that does not comply with requirements or that does not remain watertight within specified warranty period.
 - 1. Warranty Period: **[Five][10][15][20]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain [coating and polyurethane foam from single source from single manufacturer][coating from single source from single manufacturer and polyurethane foam from single manufacturer acceptable in writing to coating manufacturer].

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Coated foamed roofing to withstand exposure to weather without failure due to defective manufacture, installation, or other defects in construction. Membrane roofing to remain watertight.
1. Material Compatibility: Provide polyurethane foam, coatings, substrate board, and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Fire-Test-Response Characteristics: Provide coated foamed roofing with the fire-test-response characteristics indicated, as determined by testing identical systems in accordance with test methods below for deck type and slopes indicated by a qualified testing and inspecting agency that is acceptable to authorities having jurisdiction.
1. [Class A][Class B][Class C] roof covering in accordance with ASTM E108.
2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- a. Flame-Spread Index: [75]<Insert value> or less.
3. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- C. Wind-Uplift Resistance: Design roofing system to resist the following wind-uplift pressures when tested in accordance with FM 4474, UL 580, or UL 1897:
1. Zone 1 (Roof Area Field): <Insert lbf/sq. ft. (kPa)>.
2. Zone 2 (Roof Area Perimeter): <Insert lbf/sq. ft. (kPa)>.
- a. Location: From roof edge to <Insert dimension> inside roof edge.
3. Zone 3 (Roof Area Corners): <Insert lbf/sq. ft. (kPa)>.
- a. Location: <Insert dimension> in each direction from building corner.
- D. FM Approvals Listing: Provide roofing system and component materials that comply with requirements in [FM Approvals Standard 4450 for steel roof decks and]FM Approvals Standard 4470 for roof covers as part of a foamed roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
1. Fire/Windstorm Classification: Class 1A-[60][75][90][105][120]<Insert number>.
2. Hail-Resistance Classification: [MH][SH].

- E. Solar Reflectance Index: Not less than **[78][29]** when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- F. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][32]** or initial SRI not less than **[82][39]** when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- G. Solar Reflectance Index: Not less than **[78][29]** when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- H. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][15]** when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- I. Solar Reflectance Index: Not less than **[78][29]** when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- J. Energy Star Listing: Provide coated foam roofing that is listed on the EPA/DOE's "Energy Star Roof Product List" for **[low][steep]**-slope roof products.
- K. Energy Performance: Provide coated foamed roofing certified and labeled in accordance with one of the following when tested in accordance with ANSI/CRRC S100:
 - 1. Three-year, aged solar reflectance of not less than **[0.55]<Insert value>** and emissivity of not less than **[0.75]<Insert value>**.
 - 2. Three-year, aged Solar Reflectance Index of not less than **[64]<Insert value>** when calculated in accordance with ASTM E1980.

2.3 POLYURETHANE FOAM

- A. Polyurethane Foam: Rigid, cellular polyurethane; complying with ASTM C1029, **[Type III][or][Type IV]**; spray applied, with fire retardants as required, and acceptable to coating manufacturer.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Conklin Company Inc]**
 - b. **[Gaco; Holcim Building Envelope]**
 - c. **[General Coatings Manufacturing Corp.]**
 - d. **[Huntsman Building Solutions]**
 - e. **[Master Builders Solutions]**
 - f. **[NCFI; Barnhart Manufacturing Co.]**
 - g. **[Neogard; Hempel Group]**
 - h. **[SWD Urethane Company]**
 - i. **[Volatile Free, Inc.]**
 - j. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Conklin Company Inc]**
 - b. **[Gaco; Holcim Building Envelope]**
 - c. **[General Coatings Manufacturing Corp.]**

- d. [Huntsman Building Solutions]
- e. [Master Builders Solutions]
- f. [NCFI; Barnhart Manufacturing Co.]
- g. [Neogard; Hempel Group]
- h. [SWD Urethane Company]
- i. [Volatile Free, Inc.]
- j. <Insert manufacturer's name>

- 3. In-Place Density: **2.8 to 3.0 lb/cu. ft. (44.9 to 48.1 kg/cu. m)**; ASTM D1622/D1622M.

2.4 URETHANE COATINGS

- A. Urethane Coating: Liquid urethane elastomeric coating system specifically formulated for coating spray-applied polyurethane foam roofing. [**One-component urethanes must comply with ASTM D6947/D6947M.**]

- 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Aldo Products Inc.]
- b. [ER Systems; a Holcim brand]
- c. [Gaco; Holcim Building Envelope]
- d. [GAF]
- e. [Master Builders Solutions]
- f. [NCFI; Barnhart Manufacturing Co.]
- g. [Neogard; Hempel Group]
- h. [Volatile Free, Inc.]
- i. <Insert manufacturer's name>

- 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Aldo Products Inc.]
- b. [ER Systems; a Holcim brand]
- c. [Gaco; Holcim Building Envelope]
- d. [GAF]
- e. [Master Builders Solutions]
- f. [NCFI; Barnhart Manufacturing Co.]
- g. [Neogard; Hempel Group]
- h. [Volatile Free, Inc.]
- i. <Insert manufacturer's name>

- 3. Base Coat: [One][Two][One- or two]-component urethane[, color contrasting with topcoat].

- 4. Topcoat: [One][Two][One- or two]-component urethane.

- a. Color: [White][Gray][Tan]<Insert color>.
- b. Color at Walkways: [White][Gray][Tan]<Insert color>.

- 5. Tensile Strength: **600 psi (4.1 MPa)** minimum in accordance with ASTM D2370.

- 6. Elongation: 350 percent minimum in accordance with ASTM D412 after 1000 hours accelerated weathering in accordance with ASTM D4798/D4798M.

7. Water Absorption: 3 percent maximum by weight in accordance with ASTM D471.
8. Fungal Resistance: Zero rating in accordance with ASTM G21.
9. Tear Resistance: **100 lbf/inch (17.5 kN/m)** minimum in accordance with ASTM D624.
10. Low-Temperature Flexibility: Pass **0.5-inch (12.5-mm)** mandrel at minus 15 deg F (minus 26 deg C) in accordance with ASTM D522/D522M.
11. Vapor Permeance: Minimum **[0.7 perm (40.2 ng/Pa x s x sq. m)]****[5.0 perms (286 ng/Pa x s x sq. m)]****<Insert value>** at **20 mils (0.5 mm)** thick in accordance with ASTM E96/E96M, Desiccant Method, Procedure A.

2.5 SILICONE COATINGS

- A. Silicone Coating: Liquid silicone elastomeric coating system[**complying with ASTM D6694/D6694M and**] specifically formulated for coating spray-applied polyurethane foam roofing.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Aldo Products Inc.]**
 - b. **[ER Systems; a Holcim brand]**
 - c. **[Gaco; Holcim Building Envelope]**
 - d. **[GAF]**
 - e. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - f. **[General Coatings Manufacturing Corp.]**
 - g. **[Huntsman Building Solutions]**
 - h. **[Master Builders Solutions]**
 - i. **[NCFI; Barnhart Manufacturing Co.]**
 - j. **[Neogard; Hempel Group]**
 - k. **[Volatile Free, Inc.]**
 - l. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Aldo Products Inc.]**
 - b. **[ER Systems; a Holcim brand]**
 - c. **[Gaco; Holcim Building Envelope]**
 - d. **[GAF]**
 - e. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - f. **[General Coatings Manufacturing Corp.]**
 - g. **[Huntsman Building Solutions]**
 - h. **[Master Builders Solutions]**
 - i. **[NCFI; Barnhart Manufacturing Co.]**
 - j. **[Neogard; Hempel Group]**
 - k. **[Volatile Free, Inc.]**
 - l. **<Insert manufacturer's name>**
3. Composition: **[One][Two][One- or two]-component silicone.**
4. Base-Coat Color: Contrasting with topcoat.
5. Topcoat Color: **[White][Gray][Tan]<Insert color>.**
6. Topcoat Color at Walkways: **[White][Gray][Tan]<Insert color>.**
7. Vapor Permeance: Minimum **[5.0 perms (286 ng/Pa x s x sq. m)]****<Insert value>** at **20 mils (0.5 mm)** thick in accordance with ASTM E96/E96M, Desiccant Method, Procedure A.

2.6 ACRYLIC COATINGS

- A. Acrylic Coating: Liquid acrylic elastomeric emulsion coating system specifically formulated for coating spray-applied polyurethane foam roofing.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Aldo Products Inc.]**
 - b. **[Conklin Company Inc]**
 - c. **[ER Systems; a Holcim brand]**
 - d. **[Gaco; Holcim Building Envelope]**
 - e. **[GAF]**
 - f. **[General Coatings Manufacturing Corp.]**
 - g. **[Huntsman Building Solutions]**
 - h. **[NCFI; Barnhart Manufacturing Co.]**
 - i. **[Neogard; Hempel Group]**
 - j. **[SWD Urethane Company]**
 - k. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Aldo Products Inc.]**
 - b. **[Conklin Company Inc]**
 - c. **[ER Systems; a Holcim brand]**
 - d. **[Gaco; Holcim Building Envelope]**
 - e. **[GAF]**
 - f. **[General Coatings Manufacturing Corp.]**
 - g. **[Huntsman Building Solutions]**
 - h. **[NCFI; Barnhart Manufacturing Co.]**
 - i. **[Neogard; Hempel Group]**
 - j. **[SWD Urethane Company]**
 - k. **<Insert manufacturer's name>**
 3. Base-Coat Color: Contrasting with topcoat.
 4. Topcoat Color: **[White][Gray][Tan]<Insert color>**.
 5. Topcoat Color at Walkways: **[White][Gray][Tan]<Insert color>**.
 6. Vapor Permeance: Minimum **[5.0 perms (286 ng/Pa x s x sq. m)]<Insert value>** at 20 mils (0.5 mm) thick in accordance with ASTM E96/E96M, Desiccant Method, Procedure A.

2.7 SUBSTRATE BOARD

- A. Gypsum Board Thermal Barrier: ASTM C1396/C1396M, **[1/2 inch (13 mm)][Type X, 5/8 inch (16 mm)]** thick.
- B. Thermal Barrier Board: Board product tested in accordance with and meeting the requirements of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.
- C. Glass Mat Gypsum Thermal Barrier: Water-resistant gypsum board with fiberglass mat laminated to both sides, ASTM C1177/C1177M, **[1/2 inch (13 mm)][Type X, 5/8 inch (16 mm)]<Insert**

requirement>.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [CertainTeed; SAINT-GOBAIN]
 - b. [Georgia-Pacific Gypsum LLC]
 - c. [USG Corporation]
 - d. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [CertainTeed; SAINT-GOBAIN]
 - b. [Georgia-Pacific Gypsum LLC]
 - c. [USG Corporation]
 - d. <Insert manufacturer's name>
- D. Recover Board and Fasteners: As recommended in writing by polyurethane foam manufacturer, <Insert requirement,> and complying with the requirements in Section 070150.19 "Preparation for Re-Roofing."
- E. Thermal-Barrier Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals Standard 4470, and designed and sized for fastening thermal barrier to substrate.

2.8 ACCESSORY MATERIALS

- A. General: Accessory materials recommended in writing by roofing manufacturer for intended use.
 1. Liquid-type accessory materials must comply with VOC limits of authorities having jurisdiction.
 2. Adhesives and sealants shall comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Other Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Nonmembrane Roof Sealants: 300 g/L.
 - j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - k. Sealant Primers for Porous Substrates: 775 g/L.
 3. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 5. Adhesives and sealants shall comply with the testing and product requirements of the California

Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

6. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 7. Adhesives and sealants shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- B. Primer: Polyurethane-foam manufacturer's standard factory-formulated primer.
- C. Vapor Retarder: **[Fluid applied][Bituminous membrane][As recommended in writing by coated foamed roofing manufacturer]<Insert material>**.
- D. Mineral Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing **No. 8 (2.36-mm)** sieve and 98 percent of mass retained by **No. 40 (0.42-mm)** sieve.
1. Color: **[Buff white][Gray][Green][Red]<Insert color>**.
- E. Aggregate: Coarse mineral aggregate, **3/4 inch (19 mm)** maximum, ASTM D1863/D1863M, No. 7 or No. 67 gradation.
- F. Reinforcement: Flexible polyester or fiberglass mat of weight, type, and composition recommended in writing by coating manufacturer for embedment in liquid coating.
- G. Walkway Pads: Factory formed of nonwoven PVC strands, porous, UV stabilized, of **5/16-inch (8-mm)** nominal thickness, and approved by coating manufacturer. Provide pad sizes indicated.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Sika Greenstreak]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Sika Greenstreak]**
 - b. **<Insert manufacturer's name>**
 3. Color: **[Yellow][Gray][Blue][Orange][Green]**.
- H. Sealant: ASTM C920, Class 25, Use NT, Grade NS, **[Type M, multicomponent urethane][Type S, one-component, neutral- or acid-curing silicone]**, and as recommended in writing by coated foamed roofing manufacturer for substrate and joint conditions and for compatibility with roofing materials.
- I. Sheet Flashing and Accessories: Types recommended in writing by coated foamed roofing manufacturer, provided at locations indicated and as recommended.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that related work is complete. Do not install coated foamed roofing until roof openings, curbs, and parapets, if any, are complete and roof drains, vents, and other roof penetrations are in place.
- B. Examine substrates, areas, and conditions under which coated foamed roofing will be applied, with Installer present, for compliance with requirements.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and substrates are dry.
- D. Proceed with installation only after minimum concrete curing and drying period recommended in writing by coated foamed roofing manufacturer.
- E. Verify that concrete substrate is visibly dry and free of moisture. Test concrete substrate for capillary moisture by plastic sheet method in accordance with ASTM D4263[**at start of each day's work and**] at start of each roof area or plane. Do not proceed with roofing work if moisture condenses under the plastic sheet.

3.2 INSTALLATION OF SUBSTRATE BOARD

- A. General: Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
- B. Thermal Barrier: **[Fasten to top flanges of steel deck in accordance with recommendations in FM Global's "Approval Guide" and its FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification][Fasten to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof in accordance with coated foamed roofing manufacturer's written instructions].**
- C. Recover Board: Install in accordance with coated foamed roofing manufacturer's written instructions and the requirements in Section 070150.19 "Preparation for Re-Roofing." Fasten through existing roofing to roof structure as indicated. Space fasteners **[for wind-uplift conditions at Project site][as indicated].**

3.3 SURFACE PREPARATION

- A. General: Clean and prepare substrate in accordance with coated foamed roofing manufacturer's written instructions. Provide clean, dust-free, dew-free, and dry substrate for coated foamed roofing application.
- B. Remove grease, oil, form-release agents, curing compounds, and other contaminants from substrate.
- C. Prepare substrate for re-covering in accordance with Section 070150.19 "Preparation for Re-Roofing" and to coated foamed roofing manufacturer's written instructions.
- D. Cover and mask adjoining surfaces not receiving coated foamed roofing to prevent overspray or spillage affecting other construction. Temporarily close off roof drains, removing roof-drain plugs when not doing coated foamed roofing work or when rain is forecast.
 - 1. Remove masking after polyurethane foam application; cover and re-mask adjoining surfaces before coating polyurethane foam.

- E. Prime substrate as recommended in writing by coated foamed roofing manufacturer.
- F. Fill, cover, or tape joints and cracks in substrate that exceed a width of **1/4 inch (6 mm)**. Remove dust and dirt from narrower joints and cracks before applying polyurethane foam.
- G. Install vapor retarder in accordance with coated foamed roofing manufacturer's written instructions.

3.4 APPLICATION OF POLYURETHANE FOAM

- A. General: Mix and apply polyurethane foam in accordance with ASTM D5469/D5469M and coated foamed roofing manufacturer's written instructions.
 - 1. Fill irregularities and depressions to prevent ponding water.
 - 2. Apply the required full thickness of polyurethane foam in any specific area on same day.
 - 3. Apply only the area of polyurethane foam that can be covered with required base coating on same day or within 24 hours.
 - 4. Apply polyurethane foam to avoid overspray beyond immediate area of work.
- B. Apply polyurethane foam in lift thicknesses of not less than **1/2 inch (13 mm)** and not more than **1-1/2 inches (38 mm)**.
- C. Uniformly apply total thickness of polyurethane foam indicated, but not less than **1 inch (25 mm)**, to a surface tolerance of plus **1/4 inch (6 mm)** and no minus.
 - 1. Slope to Drain: Vary thickness uniformly and fill low spots to achieve minimum **1/4-inch-per-foot (1:48)** slope to drain unless otherwise indicated.
- D. Apply polyurethane foam to roof penetrations, terminations, and vertical surfaces as indicated. Unless otherwise indicated, extend polyurethane foam at least **4 inches (100 mm)** above elevation of adjacent roof field.
- E. Surface Finish: Provide finished surface of polyurethane foam within the following range of surface textures as defined by ASTM D5469/D5469M:
 - 1. Texture: Smooth to [**orange peel**][**coarse orange peel**][or][**verge of popcorn**].
- F. Remove and replace polyurethane foam not complying with surface-texture limitations. Remove defective thickness and prepare and reapply polyurethane foam with acceptable, uniform results.

3.5 APPLICATION OF COATING

- A. Allow polyurethane foam substrate to cure for a minimum of two hours before coating, and apply coating system to polyurethane foam no later than 24 hours after applying the foam. Remove dust, dirt, water, and other contaminants before applying coating system.
- B. Apply coating system to polyurethane foam by spray, roller, or other suitable application method in accordance with coating manufacturer's written instructions.
- C. Apply base coat and one or more topcoats to obtain a uniform, seamless membrane free of blisters and pinholes. Apply each coat at right angles to preceding coat, using contrasting color tints for successive coats.

1. Apply topcoat(s) after removing dust, dirt, water, and other contaminants from base coat.
 2. Urethane Coating: Apply coating system to a minimum dry film thickness **[recommended in writing by coated foamed roofing manufacturer][of 25 mils (0.64 mm)][of 30 mils (0.76 mm)][of 35 mils (0.89 mm)]<Insert thickness>**.
 3. Silicone Coating: Apply coating system to a minimum dry film thickness **[recommended in writing by coated foamed roofing manufacturer][of 20 mils (0.50 mm)][of 22 mils (0.56 mm)][of 26 mils (0.66 mm)][of 30 mils (0.76 mm)]<Insert thickness>**.
 4. Acrylic Coating: Apply coating system to a minimum dry film thickness **[recommended in writing by coated foamed roofing manufacturer][of 25 mils (0.64 mm)][of 28 mils (0.71 mm)][of 32 mils (0.81 mm)]<Insert thickness>**.
- D. Height at Terminations: Apply coating system at wall terminations and other vertical surfaces to extend vertically beyond polyurethane foam by a minimum of **4 inches (100 mm)**.
- E. Mineral Granules: Apply mineral granules over wet topcoat, using pressure equipment at the rate of **[0.5 lb/sq. ft. (2.45 kg/sq. m)]<Insert value>**. Remove excess granules after topcoat has cured.
- F. Sealant: Apply sealant to perimeter and other terminations where indicated on Drawings or required by coated foamed roofing manufacturer.
- G. Walkways: Install roof walkways in pattern and locations indicated and as follows:
1. Granule-Coated Walkways: Mask off completed coating adjacent to walkways, and apply one or two additional topcoats to achieve a minimum dry film thickness recommended in writing by coated foamed roofing manufacturer. Spread mineral granules uniformly at a rate of **0.5 lb/sq. ft. (2.45 kg/sq. m)** into final wet coating. Remove masking and excess granules after topcoat has cured.
 2. Fabric-Reinforced, Granule-Coated Walkways: Mask off completed coating adjacent to walkways, and apply one additional topcoat to achieve a minimum dry film thickness recommended in writing by coated foamed roofing manufacturer. Lay reinforcing fabric into wet coating and apply another topcoat, completely filling fabric. Spread mineral granules uniformly at a rate of **0.5 lb/sq. ft. (2.45 kg/sq. m)** into final wet coating. Remove masking and excess granules after topcoat has cured.
 3. Preformed Walkway-Pad Walkways: Adhere walkway pads to substrate with compatible adhesive in accordance with coated foamed roofing manufacturer's written instructions.
- H. Aggregate: Apply aggregate uniformly over coated polyurethane foam at coated foamed roofing manufacturer's recommended rate, but not less than **6 lb/sq. ft. (29 kg/sq. m)** and a minimum thickness of **3/4 inch (19 mm)**. Spread with care to prevent puncturing coating and to minimize damage to substrate foam.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
1. Testing agency will identify, seal, and certify samples of materials taken from Project site, with Contractor present.
 2. Testing agency will perform tests for product characteristics specified or cited in manufacturer's product data.
 - a. Two core samples will be required for roof areas of up to **10,000 sq. ft. (900 sq. m)**, and one core sample will be required for each additional **10,000 sq. ft. (900 sq. m)** or part thereof.
 - b. Six slit-test samples will be required for each **10,000 sq. ft. (900 sq. m)** of roof area to

determine, as a minimum, the number of coats applied and dry film thickness of coating.

3. Testing agency will verify that surfaces slope to drain.

- B. Coated foamed roofing will be considered defective if it does not pass tests and inspections.
- C. Refill cores, repair slits, and re-coat test areas.
- D. Prepare test and inspection reports.

3.7 REPAIR AND RE-COATING

- A. Correct deficiencies in, or remove, foam or coatings that do not comply with requirements; fill and repair substrates and reapply materials.
- B. Repair and re-coat coated foamed roofing in accordance with ASTM D6705/D6705M and manufacturer's written instructions.

3.8 CURING, PROTECTING, AND CLEANING

- A. Cure coatings in accordance with manufacturer's written instructions, taking care to prevent contamination and damage during application stages and curing. Do not permit traffic on uncured coatings.
- B. Protect coated foamed roofing from damage and wear during remainder of construction period.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 07 57 00 00



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 57 13 00	07 57 00 00	Coated Foamed Roofing
07 58 00 00	07 51 13 00	Built-Up Asphalt Roofing



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SECTION 07 61 00 00 - SHEET METAL ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sheet metal roofing material.
2. Underlayment.

B. Related Requirements:

1. Section 074293 "Soffit Panels" for manufactured metal panels used in horizontal soffit applications.
2. Section 077100 "Roof Specialties" for manufactured [fasciae][and][copings] that are not part of sheet metal roofing.
3. Section 077253 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface, allowing it to melt and drain off slowly.

1.2 COORDINATION

- A. Coordinate sheet metal roofing layout and seams with sizes and locations of roof curbs, equipment supports, equipment provided, and roof penetrations.
- B. Coordinate sheet metal roofing installation with rain drainage work, flashing, trim, and construction of roofing substrate, parapets, walls, and other adjoining work to provide leakproof, secure, and noncorrosive installation.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at [Project site]<Insert location>.
1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Review structural loading limitations of substrates during and after roofing installation.
 3. Review insulation, air barrier, vapor retarder, and underlayment requirements.
 4. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affect sheet metal roofing.
 5. Review requirements for insurance and certificates if applicable.
 6. Review roof observation and repair procedures after sheet metal roofing installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For sheet metal roofing panels. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and panel installation layouts, expansion joint locations, points of fixity, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include details for forming, including seams and dimensions.
4. Include details for joining and securing, including layout and spacing of fasteners, cleats, and other attachments. Include pattern of seams.
5. Include details of expansion joints, including showing direction of expansion and contraction from points of fixity.
6. Include details of roof penetrations.
7. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, corners, flashings, and counterflashings.
8. Include details of special conditions.
9. Include details of connections to adjoining work.
10. Detail the following accessory items, at scale of not less than **[1-1/2 inches per 12 inches (1:10)]****[3 inches per 12 inches (1:5)]****<Insert scale>**:

- a. Flashing and trim.
- b. Roof curbs.

- C. Samples: For each exposed product and for each color and texture specified, **12 inches (300 mm)** long by actual width.
- D. Samples for Initial Selection: For each type of sheet metal with factory-applied finishes.
1. Include Samples of trim and accessories involving finish or color selection.
- E. Samples for Verification: For each type of exposed finish.
1. Sheet Metal Roofing: **12 inches (300 mm)** long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, **[battens]**, and other attachments.
 2. Trim and Metal Closures: **12 inches (300 mm)** long and in required profile. Include fasteners and other exposed accessories.
 3. Other Accessories: **12-inch- (300-mm-)** long Samples for each type of other accessory.
- F. Sustainable Design Submittals:
1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, on which the following items are indicated and coordinated with each other, using input from installers of the items involved:
1. Sheet metal roofing, seam locations, and attachments.
 2. Roof hatches.
 3. Equipment supports, pipe supports, and penetrations.
 4. Lighting fixtures and cable runs.
 5. Snow guards.
 6. Items mounted on roof curbs.
 7. Details for penetrations.
- B. Qualification Statements: For **[Installer]****[fabricator]**.

1. Include listing of completed projects of comparable scale of this Project, including name, address, telephone, and contact person for Architect, and name, address, telephone number, and contact person for building Owner.
 - C. Product Test Reports: For self-adhering, high-temperature underlayment, from ICC-ES.
 - D. Sample Warranties: For special warranties.
- 1.6 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For sheet metal roofing and accessories.
 - B. Warranty Documentation:
 1. Manufacturers' special warranties.
 2. Installer's special warranties.
- 1.7 QUALITY ASSURANCE
- A. Roof Installer Qualifications: Entity that employs **[a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified Metal Panel Roof Systems Installers][a supervisor who is an NRCA ProCertified Roofing Foreman][a supervisor who is an NRCA ProCertified Roofing Foreman and not less than 20 percent of installers who are NRCA ProCertified Metal Panel Roof Systems Installers]**.
- 1.8 MOCKUPS
- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 1. Build mockup of typical roof area and eave as indicated on Drawings, including[, **underlayment,**] attachments, and accessories.
 - a. Size: Approximately **[12 feet (3.5 m) long by 6 feet (1.75 m)][48 inches (1200 mm) square][12 feet (3.5 m) square]<Insert dimension(s)>**.
 - b. Include **[each type of exposed seam and seam termination][fascia][soffit][and][gable end and rake]<Insert mockup item>**.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- 1.9 DELIVERY, STORAGE, AND HANDLING
- A. Do not store sheet metal roofing materials in contact with other materials that might cause staining, denting, or other surface damage.
 1. Store sheet metal roofing materials away from uncured concrete and masonry.
 2. Protect stored sheet metal roofing materials from contact with water.

- B. Protect strippable protective covering on sheet metal roofing from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal roofing installation.
- C. Copper Roof Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.10 WARRANTY

- A. Roofing System Installer's Warranty: Submit Roofing System Installer's warranty, on warranty form at end of this Section, signed by Roofing System Installer, covering the Work of this Section, including all components of roofing system, such as fasteners, adhesives, sheet metal roofing, and other components of roofing system.
 - 1. Warranty Period: **[Two][Five]<Insert number>** years from date of Substantial Completion.
- B. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal roofing that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: **[20][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Sheet metal roofing system, including, but not limited to, metal roof panels, cleats, anchors and fasteners, sheet metal flashing integral with sheet metal roofing, fascia panels, trim[, **battens**], underlayment, and accessories, is to comply with requirements without failure due to defective manufacture, fabrication, or installation, or due to other defects in construction. Sheet metal roofing is to remain watertight.
- B. Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or indicated on Drawings.
- C. Copper Roofing Standard: Comply with CDA Publication A4050. Conform to dimensions and profiles shown unless more stringent requirements are specified or indicated on Drawings.
- D. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][32]** or initial SRI not less than **[82][39]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- E. Solar Reflectance Index (SRI): Three-year-aged SRI not less than **[64][25]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.
- F. Solar Reflectance Index (SRI): Not less than **[78][29]** when calculated in accordance with ASTM E1980, based on testing identical products by a qualified testing agency.

- G. Energy Performance: Provide sheet metal roofing meeting one of the following when tested in accordance with CRRC-1:
1. Three-year, aged, solar reflectance of not less than **[0.63][0.55]<Insert value>** and emissivity of not less than **[0.75]<Insert value>**.
 2. Three-year, aged, Solar Reflectance Index (SRI) of not less than **[75][64]<Insert value>** when calculated in accordance with ASTM E1980.
- H. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.
1. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature change>**.

2.2 SHEET METAL ROOFING MATERIAL

- A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Metallic-Coated Steel Sheet: Provide **[zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 (Z275) coating designation][or][aluminum-zinc alloy-coated steel sheet in accordance with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation, Grade 40 (Grade 275)]**; with **[smooth, flat][embossed]** surface; prepainted by coil-coating process to comply with ASTM A755/A755M.
1. Thickness: Nominal **[0.022 inch (0.56 mm)][0.028 inch (0.71 mm)]<Insert dimension>** unless otherwise indicated.
 - a. Batten Caps: Nominal **0.028 inch (0.71 mm)** thick.
 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
 3. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
 - b. Three-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
 - c. Mica Fluoropolymer: Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
 - d. Metallic Fluoropolymer: Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
 - e. FEVE Fluoropolymer: Two-coat fluoropolymer finish containing 100 percent FEVE resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe**

- environments].**
- f. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with dry film thickness of not less than **0.2 mil (0.005 mm)** for primer and **0.8 mil (0.02 mm)** for topcoat.
4. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.**
 5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of **0.5 mil (0.013 mm)**.
- C. Aluminum Sheet: **ASTM B209 (ASTM B209M)** alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with **[smooth, flat][embossed]** surface.
1. Thickness: **[0.032 inch (0.81 mm)][0.040 inch (1.02 mm)]** unless otherwise indicated.
 - a. Batten Caps: **0.050 inch (1.27 mm)** thick.
 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
 3. As-Milled Finish: **[Mill][One-side bright mill][Standard one-side bright][Standard two-side bright]**.
 4. Alclad Finish: Metallurgically bonded surfacing alloy on both sides, forming aluminum sheet with reflective luster.
 5. Factory Prime Coating: Where painting after installation is required, pretreat metal with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of **0.2 mil (0.005 mm)**.
 6. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - b. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - c. Mica Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - d. Metallic Fluoropolymer: AAMA 2605. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - e. FEVE Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish containing 100 percent FEVE resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - f. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with dry film thickness of not less than **0.2 mil (0.005 mm)** for primer and **0.8 mil (0.02 mm)** for topcoat.

7. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.
 8. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of **0.5 mil (0.013 mm)**.
- D. Copper Sheet: ASTM B370 cold-rolled copper sheet, H00 temper.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Hussey Copper Ltd.]**
 - b. **[Revere Copper Products, Inc]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Hussey Copper Ltd.]**
 - b. **[Revere Copper Products, Inc]**
 - c. **<Insert manufacturer's name>**
 3. Weight (Thickness): **[16 oz./sq. ft. (0.55 mm thick)][20 oz./sq. ft. (0.70 mm thick)]<Insert weight (thickness)>** unless otherwise indicated.
 - a. Batten Caps: **20 oz./sq. ft. (0.70 mm)** thick.
 4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
 5. Nonpatinated Exposed Finish: Mill.
 6. Nonpatinated Exposed, Lacquered Finish: Finish designations for copper alloys comply with system defined in NAAMM/NOMMA AMP 500 "Metal Finishes Manual for Architectural and Metal Products."
 - a. Brushed Satin (Lacquered): M32-06x (Mechanical Finish: directionally textured, medium satin; with clear organic coating); coating of "Incralac" **[waterborne][solvent-borne]** methyl methacrylate copolymer lacquer with UV inhibitor, applied by air spray in two coats in accordance with manufacturer's written instructions to total thickness of **1 mil (0.025 mm)**.
 - b. Mirror Polished (Lacquered): M22-06x (Mechanical Finish: buffed, specular; with clear organic coating); coating of "Incralac" **[waterborne][solvent-borne]** air-drying, methyl methacrylate copolymer lacquer with UV inhibitor, applied by air spray in two coats in accordance with manufacturer's written instructions to total thickness of **1 mil (0.025 mm)**.
 7. Prepatinated Copper-Sheet Finish: **[Dark brown][Verdigris]<Insert color>**, prepatinated in accordance with ASTM B882.
- E. Zinc-Tin Alloy-Coated Copper Sheet: ASTM B370 cold-rolled copper sheet, H00 temper, coated on both sides with zinc-tin alloy (50 percent zinc, 50 percent tin).
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. **[Revere Copper Products, Inc]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Revere Copper Products, Inc]**
 - b. **<Insert manufacturer's name>**
 3. Weight (Thickness): **[16 oz./sq. ft. (0.55 mm)][20 oz./sq. ft. (0.70 mm)]<Insert weight (thickness)>** uncoated, with **0.787-mil (0.020-mm)** coating thickness applied to each side.
 - a. Batten Caps: **20 oz./sq. ft. (0.70 mm)** uncoated, with **0.787-mil (0.020-mm)** coating thickness applied to each side unless otherwise indicated.
 4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- F. Stainless Steel Sheet: ASTM A240/A240M, **[Type 304][Type 316]**, dead soft, fully annealed; with **[smooth, flat][embossed]** surface.
1. Thickness: **[0.0156 inch (0.396 mm)][0.0188 inch (0.477 mm)]** unless otherwise indicated.
 - a. Batten Caps: **0.0188 inch (0.477 mm)** thick.
 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
 3. Finish: **[ASTM A480/A480M, No. 2D (dull, cold rolled)][ASTM A480/A480M, No. 2B (bright, cold rolled)][ASTM A480/A480M, No. 3 (coarse, polished directional satin)][ASTM A480/A480M, No. 4 (polished directional satin)]<Insert finish>**.
 - a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 - b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches. Run grain of directional finishes with long dimension of each piece.
 - c. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- G. Copper-Clad Stainless Steel Sheet: ASTM B506, annealed temper O61.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Heyco Metals]**
 - b. **[SEMCO Southeastern Metals, A Gibraltar Industries Company]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Heyco Metals]**
 - b. **[SEMCO Southeastern Metals, A Gibraltar Industries Company]**

- c. **<Insert manufacturer's name>**
- 3. Thickness: **[0.016 inch (0.40 mm)]<Insert dimension>** unless otherwise indicated.
 - a. Batten Caps: **[0.018 inch (0.46 mm)]<Insert dimension>** thick.
- 4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- H. Zinc Sheet: **[99.995 percent electrolytic high-grade zinc with alloy additives of copper (0.08 to 0.20 percent), titanium (0.07 to 0.12 percent), and aluminum (0.015 percent)]****[Zinc, 99 percent pure, alloyed with 0.08 to 1.00 percent copper, 0.06 to 0.20 percent titanium, and up to 0.015 percent aluminum]**; with manufacturer's standard factory-applied, flexible, protective back coating.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following]****[provide products by one of the following]****[available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Artazn LLC]**
 - b. **[Rheinzink America]**
 - c. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Artazn LLC]**
 - b. **[Rheinzink America]**
 - c. **<Insert manufacturer's name>**
 - 3. Thickness: **[0.027 inch (0.70 mm)]****[0.032 inch (0.81 mm)]<Insert dimension>** unless otherwise indicated.
 - a. Batten Caps: **0.032 inch (0.80 mm)** thick.
 - 4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
 - 5. Finish: **[Bright rolled]****[Preweathered gray]****[Preweathered black]****<Insert finish>**.
- I. Titanium Sheet: ASTM B265, Grade 1; with **[smooth, flat]****[embossed]** surface.
 - 1. Thickness: **[0.015 inch (0.38 mm)]****[0.020 inch (0.51 mm)]<Insert dimension>** unless otherwise indicated.
 - a. Batten Caps: **0.020 inch (0.51 mm)** thick.
 - 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
 - 3. Finish: **[Low]****[Medium]** matte.
 - 4. Color Anodic Finish (Light-Interference Phenomenon): **[Silver]****[Gold]****[Purple]****[Blue]****[Match Architect's sample]****[As selected by Architect from manufacturer's full range of colors and color densities]****<Insert color>**.

2.3 UNDERLAYMENT

- A. Synthetic Underlayment: UV-resistant polypropylene, polyolefin, or polyethylene polymer fabric with surface coatings or treatments to improve traction underfoot and abrasion resistance; acceptable to authorities having jurisdiction for use as underlayment in roofing system.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[Intertape Polymer Group]**
 - c. **[Kirsch Building Products]**
 - d. **[SDP Advanced Polymer Products Inc.]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - b. **[Intertape Polymer Group]**
 - c. **[Kirsch Building Products]**
 - d. **[SDP Advanced Polymer Products Inc.]**
 - e. **<Insert manufacturer's name>**
- B. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of **30 mils (0.76 mm)** thick, specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer when recommended by underlayment manufacturer.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[ATAS International, Inc.]**
 - b. **[Carlisle WIP Products; a brand of Carlisle Construction Materials]**
 - c. **[GCP Applied Technologies Inc.]**
 - d. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - e. **[Owens Corning]**
 - f. **[Polyglass U.S.A., Inc.]**
 - g. **[Protecto Wrap Company]**
 - h. **[SDP Advanced Polymer Products Inc.]**
 - i. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ATAS International, Inc.]**
 - b. **[Carlisle WIP Products; a brand of Carlisle Construction Materials]**
 - c. **[GCP Applied Technologies Inc.]**

- d. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
 - e. [Owens Corning]
 - f. [Polyglass U.S.A., Inc.]
 - g. [Protecto Wrap Company]
 - h. [SDP Advanced Polymer Products Inc.]
 - i. <Insert manufacturer's name>
- 3. Thermal Stability: Stable after testing at **220 deg F (111 deg C)**; ASTM D1970/D1970M.
 - 4. Low-Temperature Flexibility: Passes after testing at minus **20 deg F (minus 29 deg C)**; ASTM D1970/D1970M.
- C. Felt Underlayment: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felts.
 - D. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.
 - E. Ventilation Mat: **0.40-inch (10.16-mm-)** thick, three-dimensional nylon mat.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Low & Bonar PLC]
 - b. [Rheinzink America]
 - c. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Low & Bonar PLC]
 - b. [Rheinzink America]
 - c. <Insert manufacturer's name>

2.4 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners[, **solder**], protective coatings, sealants, and other miscellaneous items as required for complete roofing system and as recommended by primary sheet metal manufacturer unless otherwise indicated.
- B. Wood Battens: Lumber in accordance with requirements for nailers for roofing in Section 061000 "Rough Carpentry."
- C. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
 - 1. General:
 - a. Exposed Fasteners: Heads matching color of sheet metal roofing, using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of roofing.
 - b. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed; with hex-washer head.
 - c. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being

fastened.

2. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.
3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
4. Fasteners for Copper, Zinc-Tin Alloy-Coated Copper, or Copper-Clad Stainless Steel Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
5. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
6. Fasteners for Zinc Sheet: Series 300 stainless steel[**or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M**].
7. Fasteners for Titanium Sheet: Titanium or Series 300 stainless steel.

D. Solder:

1. For Zinc-Coated (Galvanized) Steel: ASTM B32, [**Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead**][with maximum lead content of 0.2 percent].
2. For Copper or Copper-Clad Stainless Steel: ASTM B32, [**Grade Sn50, 50 percent tin and 50 percent lead**][with maximum lead content of 0.2 percent].
3. For Stainless Steel: ASTM B32, [**Grade Sn60**][**Grade Sn96**], with acid flux of type recommended by stainless steel sheet manufacturer.
4. For Zinc-Tin Alloy-Coated Copper: ASTM B32, 100 percent tin, with maximum lead content of 0.2 percent, as recommended by sheet metal manufacturer.
5. For Zinc: ASTM B32, [**40 percent tin and 60 percent lead with low antimony**], [with maximum lead content of 0.2 percent,] as recommended by zinc manufacturer.

- E. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape **1/2 inch (13 mm)** wide and **1/8 inch (3 mm)** thick.
- F. Elastomeric Sealant: ASTM C920, elastomeric [**polyurethane**][**polysulfide**][**silicone**] polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal roofing and remain watertight.
- G. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- H. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187.
- I. Underlayment Adhesive:
1. Cold-Applied Asphalt Adhesive: ASTM D3019, Type III, asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with underlayment.
 2. Cold-Applied Polymer-Modified Asphalt Adhesive: Underlayment manufacturer's standard solvent-and asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with underlayment.
 3. Verify adhesives and sealants comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. Verify adhesives and sealants comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

5. Verify adhesives and sealants comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.

2.5 ACCESSORIES

- A. Sheet Metal Accessories: Provide components required for complete sheet metal roofing assembly, including trim, fasciae, corner units, clips, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items. Match material and finish of sheet metal roofing unless otherwise indicated.
 1. Cleats: Intermittent and continuous attachment devices for mechanically seaming into joints and formed from the following materials and thicknesses unless otherwise indicated:
 - a. Metallic-Coated Steel or Aluminum Roofing: [0.0250-inch- (0.635-mm-)]<Insert dimension> thick stainless steel.
 - b. Copper or Zinc-Tin Alloy-Coated Copper Roofing: [16-inch- (0.55-mm-)] [20-inch- (0.70-mm-)]<Insert weight (thickness)> thick copper sheet.
 - c. Stainless Steel or Titanium Roofing: [0.0250-inch- (0.635-mm-)]<Insert dimension> thick stainless steel.
 - d. Copper-Clad Stainless Steel Roofing: [0.024-inch- (0.61-mm-)]<Insert dimension> thick, copper-clad stainless steel.
 - e. Zinc Roofing: Manufacturer's preformed stainless steel cleats.
 2. Expansion-Type Cleats: Cleats of a design that allows longitudinal movement of roof panels without stressing panel seams; of same material as other cleats.
 3. Backing Plates: Plates at roofing splices, fabricated from material recommended by SMACNA's "Architectural Sheet Metal Manual."
 4. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible-closure strips; cut or premolded to match sheet metal roofing profile. Provide closure strips where necessary to ensure weathertight construction.
 5. Flashing and Trim: Formed from same material and with same finish as sheet metal roofing, minimum [0.018 inch (0.46 mm)]<Insert dimension> thick.
- B. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.
- C. Roof Curbs: Fabricated from same material and finish as sheet metal roofing, minimum thickness [matching the sheet metal roofing]<Insert dimension>; with bottom of skirt profiled to match roof panel and seam profiles; with weatherproof top box and integral full-length cricket.
 1. Fabricate curb subframing of nominal [0.062-inch- (1.59-mm-)]<Insert dimension> thick, angle-, C- or Z-shaped, galvanized-steel or stainless steel sheet.
 2. Fabricate curb and subframing to withstand indicated loads of size and height indicated.
 3. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
 4. Insulate curbs with [1-inch- (25-mm-)]<Insert dimension> thick, rigid insulation.
 5. Provide treated wood nailers at tops of curbs.

2.6 FABRICATION

- A. Custom-Fabricated Sheet Metal Roofing: Comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions (panel width and seam

height), geometry, metal thickness, and other characteristics of installation. Fabricate sheet metal roofing and accessories in shop to greatest extent possible.

- B. Flat-Seam Sheet Metal Roofing: Form flat-seam panels from metal sheets [20 by 28 inches (508 by 710 mm)]<Insert dimensions> with 1/2-inch (13-mm) notched and folded edges.
- C. Standing-Seam Sheet Metal Roofing: Form standing-seam panels with finished seam height [of 1 inch (25 mm)][of 1-1/2 inches (38 mm)][as indicated]<Insert dimension>.
- D. Batten-Seam Sheet Metal Roofing: Form batten-seam panels with edges turned up [2-1/8 inches (54 mm)][as indicated]<Insert dimension> and with 1/2-inch (13-mm) flange turned toward center of pan.
- E. Horizontal-Seam (Bermuda-Type) Sheet Metal Roofing: Form horizontal-seam (Bermuda-type) panels with upper edges of lower panels turned up and extending 1/2 inch (13 mm) above continuous horizontal steps in substrate.
- F. Fabrication Tolerances: [Fabricate sheet metal roofing that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.][Fabricate sheet metal roofing that is capable of installation to tolerances specified in MCA's "Metal Roof Installation Manual."]
- G. Form exposed sheet metal work to fit substrates with little oil canning; free of buckling and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 1. Lay out sheet metal roofing, so transverse seams, if required, are made in direction of flow, with higher panels overlapping lower panels.
 - 2. Offset transverse seams from each other [12 inches (300 mm)]<Insert dimension> inches (mm) minimum.
 - 3. Fold and cleat eaves and transverse seams in shop.
 - 4. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of metal roofing to profiles, patterns, and drainage arrangements indicated on Drawings and as required for leakproof construction.
- H. Built-in Gutters (Integral Gutters): Fabricate to cross section indicated, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required.
 - 1. Fabricate in minimum 96-inch- (2400-mm-) long sections.
 - 2. Fabricate expansion joints and accessories from same metal as gutters unless otherwise indicated.
 - 3. Fabricate gutters with built-in expansion joints.
- I. Expansion Provisions: Fabricate sheet metal roofing to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- J. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant in accordance with SMACNA's "Architectural Sheet Metal Manual."
- K. Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item required. Obtain field measurements for accurate fit before shop fabrication.

1. Form exposed sheet metal accessories without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 2. Seams: Fabricate nonmoving seams with flat-lock seams. **[Tin edges to be seamed, form seams, and solder.][Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.][Rivet joints where necessary for strength.]**
 3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant.
 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces of accessories exposed to view.
 5. Fabricate cleats and attachment devices of sizes recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.
- L. Do not use graphite pencils to mark metal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 1. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking, that tops of fasteners are flush with surface, and that installation is within flatness tolerances required for finished roofing installation.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored, and that provision has been made for drainage, flashings, and penetrations through sheet metal roofing.
 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating sheet metal roofing to verify actual locations of penetrations relative to seam locations of sheet metal roofing before installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Lay out panel arrangement, and **[nail battens to wood sheathing][screw battens to wood sheathing][screw battens to metal deck]** before installation of sheet metal roofing.
 1. Space fasteners not more than **[18 inches (460 mm)]<Insert dimension>** o.c.

3.3 INSTALLATION OF UNDERLAYMENT

- A. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, in accordance with manufacturers' written instructions, using adhesive where possible to minimize use of mechanical fasteners under sheet metal.

1. Apply from eave to ridge.
2. Apply on roof not covered by self-adhering sheet underlayment.
3. Lap horizontal joints not less than **4 inches (100 mm)**.
4. Lap end joints not less than **12 inches (300 mm)**.

B. Self-Adhering High-Temperature Sheet Underlayment:

1. Install self-adhering high-temperature sheet underlayment, wrinkle free.
2. Prime substrate if recommended by underlayment manufacturer.
3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
4. Apply in shingle fashion to shed water, with end laps of not less than **6 inches (150 mm)** staggered **24 inches (600 mm)** between courses.
5. Overlap side edges not less than **3-1/2 inches (90 mm)**.
6. Roll laps and edges with roller.
7. Cover underlayment within 14 days of installation.
8. Install self-adhering high-temperature underlayment at the following locations:
 - a. Over entire roof.
 - b. Roof perimeter for a distance up from eaves of **[24 inches (600 mm)][36 inches (910 mm)]<Insert dimension>** beyond interior wall line.
 - c. Valleys, from lowest to highest point, for a distance on each side of **[18 inches (460 mm)]<Insert dimension>**.
 - d. Rake edges for a distance of **[18 inches (460 mm)]<Insert dimension>**.
 - e. Hips and ridges for a distance on each side of **[12 inches (300 mm)]<Insert dimension>**.
 - f. Roof-to-wall intersections for a distance from wall of **[18 inches (460 mm)]<Insert dimension>**.
 - g. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of **[18 inches (460 mm)]<Insert dimension>**.
 - h. Below entire area of integral gutters, up from eaves a minimum of **[36 inches (910 mm)]<Insert dimension>** beyond interior wall line, but not less than **[12 inches (300 mm)]<Insert dimension>** up from ridge side of gutter.
 - i. Directional transitions for a distance of **[12 inches (300 mm)]<Insert dimension>** in each direction.

C. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal roofing.

1. Install in shingle fashion to shed water, with lapped joints of not less than **4 inches (100 mm)**.
2. Apply from eave to ridge.
3. Apply on roof not covered by self-adhering sheet underlayment.

D. Install slip sheet, wrinkle free, [over underlayment][directly on substrate]<Insert requirement> before installing sheet metal roofing and related flashing.

1. Install in shingle fashion to shed water, with lapped joints of not less than **4 inches (100 mm)**.

E. Install ventilation mat over underlayment before installing sheet metal roofing and related flashing.

F. Install flashings to cover [underlayment][slip sheet][ventilation mat] in accordance with requirements in Section 076200 "Sheet Metal Flashing and Trim."

3.4 INSTALLATION, GENERAL

- A. Install sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to installation characteristics required unless otherwise indicated on Drawings.
1. Install fasteners[, **solder**], protective coatings, separators, sealants, and other miscellaneous items as required for complete roofing system.
 2. Install sheet metal roofing true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of [**solder**][**welds**][**sealant**].
 3. Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement.
 4. Do not field cut sheet metal roofing by torch.
 5. Provide metal closures at [**peaks**][**rake edges**][**rake walls**][**eaves**][**and**] each side of ridge[**and hip**] caps.
 6. Flash and seal sheet metal roofing with closure strips at eaves, rakes, and perimeter of all openings. Fasten with self-tapping screws.
 7. Locate and space fastenings in uniform vertical and horizontal alignment. Predrill panels for fasteners.
 8. Install ridge[**and hip**] caps as sheet metal roofing work proceeds.
 9. Lap metal flashing over sheet metal roofing to direct moisture to run over and off roofing.
 10. Do not use graphite pencils to mark metal surfaces.
- B. Thermal Movement: Rigidly fasten metal roof panels to structure at only one location for each panel.
1. Allow remainder of panel to move freely for thermal expansion and contraction.
 2. Point of Fixity: Fasten each panel along a single common line of fixing located at [**eave**][**ridge**][**center of panel length**][**locations indicated on Drawings**]<Insert location>.
 3. Avoid attaching accessories through roof panels in manner that inhibits thermal movement.
- C. Fasteners: Use fastener sizes that penetrate [**wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws**][**substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance**]<Insert size requirement>.
- D. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating, by applying self-adhering sheet underlayment to each contact surface, or by other permanent separation as recommended in SMACNA's "Architectural Sheet Metal Manual."
1. Coat concealed side of [**uncoated-aluminum**][**and**][**stainless steel**] sheet metal roofing with bituminous coating where roofing contacts wood, ferrous metal, or cementitious construction.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Fasciae:
1. Align bottom of sheet metal roofing and fasten with blind rivets, bolts, or self-tapping screws.
 2. Flash and seal sheet metal roofing with closure strips where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.5 INSTALLATION OF SHEET METAL ROOFING

- A. Install sheet metal roofing system with lines and corners of exposed units true and accurate.
 - 1. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering metal temper and reflectivity.
 - 2. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 3. Fold back sheet metal to form hem on concealed side of exposed edges unless otherwise indicated.
- B. Install cleats to hold sheet metal roofing panels in position.
 - 1. Attach each cleat with at least two fasteners to prevent rotation.
 - 2. Space cleats not more than **[12 inches (300 mm)]<Insert dimension> o.c.**
 - 3. Bend tabs over fastener head.
 - 4. Provide expansion-type cleats for roof panels that exceed **30 feet (9.1 m)** in length.
- C. Seal joints as required for watertight construction. For roofing with 3:12 slopes or less, use cleats at transverse seams.
 - 1. Use sealant-filled joints unless otherwise indicated.
 - a. Embed hooked flanges of joint members not less than **1 inch (25 mm)** into sealant.
 - b. Form joints to completely conceal sealant.
 - c. When ambient temperature at time of installation is between **40 and 70 deg F (4 and 21 deg C)**, set joint members for 50 percent movement each way.
 - d. Adjust setting proportionately for installation at higher ambient temperatures.
 - e. Do not install sealant-type joints at temperatures below **40 deg F (4 deg C)**.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- D. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.
 - 1. Pre-tin edges of sheets with solder to a width of **1-1/2 inches (38 mm)**; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 2. Do not solder **[metallic-coated steel][aluminum][and][titanium]** sheet.
 - 3. Do not pre-tin zinc-tin alloy-coated copper.
 - 4. Do not use torches for soldering.
 - 5. Heat surfaces to receive solder, and flow solder into joint.
 - a. Fill joint completely.
 - b. Completely remove flux and spatter from exposed surfaces.
 - 6. Stainless Steel Soldering:
 - a. Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
 - b. Promptly remove acid flux residue from metal after tinning and soldering.
 - c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
 - 7. Copper Soldering: Tin edges of uncoated sheets, using solder for copper.
 - 8. Copper-Clad Stainless Steel Soldering: Tin edges of uncoated sheets, using solder for copper-clad stainless steel.
- E. Rivets: Rivet joints in **[uncoated aluminum][zinc]** where necessary for strength.

F. Flat-Seam Roofing:

1. Attach flat-seam metal panels to substrate with cleats, starting at eave and working upward toward ridge.
2. After panels are in place, mallet seams tight and solder.
3. Attach roofing panels with cleats spaced not more than **[24 inches (600 mm)]<Insert dimension>** o.c. Lock and solder panels to base flashing.
4. Attach edge flashing to face of roof edge with continuous cleat fastened to roof substrate at **[12-inch (300-mm)]<Insert dimension>** o.c. spacing. Lock panels to edge flashing and **[solder][apply sealant]**.

G. Standing-Seam Roofing:

1. Attach standing-seam metal panels to substrate with double-fastened cleats spaced at **[12 inches (300 mm)]<Insert dimension>** o.c.
2. Install panels reaching from eave to ridge before moving to adjacent panels.
 - a. Where transverse joints are required, stagger joints in adjacent panels not less than **48 inches (1200 mm)**.
3. Before panels are interlocked, apply continuous bead of sealant to top of flange of lower panel.
4. Lock standing seams by folding over twice, so cleat and panel edges are completely engaged.
5. Lock each panel to panel below with **[soldered][sealed]** transverse seam.
6. Loose-lock panels at eave edges to continuous cleats and flanges at roof edge at gutters.
7. Loose-lock panels at eave edges to continuous edge flashing exposed **24 inches (600 mm)** from roof edge.
 - a. Attach edge flashing to face of roof edge with continuous cleat fastened to roof substrate at **[12-inch (305-mm)]<Insert dimension>** o.c. spacing.
 - b. Lock panels to edge flashing.
8. **[Leave seams upright][Fold over seams]** after locking at ridges and hips.

H. Batten-Seam Roofing:

1. Attach batten-seam metal panels to substrate with cleats, starting at eave and working upward toward ridge.
2. Hold cleats in place with battens, and fold edges of cleats over to hold panels.
3. After panels are in place and before batten cap is installed, apply continuous bead of sealant to top of upturned flanges of each panel.
4. Install batten cap covering batten and panel edges, and fold batten cap and panel together, so batten cap and panel edges are completely engaged in seams.
5. Hook each panel to panel below with **[soldered][sealed]** transverse seam.
6. Splay upturned edges of panels at a slightly obtuse angle, so pan-bottom width is slightly narrower than space between battens, to provide expansion capability.
7. Close batten ends with metal closures. Fold together with panel edges and end of batten cap.
8. Loose-lock panels at eave edges to continuous cleats and flanges at roof edge at gutters.
9. Loose-lock panels at eave edges to continuous-edge flashing exposed **24 inches (600 mm)** from roof edge.
 - a. Attach edge flashing to face of roof edge with continuous cleat fastened to roof substrate at **[12-inch (305-mm)]<Insert dimension>** o.c. spacing.
 - b. Lock panels to edge flashing.

I. Horizontal-Seam (Bermuda-Type) Roofing:

1. Attach horizontal-seam metal panels to substrate with cleats, starting at eave and working upward toward ridge.
2. Attach cleats along continuous horizontal steps in substrate, with cleats at [8-inch (203-mm)]<Insert dimension> o.c. spacing.
3. Lock lower edge of each panel to turned-up upper edge of panel below, folding seam over to engage cleat and panel edges.
4. After first fold, mallet seams against substrate, leaving joint slightly angled over lower panel to form drip.
5. Hook end of each panel to adjacent panel with [soldered][sealed] cross seam.
6. Hook panel at eave edge to continuous cleat.
7. Join ridges and hips with a standing seam, and [leave seams upright][fold over seams] after locking.

J. Built-in Gutters:

1. Anchor back edge of gutter with continuous cleat.
2. Provide expansion joints at locations indicated on Drawings, but not less than **50 feet (14 m)** on center.
3. Join gutter sections with soldered joints.
 - a. Join sections with lapped joints sealed with sealant where required for expansion.
4. Provide for thermal expansion.
5. Slope gutters to drainage points.
6. Provide end closures and seal watertight with sealant.
7. Install self-adhering, high-temperature sheet underlayment inside built-in gutter as indicated on Drawings.
 - a. Extend self-adhering, high-temperature sheet underlayment to eave drip edges and beneath roof underlayment.
 - b. Lap edges **2 inches (50 mm)**.
 - c. Lap ends **4 inches (100 mm)**.

3.6 INSTALLATION OF ACCESSORIES

- A. Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion.
1. Coordinate installation with flashings and other components.
 2. Install components required for complete sheet metal roofing assembly, including trim, seam covers, flashings, sealants, gaskets, fillers, metal closures, closure strips, and similar items.
 3. Install accessories integral to sheet metal roofing that are specified in Section 076200 "Sheet Metal Flashing and Trim" to comply with that Section's requirements.
- B. Flashing and Trim: Comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual."
1. Provide concealed fasteners where possible, and install units true to line, levels, and slopes.
 2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
 3. Install flashing and trim as required to seal against weather and to provide finished appearance, including, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
 4. Install continuous strip of self-adhering underlayment at edge of continuous flashing overlapping self-adhering underlayment, where "continuous seal strip" is indicated in SMACNA's

- "Architectural Sheet Metal Manual" and on Drawings.
5. Install exposed flashing and trim without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 6. Install sheet metal flashing and trim to fit substrates, and to result in waterproof and weather-resistant performance.
 7. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
 - a. Space expansion joints at maximum of **10 feet (3 m)** with no joints within **24 inches (600 mm)** of corner or intersection.
 - b. Form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, and filled with butyl sealant concealed within joints.
 - c. Use lapped expansion joints only where indicated on Drawings.
- C. Pipe Flashing: Form flashing around pipe penetration and sheet metal roofing. Fasten and seal to sheet metal roofing as recommended in SMACNA's "Architectural Sheet Metal Manual."
- D. Roof Curbs: Install flashing around bases where curbs meet sheet metal roofing.

3.7 INSTALLATION TOLERANCES

- A. Installation Tolerances: **[Shim and align sheet metal roofing within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.][Shim and align sheet metal roofing within installed tolerances specified in MCA's "Metal Roof Installation Manual."]**

3.8 CLEANING

- A. Remove temporary protective coverings and strippable films as sheet metal roofing is installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- C. On completion of sheet metal roofing installation, clean finished surfaces as recommended by sheet metal roofing manufacturer.
- D. Clean and neutralize flux materials. Clean off excess solder.
- E. Clean off excess sealants.

3.9 PROTECTION

- A. Prohibit traffic of any kind on installed sheet metal roofing.
- B. Maintain sheet metal roofing in clean condition during construction.
- C. Replace sheet metal roofing components that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

3.10 ROOFING SYSTEM INSTALLER'S WARRANTY

- A. WHEREAS _____ of _____, herein called

the "Roofing System Installer," has performed roofing and associated Work on the following Project:

1. Owner: **<Insert name of Owner>**.
2. Owner Address: **<Insert address>**.
3. Building Name/Type: **<Insert information>**.
4. Building Address: **<Insert address>**.
5. Area of Work: **<Insert information>**.
6. Acceptance Date: _____.
7. Warranty Period: **[Two][Five]<Insert number>** years from date of Substantial Completion.
8. Date of Substantial Completion: _____.

- B. AND WHEREAS Roofing System Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said Work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing System Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing System Installer's own cost and expense, make or cause to be made such repairs to or replacements of said Work as are necessary to correct faulty and defective work and as are necessary to maintain said Work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to Work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding **<Insert mph (m/sec)>**;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the Work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When Work has been damaged by any of foregoing causes, Warranty will be null and void until such damage has been repaired by Roofing System Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing System Installer is responsible for damage to Work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of Work.
 4. During Warranty Period, if Owner allows alteration of Work by anyone other than Roofing System Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty will become null and void on date of said alterations, but only to the extent said alterations affect Work covered by this Warranty. If Owner engages Roofing System Installer to perform said alterations, Warranty will not become null and void unless Roofing System Installer, before starting said Work, will have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate Work, thereby reasonably justifying a limitation or termination of this Warranty.
 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty will become null and void on date of said change, but only to the extent said change affects Work covered by this Warranty.



6. Owner will promptly notify Roofing System Installer of observed, known, or suspected leaks, defects, or deterioration and afford reasonable opportunity for Roofing System Installer to inspect Work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing System Installer on said Work and will not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty will not operate to relieve Roofing System Installer of responsibility for performance of original Work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 07 61 00 00



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07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 61 13 00	07 61 00 00	Sheet Metal Roofing
07 61 16 00	07 61 00 00	Sheet Metal Roofing
07 61 19 00	07 61 00 00	Sheet Metal Roofing



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SECTION 07 62 00 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sheet metal materials.
2. Underlayment.
3. Miscellaneous materials.
4. Roof-drainage sheet metal fabrications.
5. Sloped roof sheet metal fabrications.
6. Wall sheet metal fabrications.
7. Miscellaneous sheet metal fabrications.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section <Insert Section number> " <Insert Section title> " for [materials and] installation of manufactured sheet metal through-wall flashing and trim integral with masonry.
3. Section <Insert Section number> " <Insert Section title> " for [materials and] installation of sheet metal flashing and trim integral with roofing.
4. Section <Insert Section number> " <Insert Section title> " for sheet metal flashing and trim integral with metal wall panels.
5. Section 077100 "Roof Specialties" for manufactured copings, roof-edge specialties, roof-edge drainage systems, reglets, and counterflashings.
6. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
7. Section 079513.13 "Interior Expansion Joint Cover Assemblies" for manufactured expansion-joint cover assemblies for interior floors, walls, and ceilings.
8. Section 079513.16 "Exterior Expansion Joint Cover Assemblies" for manufactured expansion-joint cover assemblies for exterior building walls, soffits, and parapets.
9. Section 079513.19 "Parking Deck Expansion Joint Cover Assemblies" for manufactured expansion-joint cover assemblies subject to vehicular traffic.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference [at Project site][by web conference]<Insert location> .

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of specified product.

- B. Shop Drawings: For sheet metal flashing and trim.
 - 1. Plans, elevations, sections, and attachment details.
 - 2. Fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
 - 3. Identification of material, thickness, weight, and finish for each item and location in Project.
 - 4. Details for forming, including profiles, shapes, seams, and dimensions.
 - 5. Details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 - 6. Details of termination points and assemblies.
 - 7. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
 - 8. Details of roof-penetration flashing.
 - 9. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
 - 10. Details of special conditions.
 - 11. Details of connections to adjoining work.
 - 12. Formed flashing and trim at scale of not less than **1-1/2 inches per 12 inches (1:10)**.
- C. Samples: For each exposed product and for each color and texture specified, **12 inches (300 mm)** long by actual width.
- D. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.
- E. Samples for Verification: Actual sample of finished products for each type of exposed finish for sheet metal and other metal accessories.
 - 1. Sheet Metal Flashing and Trim: **[Manufacturers' standard size]<Insert size>** . Include finished seam with required profile. Include fasteners, cleats, clips, closures, and other attachments.
 - 2. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.
- F. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.

1.4 INFORMATIONAL SUBMITTALS

- A. Certificates: For each type of coping and roof edge flashing that is **[ANSI/SPRI/FM 4435/ES-1 tested][and][FM Approvals approved]** .
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Research Reports: For copings and roof edge flashing, from **[an agency acceptable to authority having jurisdiction][ICC-ES]<Insert evaluation agency>** showing compliance with ANSI/SPRI/FM 4435/ES-1.
- D. Qualification Statements: For fabricator.
- E. Sample Warranties: For specified special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Entity that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Entity that employs **[a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified Architectural Metal Flashings and Accessories Installers][a supervisor who is an NRCA ProCertified Roofing Foreman][a supervisor who is an NRCA ProCertified Roofing Foreman and not less than 20 percent of installers who are NRCA ProCertified Architectural Metal Flashings and Accessories Installers]** .
- C. For roof edge flashings and copings that are ANSI/SPRI/FM 4435/ES-1 tested **[and FM Approvals approved]** , shop is to be listed as able to fabricate required details as tested and approved.

1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof **[edge][eave]** , including **[built-in gutter][fascia][fascia trim][apron flashing]<Insert item>** , approximately **[10 ft. (3.0 m)]<Insert dimension>** long, including supporting construction cleats, seams, attachments, **[underlayment,]** and accessories.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
 - 1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
 - 2. Protect stored sheet metal flashing and trim from contact with water.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.9 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: **[20][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with **[NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing"]****[and][SMACNA's "Architectural Sheet Metal Manual"]** requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Sheet Metal Standard for Copper: Comply with CDA's "Copper in Architecture Design Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- D. SPRI Wind Design Standard: Manufacture and install roof edge flashings and copings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: **[As indicated on Drawings]<Insert design pressure>** .
- E. FM Approvals Listing: Manufacture and install roof edge flashings and copings that comply with requirements in FM Approvals 4471 as part of a roofing system and that are listed in FM Approvals' "Approval Guide" and approved for windstorm classification, **[Class 1A-60][Class 1A-75][Class 1A-90][Class 1A-105][Class 1A-120]<Insert class>** . Identify materials with name of fabricator and design approved by FM Approvals.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature change>** .

2.2 SHEET METAL MATERIALS

- A. Sheet Metal Materials, General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

- B. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with minimum ASTM A653/A653M, **G90 (Z275)** coating designation, or aluminum-zinc alloy-coated steel sheet complying with minimum ASTM A792/A792M, **Class AZ50 (Class AZM150)** coating designation; structural quality.
1. Nominal Thickness: **[0.022 inch (0.56 mm)][0.028 inch (0.71 mm)][0.034 inch (0.86 mm)][0.040 inch (1.02 mm)][0.052 inch (1.32 mm)]** .
 2. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
 3. Surface: **[Smooth, flat][Embossed][and mill phosphatized for field painting][and with manufacturer's standard clear acrylic coating on both sides]** .
 4. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Two-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]** .
 - b. Three-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]** .
 - c. Mica Fluoropolymer: Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]** .
 - d. Metallic Fluoropolymer: Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]** .
 - e. FEVE Fluoropolymer: Two-coat fluoropolymer finish containing 100 percent FEVE resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]** .
 - f. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with dry film thickness of not less than **0.2 mil (0.005 mm)** for primer and **0.8 mil (0.02 mm)** for topcoat.
 5. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>** .
 6. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of **0.5 mil (0.013 mm)**.
- C. Aluminum Sheet: ASTM B209/B209M, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
1. Thickness: **[0.032 inch (0.81 mm)][0.040 inch (1.02 mm)][0.050 inch (1.27 mm)][0.063 inch (1.60 mm)]** .
 2. Surface: **[Smooth, flat][Embossed]** .
 3. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
 4. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to

- exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**] .
- b. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**] .
 - c. Mica Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**] .
 - d. Metallic Fluoropolymer: AAMA 2605. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**] .
 - e. FEVE Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish containing 100 percent FEVE resin in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**] .
 - f. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with dry film thickness of not less than **0.2 mil (0.005 mm)** for primer and **0.8 mil (0.02 mm)** for topcoat.
5. Color: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color> .
 6. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of **0.5 mil (0.013 mm)**.
 7. Clear Anodic Finish, Coil Coated: AAMA 611, [AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm] or thicker.
 8. Color Anodic Finish, Coil Coated: AAMA 611, [AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm] or thicker.
 - a. Color: [Champagne][Light bronze][Medium bronze][Dark bronze][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color> .
 - b. Color Range: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
 9. As-Milled Finish: [Mill][One-side bright mill][Standard one-side bright][Standard two-side bright] .
 10. Alclad Finish: Metallurgically bonded surfacing alloy on both sides, forming aluminum sheet with reflective luster.
 11. Factory Prime Coating: Where painting after installation is required, pretreat metal with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of **0.2 mil (0.005 mm)**.
- D. Stainless Steel Sheet: ASTM A240/A240M, [Type 304][Type 316] ; dead soft, fully annealed.
1. Nominal Thickness: [0.0156 inch (0.396 mm)][0.0188 inch (0.477 mm)][0.0250 inch (0.635 mm)][0.0313 inch (0.795 mm)][0.0375 inch (0.952 mm)][0.0500 inch (1.270 mm)] .
 2. Surface: [Smooth, flat][Embossed] .
 3. Exterior Finish: [ASTM A480/A480M, No. 2B (bright, cold rolled)][ASTM A480/A480M, No. 2D (dull, cold rolled)][ASTM A480/A480M, No. 3 (coarse, polished directional satin)][ASTM

A480/A480M No. 4]<Insert finish> .

- a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 - b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1) Run grain of directional finishes with long dimension of each piece.
 - 2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- E. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Hussey Copper Ltd.]**
 - b. **[Revere Copper Products, Inc]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Hussey Copper Ltd.]**
 - b. **[Revere Copper Products, Inc]**
 - c. **<Insert manufacturer's name>**
 3. Thickness: **[16 oz./sq. ft. (0.55 mm)][20 oz./sq. ft. (0.68 mm)][24 oz./sq. ft. (0.82 mm)]** .
 4. Nonpatinated, Exposed Finish: Mill.
 5. Nonpatinated, Exposed, Lacquered Finish: Finish designations for copper alloys comply with system defined in NAAMM/NOMMA AMP 500.
 - a. Brushed Satin (Lacquered): M32-06x (Mechanical Finish: directionally textured, medium satin; with clear organic coating); coating of "Incralac," **[waterborne,][solvent-borne,]** methyl methacrylate copolymer lacquer with UV inhibitor, applied by air spray in two coats in accordance with manufacturer's written instructions to total thickness of **1 mil (0.025 mm)**.
 - b. Mirror Polished (Lacquered): M22-06x (Mechanical Finish: buffed, specular; with clear organic coating); coating of "Incralac," **[waterborne,][solvent-borne,]** air-drying, methyl methacrylate copolymer lacquer with UV inhibitor, applied by air spray in two coats in accordance with manufacturer's written instructions to total thickness of **1 mil (0.025 mm)**.
 6. Prepatinated Copper-Sheet Finish: **[Dark brown][Verdigris]<Insert color>** , prepatinated in accordance with ASTM B882.
- F. Zinc-Tin Alloy-Coated Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 temper; coated on both sides with zinc-tin alloy (50 percent zinc, 50 percent tin).
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the**

following] :

- a. **[Revere Copper Products, Inc]**
- b. **<Insert manufacturer's name>**

- 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Revere Copper Products, Inc]**
- b. **<Insert manufacturer's name>**

- 3. Thickness: **[16 oz./sq. ft. (0.55 mm thick)][20 oz./sq. ft. (0.68 mm thick)][24 oz./sq. ft. (0.82 mm thick)][25 oz./sq. ft. (0.87 mm thick)]** .
- 4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.

- G. Zinc Sheet: With manufacturer's standard factory-applied, flexible, protective back coating.

- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- a. **[Artazn LLC]**
- b. **[Rheinzink America]**
- c. **<Insert manufacturer's name>**

- 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Artazn LLC]**
- b. **[Rheinzink America]**
- c. **<Insert manufacturer's name>**

- 3. Grade: **[99.995 percent electrolytic high-grade zinc with alloy additives of copper (0.08 to 0.20 percent), titanium (0.07 to 0.12 percent), and aluminum (0.015 percent)][Zinc, 99 percent pure, alloyed with 0.08 to 1.00 percent copper, 0.06 to 0.20 percent titanium, and up to 0.015 percent aluminum]** .
- 4. Thickness: **[0.032 inch (0.80 mm)][0.039 inch (1.00 mm)][0.048 inch (1.25 mm)][0.059 inch (1.50 mm)]** .
- 5. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.
- 6. Finish: **[Bright rolled][Preweathered gray][Preweathered black]<Insert finish>** .

- H. Copper-Clad Stainless Steel Sheet: ASTM B506, annealed Temper O61.

- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :

- a. **[Heyco Metals]**
- b. **[SEMCO Southeastern Metals, A Gibraltar Industries Company]**

- c. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Heyco Metals]
 - b. [SEMCO Southeastern Metals, A Gibraltar Industries Company]
 - c. <Insert manufacturer's name>
 3. Thickness: [0.016 inch (0.40 mm)][0.018 inch (0.46 mm)][0.027 inch (0.69 mm)] .
 4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.
 5. Nonpatinated, Exposed Finish: Mill.
 6. Nonpatinated, Exposed, Lacquered Finish: Finish designations for copper alloys comply with system defined in NAAMM/NOMMA AMP 500.
 - a. Brushed Satin (Lacquered): M32-06x (Mechanical Finish: directionally textured, medium satin; with clear organic coating); coating of "Incralac," [waterborne,][solvent-borne,] methyl methacrylate copolymer lacquer with UV inhibitor, applied by air spray in two coats per manufacturer's written instructions to total thickness of **1 mil (0.025 mm)**.
 - b. Mirror Polished (Lacquered): M22-06x (Mechanical Finish: buffed, specular; with clear organic coating); coating of "Incralac," [waterborne,][solvent-borne,] air-drying, methyl methacrylate copolymer lacquer with UV inhibitor, applied by air spray in two coats per manufacturer's written instructions to total thickness of **1 mil (0.025 mm)**.
 - I. Lead Sheet: ASTM B749 lead sheet.
 1. Thickness: **4 lb (1.8 kg)**.
- 2.3 UNDERLAYMENT
- A. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over **220 deg F (111 deg C)**; and complying with physical requirements of ASTM D226/D226M for Type I and Type II felts.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [Intertape Polymer Group]
 - c. [Kirsch Building Products]
 - d. [SDP Advanced Polymer Products Inc.]
 - e. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Atlas Molded Products, a division of Atlas Roofing Corporation]
 - b. [Intertape Polymer Group]
 - c. [Kirsch Building Products]

- d. [SDP Advanced Polymer Products Inc.]
- e. <Insert manufacturer's name>

B. Self-Adhering, High-Temperature Sheet Underlayment: Provide self-adhering, cold-applied, sheet underlayment, specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer when recommended by underlayment manufacturer.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [ATAS International, Inc.]
 - b. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
 - c. [GCP Applied Technologies Inc.]
 - d. [Henry; a Carlisle Company]
 - e. [Owens Corning]
 - f. [Polyglass U.S.A., Inc.]
 - g. [Protecto Wrap Company]
 - h. [SDP Advanced Polymer Products Inc.]
 - i. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [ATAS International, Inc.]
 - b. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
 - c. [GCP Applied Technologies Inc.]
 - d. [Henry; a Carlisle Company]
 - e. [Owens Corning]
 - f. [Polyglass U.S.A., Inc.]
 - g. [Protecto Wrap Company]
 - h. [SDP Advanced Polymer Products Inc.]
 - i. <Insert manufacturer's name>
3. Thickness: **30 mils (0.76 mm)** minimum.
4. Thermal Stability: Stable after testing at **240 deg F (116 deg C)**; ASTM D1970/D1970M.
5. Low-Temperature Flexibility: Passes after testing at **minus 20 deg F (minus 29 deg C)** or lower; ASTM D1970/D1970M.

C. Felt Underlayment: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

D. Slip Sheet: Rosin-sized building paper, **3 lb/100 sq. ft. (0.16 kg/sq. m)** minimum, of type required for application.

2.4 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners [, **solder**] , protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal [**or manufactured item**] unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and

other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal [**or manufactured item**] .

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
2. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.
3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
4. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
5. Fasteners for Copper, Zinc-Tin Alloy-Coated Copper, or Copper-Clad Stainless Steel Sheet: Copper, hardware bronze or passivated Series 300 stainless steel.
6. Fasteners for Zinc Sheet: Series 300 stainless steel [**or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M**] .

C. Solder:

1. For Zinc-Coated (Galvanized) Steel: ASTM B32, [**Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead**][with maximum lead content of 0.2 percent] .
2. For Stainless Steel: ASTM B32, [**Grade Sn60**][**Grade Sn96**] , with acid flux of type recommended by stainless steel sheet manufacturer.
3. For Copper or Copper-Clad Stainless Steel: ASTM B32, [**Grade Sn50, 50 percent tin and 50 percent lead**][with maximum lead content of 0.2 percent] .
4. For Zinc-Tin Alloy-Coated Copper: ASTM B32, 100 percent tin, with maximum lead content of 0.2 percent, as recommended by sheet metal manufacturer.
5. For Zinc: ASTM B32, [**40 percent tin and 60 percent lead with low antimony**], [with maximum lead content of 0.2 percent,] as recommended by zinc manufacturer.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape **1/2 inch (13 mm)** wide and **1/8 inch (3 mm)** thick.

E. Elastomeric Sealant: ASTM C920, elastomeric polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

1. Material: [**Polyurethane**][**Polysulfide**][**Silicone**] .

F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

I. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

- J. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated **[with factory-mitered and -welded corners and junctions][and][with interlocking counterflashing on exterior face, of same metal as reglet]** .
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Cheney Flashing Company]**
 - b. **[Fry Reglet Corporation]**
 - c. **[Heckmann Building Products, Inc.]**
 - d. **[Hohmann & Barnard, Inc]**
 - e. **[Keystone Flashing Company, Inc]**
 - f. **[Metal-Era, Inc.; a Carlisle Company]**
 - g. **[OMG Roofing Products; a Division of OMG, Inc.]**
 - h. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Cheney Flashing Company]**
 - b. **[Fry Reglet Corporation]**
 - c. **[Heckmann Building Products, Inc.]**
 - d. **[Hohmann & Barnard, Inc]**
 - e. **[Keystone Flashing Company, Inc]**
 - f. **[Metal-Era, Inc.; a Carlisle Company]**
 - g. **[OMG Roofing Products; a Division of OMG, Inc.]**
 - h. **<Insert manufacturer's name>**
 3. Material: **[Galvanized steel, 0.022 inch (0.56 mm) thick][Aluminum, 0.024 inch (0.61 mm) thick][Stainless steel, 0.0188 inch (0.477 mm) thick][Copper, 16 oz./sq. ft. (0.55 mm thick)]** .
 4. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 5. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
 6. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
 7. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
 8. Accessories:
 - a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
 - b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
 9. Finish: **[Mill][With manufacturer's standard color coating]<Insert finish>** .

2.5 FABRICATION, GENERAL

- A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
 - 1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
 - 4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances:
 - 1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of **1/4 inch in 20 ft. (6 mm in 6 m)** on slope and location lines indicated on Drawings and within **1/8-inch (3-mm)** offset of adjoining faces and of alignment of matching profiles.
 - 2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard [**and by FM Global Property Loss Prevention Data Sheet 1-49**] for application, but not less than thickness of metal being secured.
- G. Seams:
 - 1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. [**Rivet joints where necessary for strength.**]
 - 3. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. [**Rivet joints where necessary for strength.**]
- H. Do not use graphite pencils to mark metal surfaces.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.

1. Minimum Fabrication Length: **96-inch- (2400-mm-)** long sections.
2. Gutter Brackets, Spacers, and Straps: Furnish flat-stock gutter brackets and **[flat-stock][twisted]** gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness not less than **[twice the gutter thickness][dimension indicated on Drawings]<Insert dimension>** .
3. Gutter Components: Fabricate expansion joints, expansion-joint covers, **[gutter bead reinforcing bars,]** and gutter accessories from same metal as gutters. **[Shop fabricate interior and exterior corners.]**
4. Gutter Profile: **[Style A][Style B][Style C][Style D][Style E][Style F][Style G][Style H][Style I][Style J][Style K][Style L]** in accordance with cited sheet metal standard.
5. Expansion Joints: **[Lap type][Butt type][Butt type with cover plate][Built in]** .
6. Accessories: **[Continuous, removable leaf screen with sheet metal frame and hardware cloth screen][Wire-ball downspout strainer][Valley baffles]** .
7. Gutters with Girth up to 15 Inches (380 mm): Fabricate from the following materials:
 - a. Galvanized Steel: **[0.022 inch (0.56 mm)]<Insert dimension>** thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: **[0.022 inch (0.56 mm)]<Insert dimension>** thick.
 - c. Aluminum: **[0.032 inch (0.81 mm)]<Insert dimension>** thick.
 - d. Stainless Steel: **[0.0156 inch (0.396 mm)]<Insert dimension>** thick.
 - e. Copper: **[16 oz./sq. ft. (0.55 mm thick)]<Insert value>** .
 - f. Zinc-Tin Alloy-Coated Copper: **[16 oz./sq. ft. (0.55 mm thick)]<Insert value>** .
 - g. Zinc: **[0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension>** thick.
 - h. Copper-Clad Stainless Steel: **[0.016 inch (0.40 mm)]<Insert dimension>** thick.
8. Gutters with Girth 16 to 20 Inches (410 to 510 mm): Fabricate from the following materials:
 - a. Galvanized Steel: **[0.028 inch (0.71 mm)]<Insert dimension>** thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: **[0.028 inch (0.71 mm)]<Insert dimension>** thick.
 - c. Aluminum: **[0.040 inch (1.02 mm)]<Insert dimension>** thick.
 - d. Stainless Steel: **[0.0188 inch (0.477 mm)]<Insert dimension>** thick.
 - e. Copper: **[16 oz./sq. ft. (0.55 mm thick)]<Insert value>** .
 - f. Zinc-Tin Alloy-Coated Copper: **[16 oz./sq. ft. (0.55 mm thick)]<Insert value>** .
 - g. Zinc: **[0.039 inch (1.00 mm)][0.048 inch (1.25 mm)]<Insert dimension>** thick.
 - h. Copper-Clad Stainless Steel: **[0.018 inch (0.46 mm)]<Insert dimension>** thick.
9. Gutters with Girth 21 to 25 Inches (530 to 640 mm): Fabricate from the following materials:
 - a. Galvanized Steel: **[0.034 inch (0.86 mm)]<Insert dimension>** thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: **[0.034 inch (0.86 mm)]<Insert dimension>** thick.
 - c. Aluminum: **[0.050 inch (1.27 mm)]<Insert dimension>** thick.
 - d. Stainless Steel: **[0.0250 inch (0.635 mm)]<Insert dimension>** thick.
 - e. Copper: **[20 oz./sq. ft. (0.68 mm thick)]<Insert value>** .
 - f. Zinc-Tin Alloy-Coated Copper: **[20 oz./sq. ft. (0.68 mm thick)]<Insert value>** .
 - g. Zinc: **[0.048 inch (1.25 mm)][0.059 inch (1.50 mm)]<Insert dimension>** thick.
 - h. Copper-Clad Stainless Steel: **[0.027 inch (0.69 mm)]<Insert dimension>** thick.
10. Gutters with Girth 26 to 30 Inches (660 to 760 mm): Fabricate from the following materials:
 - a. Galvanized Steel: **[0.040 inch (1.02 mm)]<Insert dimension>** thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: **[0.040 inch (1.02 mm)]<Insert dimension>** thick.
 - c. Aluminum: **[0.063 inch (1.60 mm)]<Insert dimension>** thick.
 - d. Stainless Steel: **[0.0313 inch (0.795 mm)]<Insert dimension>** thick.
 - e. Copper: **[24 oz./sq. ft. (0.82 mm thick)]<Insert value>** .
 - f. Zinc-Tin Alloy-Coated Copper: **[24 oz./sq. ft. (0.82 mm thick)]<Insert value>** .

11. Gutters with Girth 31 to 35 Inches (790 to 890 mm): Fabricate from the following materials:
 - a. Galvanized Steel: **[0.052 inch (1.32 mm)]<Insert dimension>** thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: **[0.052 inch (1.32 mm)]<Insert dimension>** thick.
 - c. Stainless Steel: **[0.0375 inch (0.952 mm)]<Insert dimension>** thick.
 - d. Copper: **[24 oz./sq. ft. (0.82 mm thick)]<Insert value>** .
 - e. Zinc-Tin Alloy-Coated Copper: **[25 oz./sq. ft. (0.87 mm thick)]<Insert value>** .

- B. Built-In Gutters: Fabricate to cross section required, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required.
 1. Minimum Fabrication Length: **96-inch- (2400-mm-)** long sections.
 2. Gutter Components: Fabricate expansion joints and accessories from same metal as gutters unless otherwise indicated.
 3. Expansion Joints: Fabricate gutters with built-in expansion joints [**and gutter-end expansion joints at walls**] .
 4. Accessories: **[Continuous, removable leaf screen with sheet metal frame and hardware cloth screen][Bronze wire-ball downspout strainer][Wire-ball downspout strainer]** .
 5. Fabricate from the following materials:
 - a. Stainless Steel: **[0.0156 inch (0.396 mm)]<Insert dimension>** thick.
 - b. Copper: **[16 oz./sq. ft. (0.55 mm thick)]<Insert value>** .
 - c. Zinc-Tin Alloy-Coated Copper: **[16 oz./sq. ft. (0.55 mm thick)]<Insert value>** .
 - d. Zinc: **[0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension>** thick.
 - e. Copper-Clad Stainless Steel: **[0.016 inch (0.40 mm)]<Insert dimension>** thick.

- C. Downspouts: Fabricate downspouts to dimensions indicated on Drawings.
 1. Type: **[Round][Rectangular][Open face]** .
 2. Downspout Elbows: Mitered [**and shop fabricated**] .
 3. Metal Hangers: Provide **[same material as downspouts and anchors]<Insert material>** .
 4. Fabricated Hanger Style: **[Fig. 1-35A][Fig. 1-35B][Fig. 1-35C][Fig. 1-35D][Fig. 1-35E][Fig. 1-35F][Fig. 1-35G][Fig. 1-35H][Fig. 1-35I][Fig. 1-35J]** in accordance with SMACNA's "Architectural Sheet Metal Manual."
 5. Manufactured Hanger Style: **[Fig. 1-34A][Fig. 1-34B][Fig. 1-34C][Fig. 1-34D][Fig. 1-34E]** in accordance with SMACNA's "Architectural Sheet Metal Manual."
 6. Hanger Style: **<Insert description>** .
 7. Fabricate from the following materials:
 - a. Galvanized Steel: **[0.022 inch (0.56 mm)]<Insert dimension>** thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: **[0.022 inch (0.56 mm)]<Insert dimension>** thick.
 - c. Aluminum: **[0.024 inch (0.61 mm)]<Insert dimension>** thick.
 - d. Stainless Steel: **[0.0156 inch (0.396 mm)]<Insert dimension>** thick.
 - e. Copper: **[16 oz./sq. ft. (0.55 mm thick)]<Insert value>** .
 - f. Zinc-Tin Alloy-Coated Copper: **[16 oz./sq. ft. (0.55 mm thick)]<Insert value>** .
 - g. Zinc: **[0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension>** thick.
 - h. Copper-Clad Stainless Steel: **[0.016 inch (0.40 mm)]<Insert dimension>** thick.

- D. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, **4-inch- (100-mm-)** wide wall flanges to interior, and base extending **4 inches (100 mm)** beyond cant or tapered strip into field of roof. [**Fasten gravel guard angles to base of scupper.**]
 1. Fabricate from the following materials:
 - a. Galvanized Steel: **[0.028 inch (0.71 mm)]<Insert dimension>** thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: **[0.028 inch (0.71 mm)]<Insert dimension>** thick.

- c. Aluminum: [0.032 inch (0.81 mm)]<Insert dimension> thick.
- d. Stainless Steel: [0.0188 inch (0.477 mm)]<Insert dimension> thick.
- e. Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
- f. Zinc-Tin Alloy-Coated Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
- g. Zinc: [0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension> thick.
- h. Copper-Clad Stainless Steel: [0.018 inch (0.46 mm)]<Insert dimension> thick.

E. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes [, exterior flange trim,][and][built-in overflows] .

1. Fabricate from the following materials:

- a. Galvanized Steel: [0.028 inch (0.71 mm)]<Insert dimension> thick.
- b. Aluminum-Zinc Alloy-Coated Steel: [0.028 inch (0.71 mm)]<Insert dimension> thick.
- c. Aluminum: [0.032 inch (0.81 mm)]<Insert dimension> thick.
- d. Stainless Steel: [0.0156 inch (0.396 mm)]<Insert dimension> thick.
- e. Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
- f. Zinc-Tin Alloy-Coated Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
- g. Zinc: [0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension> thick.
- h. Copper-Clad Stainless Steel: [0.016 inch (0.40 mm)]<Insert dimension> thick.

F. Splash Pans: Fabricate to dimensions and shape required.

1. Fabricate from the following materials:

- a. Aluminum: [0.040 inch (1.02 mm)]<Insert dimension> thick.
- b. Stainless Steel: [0.0188 inch (0.477 mm)]<Insert dimension> thick.
- c. Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
- d. Zinc-Tin Alloy-Coated Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
- e. Zinc: [0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension> thick.
- f. Copper-Clad Stainless Steel: [0.018 inch (0.46 mm)]<Insert dimension> thick.

2.7 SLOPED ROOF SHEET METAL FABRICATIONS

A. Low-Sloped Roof Sheet Metal Fabrications:

1. Roof Edge Flashing (Gravel Stop) and Fascia Cap:

- a. Fabricate in minimum **96-inch- (2400-mm-)** long, but not exceeding **12 ft. (3.6 m)** long sections. Furnish with **6-inch- (150-mm-)** wide, joint cover plates. [**Shop fabricate interior and exterior corners.**]
- b. Joint Style: [**Overlapped, 4 inches (100 mm) wide**][**Butted with expansion space and 6-inch- (150-mm-) wide, concealed backup plate**][**Butted with expansion space and 6-inch- (150-mm-) wide, exposed cover plate**]<Insert description> .
- c. Scuppers: Fabricate with scuppers spaced [10 ft. (3 m)]<Insert dimension> apart, to dimensions required with **4-inch- (100-mm-)** wide flanges and base extending **4 inches (100 mm)** beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
- d. Fabricate from the following materials:
 - 1) Galvanized Steel: [0.028 inch (0.71 mm)]<Insert dimension> thick.
 - 2) Aluminum-Zinc Alloy-Coated Steel: [0.028 inch (0.71 mm)]<Insert dimension> thick.

- 3) Aluminum: [0.050 inch (1.27 mm)]<Insert dimension> thick.
- 4) Stainless Steel: [0.0188 inch (0.477 mm)]<Insert dimension> thick.
- 5) Copper: [20 oz./sq. ft. (0.68 mm thick)]<Insert value> .
- 6) Zinc-Tin Alloy-Coated Copper: [20 oz./sq. ft. (0.68 mm thick)]<Insert value> .
- 7) Zinc: [0.048 inch (1.25 mm)][0.059 inch (1.50 mm)]<Insert dimension> thick.
- 8) Copper-Clad Stainless Steel: [0.018 inch (0.46 mm)]<Insert dimension> thick.

2. Copings:

- a. Fabricate in minimum **96-inch- (2400-mm-)** long, but not exceeding **12 ft. (3.6 m)** long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and [**drill elongated holes for fasteners on**] interior leg. Miter corners, [**fasten and seal**][**solder or weld**] watertight. [**Shop fabricate interior and exterior corners.**]
- b. Coping Profile: [Fig. 3-4A][Fig. 3-4B][Fig. 3-4C][Fig. 3-4D][Fig. 3-4E][Fig. 3-4F][Fig. 3-4G] in accordance with SMACNA's "Architectural Sheet Metal Manual."
- c. Joint Style: [**Butted with expansion space and 6-inch- (150-mm-) wide, concealed backup plate**][**Butted with expansion space and 6-inch- (150-mm-) wide, exposed cover plate**]<Insert description> .
- d. Fabricate from the following materials:
 - 1) Galvanized Steel: [0.040 inch (1.02 mm)]<Insert dimension> thick.
 - 2) Aluminum-Zinc Alloy-Coated Steel: [0.040 inch (1.02 mm)]<Insert dimension> thick.
 - 3) Aluminum: [0.050 inch (1.27 mm)]<Insert dimension> thick.
 - 4) Stainless Steel: [0.0250 inch (0.635 mm)]<Insert dimension> thick.
 - 5) Copper: [24 oz./sq. ft. (0.82 mm thick)]<Insert value> .
 - 6) Zinc-Tin Alloy-Coated Copper: [24 oz./sq. ft. (0.82 mm thick)]<Insert value> .
 - 7) Zinc: [0.048 inch (1.25 mm)][0.059 inch (1.50 mm)]<Insert dimension> thick.
 - 8) Copper-Clad Stainless Steel: [0.027 inch (0.69 mm)]<Insert dimension> thick.

3. Expansion-Joint Covers:

- a. General: [**Shop fabricate interior and exterior corners.**] Fabricate [roof][and][roof-to-wall transition][roof-to-roof edge-flashing (gravel-stop) transition][roof-to-roof edge-flashing (gravel-stop) and fascia-cap transition] expansion-joint cover from the following materials:
 - 1) Galvanized Steel: [0.034 inch (0.86 mm)]<Insert dimension> thick.
 - 2) Aluminum-Zinc Alloy-Coated Steel: [0.034 inch (0.86 mm)]<Insert dimension> thick.
 - 3) Aluminum: [0.050 inch (1.27 mm)]<Insert dimension> thick.
 - 4) Stainless Steel: [0.0250 inch (0.635 mm)]<Insert dimension> thick.
 - 5) Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
 - 6) Zinc-Tin Alloy-Coated Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
 - 7) Zinc: [0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension> thick.
 - 8) Copper-Clad Stainless Steel: [0.027 inch (0.69 mm)]<Insert dimension> thick.

4. Base Flashing:

- a. General: [**Shop fabricate interior and exterior corners.**] Fabricate from the following materials:
 - 1) Galvanized Steel: [0.028 inch (0.71 mm)]<Insert dimension> thick.
 - 2) Aluminum-Zinc Alloy-Coated Steel: [0.028 inch (0.71 mm)]<Insert dimension> thick.

- 3) Aluminum: [0.040 inch (1.02 mm)]<Insert dimension> thick.
- 4) Stainless Steel: [0.0188 inch (0.477 mm)]<Insert dimension> thick.
- 5) Copper: [20 oz./sq. ft. (0.68 mm thick)]<Insert value> .
- 6) Zinc-Tin Alloy-Coated Copper: [20 oz./sq. ft. (0.68 mm thick)]<Insert value> .
- 7) Zinc: [0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension> thick.
- 8) Copper-Clad Stainless Steel: [0.018 inch (0.46 mm)]<Insert dimension> thick.

5. Counterflashing:

- a. General: [**Shop fabricate interior and exterior corners.**] Fabricate from the following materials:

- 1) Galvanized Steel: [0.022 inch (0.56 mm)]<Insert dimension> thick.
- 2) Aluminum-Zinc Alloy-Coated Steel: [0.022 inch (0.56 mm)]<Insert dimension> thick.
- 3) Aluminum: [0.032 inch (0.81 mm)]<Insert dimension> thick.
- 4) Stainless Steel: [0.0188 inch (0.477 mm)]<Insert dimension> thick.
- 5) Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
- 6) Zinc-Tin Alloy-Coated Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
- 7) Zinc: [0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension> thick.
- 8) Copper-Clad Stainless Steel: [0.018 inch (0.46 mm)]<Insert dimension> thick.

6. Flashing Receivers: Fabricate from the following materials:

- a. Galvanized Steel: [0.022 inch (0.56 mm)]<Insert dimension> thick.
- b. Aluminum-Zinc Alloy-Coated Steel: [0.022 inch (0.56 mm)]<Insert dimension> thick.
- c. Aluminum: [0.032 inch (0.81 mm)]<Insert dimension> thick.
- d. Stainless Steel: [0.0156 inch (0.396 mm)]<Insert dimension> thick.
- e. Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
- f. Zinc-Tin Alloy-Coated Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
- g. Zinc: [0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension> thick.
- h. Copper-Clad Stainless Steel: [0.016 inch (0.40 mm)]<Insert dimension> thick.

7. Roof-Penetration Flashing: Fabricate from the following materials:

- a. Galvanized Steel: [0.028 inch (0.71 mm)]<Insert dimension> thick.
- b. Aluminum-Zinc Alloy-Coated Steel: [0.028 inch (0.71 mm)]<Insert dimension> thick.
- c. Stainless Steel: [0.0188 inch (0.477 mm)]<Insert dimension> thick.
- d. Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
- e. Zinc-Tin Alloy-Coated Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
- f. Zinc: [0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension> thick.
- g. Copper-Clad Stainless Steel: [0.018 inch (0.46 mm)]<Insert dimension> thick.
- h. Lead: [4 lb (1.8 kg)]<Insert weight> .

8. Roof-Drain Flashing: Fabricate from the following materials:

- a. Stainless Steel: [0.0156 inch (0.396 mm)]<Insert dimension> thick.
- b. Copper: [12 oz./sq. ft. (0.41 mm thick)]<Insert value> .
- c. Copper-Clad Stainless Steel: [0.016 inch (0.40 mm)]<Insert dimension> thick.

B. Steep-Slope Roof Sheet Metal Fabrications:

1. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:

- a. Galvanized Steel: [0.022 inch (0.56 mm)]<Insert dimension> thick.

- b. Aluminum-Zinc Alloy-Coated Steel: [0.022 inch (0.56 mm)]<Insert dimension> thick.
 - c. Aluminum: [0.032 inch (0.81 mm)]<Insert dimension> thick.
 - d. Stainless Steel: [0.0156 inch (0.396 mm)]<Insert dimension> thick.
 - e. Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
 - f. Zinc-Tin Alloy-Coated Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
 - g. Zinc: [0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension> thick.
 - h. Copper-Clad Stainless Steel: [0.016 inch (0.40 mm)]<Insert dimension> thick.
2. Valley Flashing: Fabricate from the following materials:
 - a. Galvanized Steel: [0.028 inch (0.71 mm)]<Insert dimension> thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: [0.028 inch (0.71 mm)]<Insert dimension> thick.
 - c. Stainless Steel: [0.0188 inch (0.477 mm)]<Insert dimension> thick.
 - d. Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
 - e. Zinc-Tin Alloy-Coated Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
 - f. Zinc: [0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension> thick.
 - g. Copper-Clad Stainless Steel: [0.018 inch (0.46 mm)]<Insert dimension> thick.
3. Drip Edges: Fabricate from the following materials:
 - a. Galvanized Steel: [0.022 inch (0.56 mm)]<Insert dimension> thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: [0.022 inch (0.56 mm)]<Insert dimension> thick.
 - c. Aluminum: [0.032 inch (0.81 mm)]<Insert dimension> thick.
 - d. Stainless Steel: [0.0156 inch (0.396 mm)]<Insert dimension> thick.
 - e. Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
 - f. Zinc-Tin Alloy-Coated Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
 - g. Zinc: [0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension> thick.
 - h. Copper-Clad Stainless Steel: [0.016 inch (0.40 mm)]<Insert dimension> thick.
4. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following materials:
 - a. Galvanized Steel: [0.022 inch (0.56 mm)]<Insert dimension> thick.
 - b. Aluminum-Zinc Alloy-Coated Steel: [0.022 inch (0.56 mm)]<Insert dimension> thick.
 - c. Aluminum: [0.032 inch (0.81 mm)]<Insert dimension> thick.
 - d. Stainless Steel: [0.0156 inch (0.396 mm)]<Insert dimension> thick.
 - e. Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
 - f. Zinc-Tin Alloy-Coated Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
 - g. Zinc: [0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension> thick.
 - h. Copper-Clad Stainless Steel: [0.016 inch (0.40 mm)]<Insert dimension> thick.
5. Counterflashing:
 - a. General: [**Shop fabricate interior and exterior corners.**] Fabricate from the following materials:
 - 1) Galvanized Steel: [0.022 inch (0.56 mm)]<Insert dimension> thick.
 - 2) Aluminum-Zinc Alloy-Coated Steel: [0.022 inch (0.56 mm)]<Insert dimension> thick.
 - 3) Aluminum: [0.032 inch (0.81 mm)]<Insert dimension> thick.
 - 4) Stainless Steel: [0.0188 inch (0.477 mm)]<Insert dimension> thick.
 - 5) Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
 - 6) Zinc-Tin Alloy-Coated Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
 - 7) Zinc: [0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension> thick.
 - 8) Copper-Clad Stainless Steel: [0.018 inch (0.46 mm)]<Insert dimension> thick.
6. Flashing Receivers: Fabricate from the following materials:

- a. Galvanized Steel: [0.022 inch (0.56 mm)]<Insert dimension> thick.
- b. Aluminum-Zinc Alloy-Coated Steel: [0.022 inch (0.56 mm)]<Insert dimension> thick.
- c. Aluminum: [0.032 inch (0.81 mm)]<Insert dimension> thick.
- d. Stainless Steel: [0.0156 inch (0.396 mm)]<Insert dimension> thick.
- e. Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
- f. Zinc-Tin Alloy-Coated Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
- g. Zinc: [0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension> thick.
- h. Copper-Clad Stainless Steel: [0.016 inch (0.40 mm)]<Insert dimension> thick.

7. Roof-Penetration Flashing: Fabricate from the following materials:

- a. Galvanized Steel: [0.028 inch (0.71 mm)]<Insert dimension> thick.
- b. Aluminum-Zinc Alloy-Coated Steel: [0.028 inch (0.71 mm)]<Insert dimension> thick.
- c. Stainless Steel: [0.0188 inch (0.477 mm)]<Insert dimension> thick.
- d. Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
- e. Zinc-Tin Alloy-Coated Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
- f. Zinc: [0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension> thick.
- g. Copper-Clad Stainless Steel: [0.018 inch (0.46 mm)]<Insert dimension> thick.
- h. Lead: [4 lb (1.8 kg)]<Insert weight> .

2.8 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing:

1. General: Fabricate continuous flashings in minimum **96-inch- (2400-mm-)** long, but not exceeding **12 ft. (3.6 m)** long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend **6 inches (150 mm)** beyond each side of wall openings; and form with **2-inch- (50-mm-)** high, end dams. Fabricate from the following materials:

- a. Stainless Steel: [0.0156 inch (0.396 mm)]<Insert dimension> thick.
- b. Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
- c. Zinc-Tin Alloy-Coated Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
- d. Zinc: [0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension> thick.
- e. Copper-Clad Stainless Steel: [0.016 inch (0.40 mm)]<Insert dimension> thick.

B. Opening Flashings in Frame Construction:

1. General: Fabricate head, sill, [**jamb,**] and similar flashings to extend [**4 inches (100 mm)]<Insert dimension>** beyond wall openings. Form head and sill flashing with **2-inch- (50-mm-)** high, end dams. Fabricate from the following materials:

- a. Galvanized Steel: [0.022 inch (0.56 mm)]<Insert dimension> thick.
- b. Aluminum-Zinc Alloy-Coated Steel: [0.022 inch (0.56 mm)]<Insert dimension> thick.
- c. Aluminum: [0.032 inch (0.81 mm)]<Insert dimension> thick.
- d. Stainless Steel: [0.0156 inch (0.396 mm)]<Insert dimension> thick.
- e. Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
- f. Zinc-Tin Alloy-Coated Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
- g. Zinc: [0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension> thick.
- h. Copper-Clad Stainless Steel: [0.016 inch (0.40 mm)]<Insert dimension> thick.

C. Wall Expansion-Joint Cover: Fabricate from the following materials:

1. Galvanized Steel: [0.028 inch (0.71 mm)]<Insert dimension> thick.

2. Aluminum-Zinc Alloy-Coated Steel: [0.028 inch (0.71 mm)]<Insert dimension> thick.
3. Aluminum: [0.040 inch (1.02 mm)]<Insert dimension> thick.
4. Stainless Steel: [0.0188 inch (0.477 mm)]<Insert dimension> thick.
5. Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
6. Zinc-Tin Alloy-Coated Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
7. Zinc: [0.032 inch (0.80 mm)][0.039 inch (1.00 mm)]<Insert dimension> thick.
8. Copper-Clad Stainless Steel: [0.018 inch (0.46 mm)]<Insert dimension> thick.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Galvanized Steel: [0.028 inch (0.71 mm)]<Insert dimension> thick.
2. Aluminum-Zinc Alloy-Coated Steel: [0.028 inch (0.71 mm)]<Insert dimension> thick.
3. Stainless Steel: [0.0188 inch (0.477 mm)]<Insert dimension> thick.
4. Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
5. Zinc-Tin Alloy-Coated Copper: [16 oz./sq. ft. (0.55 mm thick)]<Insert value> .
6. Copper-Clad Stainless Steel: [0.018 inch (0.46 mm)]<Insert dimension> thick.

B. Overhead-Piping Safety Pans: Fabricate from the following materials:

1. Galvanized Steel: [0.040 inch (1.02 mm)]<Insert dimension> thick.
2. Aluminum-Zinc Alloy-Coated Steel: [0.040 inch (1.02 mm)]<Insert dimension> thick.
3. Stainless Steel: [0.0250 inch (0.635 mm)]<Insert dimension> thick.
4. Copper: [24 oz./sq. ft. (0.82 mm thick)]<Insert value> .
5. Zinc-Tin Alloy-Coated Copper: [24 oz./sq. ft. (0.82 mm thick)]<Insert value> .
6. Copper-Clad Stainless Steel: [0.027 inch (0.69 mm)]<Insert dimension> thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrates, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

A. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, in accordance with manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.

1. Lap horizontal joints not less than 4 inches (100 mm).
2. Lap end joints not less than 12 inches (300 mm).

- B. Self-Adhering, High-Temperature Sheet Underlayment:
1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
 2. Prime substrate if recommended by underlayment manufacturer.
 3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
 4. Apply in shingle fashion to shed water, with end laps of not less than **6 inches (150 mm)** staggered **24 inches (600 mm)** between courses.
 5. Overlap side edges not less than **3-1/2 inches (90 mm)**. Roll laps and edges with roller.
 6. Roll laps and edges with roller.
 7. Cover underlayment within 14 days.
- C. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim.
1. Install in shingle fashion to shed water.
 2. Lap joints not less than **2 inches (50 mm)**.
- D. Slip Sheet: Install slip sheet, wrinkle free, **[over underlayment][directly on substrate]<Insert requirement>** before installing sheet metal flashing and trim.
1. Install in shingle fashion to shed water.
 2. Lapp joints not less than **4 inches (100 mm)**.

3.3 INSTALLATION OF SHEET METAL FLASHING AND TRIM, GENERAL

- A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
1. Install fasteners [, **solder**] , protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of **[solder][welds][sealant]** .
 3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
 4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
 5. Install continuous cleats with fasteners spaced not more than **12 inches (300 mm)** o.c.
 6. Space individual cleats not more than **12 inches (300 mm)** apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
 8. Do not field cut sheet metal flashing and trim by torch.
 9. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of **[uncoated-aluminum][and][stainless steel]** sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood

substrates, install underlayment and cover with slip sheet.

- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
 - 1. Space movement joints at maximum of **[10 ft. (3 m)]<Insert dimension>** with no joints within **24 inches (600 mm)** of corner or intersection.
 - 2. Form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with sealant concealed within joints.
 - 3. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate **[wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws][substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance]<Insert size requirement>** .
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
 - 1. Use sealant-filled joints unless otherwise indicated.
 - a. Embed hooked flanges of joint members not less than **1 inch (25 mm)** into sealant.
 - b. Form joints to completely conceal sealant.
 - c. When ambient temperature at time of installation is between **40 and 70 deg F (4 and 21 deg C)**, set joint members for 50 percent movement each way.
 - d. Adjust setting proportionately for installation at higher ambient temperatures.
 - 1) Do not install sealant-type joints at temperatures below **40 deg F (4 deg C)**.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.
 - 1. Pre-tin edges of sheets with solder to width of **1-1/2 inches (38 mm)**; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
 - 2. Do not solder **[metallic-coated steel][and][aluminum]** sheet.
 - 3. Do not pre-tin zinc-tin alloy-coated copper.
 - 4. Do not use torches for soldering.
 - 5. Heat surfaces to receive solder, and flow solder into joint.
 - a. Fill joint completely.
 - b. Completely remove flux and spatter from exposed surfaces.
 - 6. Stainless Steel Soldering:
 - a. Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
 - b. Promptly remove acid-flux residue from metal after tinning and soldering.
 - c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
 - 7. Copper Soldering: Tin edges of uncoated sheets, using solder for copper.
 - 8. Copper-Clad Stainless Steel Soldering: Tin edges of uncoated sheets, using solder for copper-clad stainless steel.
- H. Rivets: Rivet joints in **[uncoated aluminum][zinc]** where necessary for strength.

3.4 INSTALLATION OF ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Hanging Gutters:
 1. Join sections with **[riveted and soldered joints][or][joints sealed with sealant]** .
 2. Provide for thermal expansion.
 3. Attach gutters at eave or fascia to firmly anchor them in position.
 4. Provide end closures and seal watertight with sealant.
 5. Slope to downspouts.
 6. Fasten gutter spacers to front and back of gutter.
 7. Anchor and loosely lock back edge of gutter to continuous **[cleat][eave or apron flashing]** .
 8. Anchor back of gutter that extends onto roof deck with cleats spaced not more than **[24 inches (600 mm)]<Insert dimension>** apart.
 9. Anchor gutter with **[gutter brackets][straps][twisted straps]** spaced not more than **[24 inches (600 mm)][30 inches (760 mm)][36 inches (910 mm)]<Insert dimension>** apart to roof deck unless otherwise indicated, and loosely lock to front gutter bead.
 10. Anchor gutter with spikes and ferrules spaced not more than **[24 inches (600 mm)][30 inches (760 mm)]<Insert dimension>** apart.
 11. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, **[50 ft. (15.2 m)]<Insert dimension>** apart. Install expansion-joint caps.
 12. Install continuous gutter screens on gutters with noncorrosive fasteners, **[removable][hinged to swing open]** for cleaning gutters.
- C. Built-In Gutters:
 1. Join sections with **[riveted and soldered joints][or][joints sealed with sealant]** .
 2. Provide for thermal expansion.
 3. Slope to downspouts.
 4. Provide end closures and seal watertight with sealant.
 5. Install underlayment layer in built-in gutter trough and extend to drip edge at eaves and under underlayment on roof sheathing.
 - a. Lap sides minimum of **2 inches (50 mm)** over underlying course.
 - b. Lap ends minimum of **4 inches (100 mm)**.
 - c. Stagger end laps between succeeding courses at least **72 inches (1830 mm)**.
 - d. Fasten with roofing nails.
 - e. Install slip sheet over underlayment.
 6. Anchor and loosely lock back edge of gutter to continuous **[cleat][eave or apron flashing]** .
 7. Anchor back of gutter that extends onto roof deck with cleats spaced not more than **[18 inches (460 mm)]<Insert dimension>** apart.
 8. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, **[50 ft. (15.2 m)]<Insert dimension>** apart. Install expansion-joint caps.
- D. Downspouts:
 1. Join sections with **1-1/2-inch (38-mm)** telescoping joints.
 2. Provide hangers with fasteners designed to hold downspouts securely to walls.
 3. Locate hangers at top and bottom and at approximately **60 inches (1500 mm)** o.c.
 4. Provide elbows at base of downspout to direct water away from building.
 5. Connect downspouts to underground drainage system.

E. Parapet Scuppers:

1. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
2. Anchor scupper closure trim flange to exterior wall and **[solder][or][seal with elastomeric sealant]** to scupper.
3. Loosely lock front edge of scupper with conductor head.
4. **[Solder][or][seal with elastomeric sealant]** exterior wall scupper flanges into back of conductor head.

F. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of **1 inch (25 mm)** below **[scupper][or][gutter]** discharge.

G. Splash Pans:

1. Install where downspouts discharge on **[low-slope roofs]<Insert surface>**.
2. Set in **[asphalt roofing cement][or][elastomeric sealant]** compatible with the substrate.

H. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated on Drawings. Lap joints minimum of **4 inches (100 mm)** in direction of water flow.

3.5 INSTALLATION OF SLOPED ROOF SHEET METAL FABRICATIONS

A. Install sheet metal flashing and trim to comply with performance requirements [, **sheet metal manufacturer's written installation instructions,**] and cited sheet metal standard.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at **[staggered 3-inch (75-mm)]<Insert spacing>** centers.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Copings:

1. Install copings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.
 - a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at **[24-inch (600-mm)][16-inch (400-mm)]<Insert dimension>** centers.
 - b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at **[24-inch (600-mm)]<Insert dimension>** centers.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge

flared for elastomeric sealant, extending minimum of **4 inches (100 mm)** over base flashing. Install stainless steel draw band and tighten.

- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
 - 1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
 - 2. Extend counterflashing **4 inches (100 mm)** over base flashing.
 - 3. Lap counterflashing joints minimum of **4 inches (100 mm)**.
 - 4. Secure in waterproof manner by means of **[snap-in installation and sealant or lead wedges and sealant][interlocking folded seam or blind rivets and sealant][anchor and washer spaced at 12 inches (300 mm) o.c. along perimeter and 6 inches (150 mm) o.c. at corners areas]<Insert requirement>** unless otherwise indicated.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with **[elastomeric][butyl]** sealant and clamp flashing to pipes that penetrate roof.

3.6 INSTALLATION OF WALL SHEET METAL FABRICATIONS

- A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Opening Flashings in Frame Construction: Install continuous head, sill, **[jamb,]** and similar flashings to extend **[4 inches (100 mm)]<Insert dimension>** beyond wall openings.
- C. Reglets: Installation of reglets is specified in **[Section 033000 "Cast-in-Place Concrete."][Section 042000 "Unit Masonry."]<Insert Section number and title.>**

3.7 INSTALLATION OF MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing:
 - 1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
 - 2. Weld or seal flashing with elastomeric sealant to equipment support member.
- B. Overhead-Piping Safety Pans:
 - 1. Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings.
 - 2. Pipe and install drain line to plumbing waste or drainage system.

3.8 INSTALLATION TOLERANCES

- A. Shim and align sheet metal flashing and trim within installed tolerance of **1/4 inch in 20 ft. (6 mm in 6 m)** on slope and location lines indicated on Drawings and within **1/8-inch (3-mm)** offset of adjoining faces and of alignment of matching profiles.



3.9 CLEANING

- A. Clean and neutralize flux materials. Clean off excess solder.
- B. Clean off excess sealants.

3.10 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.
- C. Maintain sheet metal flashing and trim in clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 07 62 00 00



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07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 62 13 00	07 62 00 00	Sheet Metal Flashing And Trim
07 62 19 00	07 62 00 00	Sheet Metal Flashing And Trim
07 63 00 00	07 62 00 00	Sheet Metal Flashing And Trim
07 63 00 00	21 05 00 00	Common Work Results for Fire Suppression
07 63 00 00	22 05 00 00	Common Work Results for Plumbing
07 63 00 00	23 05 00 00	Common Work Results for HVAC
07 65 16 00	07 51 13 00	Built-Up Asphalt Roofing
07 65 16 00	07 01 50 81	Built-Up Coal Tar Roofing
07 65 16 00	07 53 23 00	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing
07 65 16 00	07 57 00 00	Coated Foamed Roofing



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SECTION 07 71 00 00 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Manufactured units for the following applications:

1. Copings.
2. Roof-edge specialties.
3. Roof-edge drainage systems.
4. Reglets and counterflashings.
5. Underlayment.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing embedded reglets.
2. Section 042000 "Unit Masonry" for installing embedded reglets and for masonry through-wall flashing with receiver for counterflashing.
3. Section 055000 "Metal Fabrications" for downspout guards and downspout boots.
4. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
5. Section <Insert Section number> "<Insert Section title>" for air barrier and compatibility with and transitions to underlayment for roof specialties.
6. Section <Insert Section number> "<Insert Section title>" for roof-edge drainage-system components provided by metal-roof-panel manufacturer.
7. Section 076200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated, sheet metal flashing and trim.
8. Section 077129 "Manufactured Roof Expansion Joints" for manufactured roof expansion-joint cover assemblies.
9. Section 077200 "Roof Accessories" for manufactured roof curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
10. Section 077253 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface, allowing it to melt and drain off slowly.
11. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.
12. Section 099113 "Exterior Painting" for field painting of roof specialties.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [Project site]<Insert location>.

1. Meet with Owner, Architect, Owner's insurer if applicable, roofing-system testing and inspecting agency representative, roofing Installer, roofing-system manufacturer's representative, Installer, structural-support Installer, and installers whose work interfaces with or affects roof specialties, including installers of roofing materials and accessories.
2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of roof specialty.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof specialties.
 - 1. Plans, expansion-joint locations, keyed details, and attachments to other work. Distinguish between factory pre manufactured- and field-assembled installation.
 - 2. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
 - 3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
 - 4. Details of termination points and assemblies, including fixed points.
 - 5. Details of special conditions.
- C. Samples: For each type of roof specialty and for each color and texture specified.
- D. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.
- E. Samples for Verification:
 - 1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
 - 2. Include **[copings][roof-edge specialties][roof-edge drainage systems][reglets and counterflashings]** made from **12-inch (300-mm)** lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.
- F. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of roof specialty **[copings][and][roof-edge flashings]** that is **[ANSI/SPRI/FM 4435/ES-1 tested][and][FM Approvals approved]**.
- B. Product Test Reports: For **[copings][and][roof-edge flashings]**, for tests performed by a qualified testing agency.
- C. Research Reports: For **[copings][and][roof-edge flashings]**, from **[an agency acceptable to authorities having jurisdiction][ICC-ES]<Insert evaluation agency>** showing compliance with ANSI/SPRI/FM 4435/ES-1.
- D. Qualification Statements: For manufacturer.
- E. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roof specialties.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer offering products that are **[FM Approvals listed for specified class][and][ANSI/SPRI/FM 4435/ES-1 tested to specified design pressure]**.

1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
1. Build mockup of typical roof edge as indicated on Drawings.
 2. Build mockup of typical roof edge as part of "Integrated Exterior Mockup" specified in **[Section 014000 "Quality Requirements."]<Insert Section number and title.>**
 3. Build mockup of typical roof edge, including **[fascia][gutter][and][downspout]<Insert item>**, approximately **[10 ft. (3.0 m)]<Insert dimension>** long, including supporting construction, seams, attachments,**[underlayment,]** and accessories.
 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.9 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.10 COORDINATION

- A. Coordinate roof specialties with roofing system, exterior wall system, air barrier, flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, weathertight, secure, and noncorrosive installation.
1. Performance Coordination: Coordinate with the Work of roofing and exterior wall Sections to ensure that roof specialties provided under the Work of this Section meet or exceed specified roofing and exterior wall design performance requirements.
- B. Confirm and coordinate compatibility of materials and comply with warranty requirements of roofing system manufacturer.

- C. Coordinate roof specialties layout and seams with sizes and locations of joints and seams in adjacent materials.

1.11 WARRANTY

- A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section **<Insert Section number> "<Insert Section title>."**
- B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finishes or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: **[20][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain roof specialties from single manufacturer providing roofing-system warranty specified in Section **<Insert Section number> "<Insert Section title>."**

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof specialties to withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert value>** percent.
- C. Recycled Content: Provide manufacturer documentation for recycled content, indicating postconsumer and preconsumer recycled content.
- D. FM Approvals' Listing: Manufacture and install **[copings][roof-edge specialties]** that are listed in FM Approvals' "Approval Guide" and approved for windstorm classification, **[Class 1-60][Class 1-75][Class 1-90][Class 1-105][Class 1-120]<Insert class>**. Identify materials with FM Approvals' markings.
- E. SPRI Wind Design Standard: Manufacture and install **[copings][roof-edge specialties]** tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressures:
 - 1. Design Pressure: **[As indicated on Drawings]<Insert design pressure>**.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid

shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature change>**.

2.3 COPINGS

- A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding **[12 ft. (3.6 m)]<Insert dimension>**, concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Architectural Products Company]**
 - b. **[ATAS International, Inc.]**
 - c. **[Berridge Manufacturing Company]**
 - d. **[Castle Metal Products]**
 - e. **[Cheney Flashing Company]**
 - f. **[Drexel Metals Corp.]**
 - g. **[Englert, Inc.]**
 - h. **[EXCEPTIONAL Metals]**
 - i. **[FlashCo Manufacturing Inc.]**
 - j. **[Hickman; an MTL Company]**
 - k. **[Merchant & Evans Inc.]**
 - l. **[Metal-Era, Inc.]**
 - m. **[OMG Roofing Products; a Division of OMG, Inc.]**
 - n. **[PAC-CLAD; Petersen; a Carlisle company]**
 - o. **[SAF (Southern Aluminum Finishing Company, Inc.)]**
 - p. **[Sentrigard; NB Handy Company]**
 - q. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Products Company]**
 - b. **[ATAS International, Inc.]**
 - c. **[Berridge Manufacturing Company]**
 - d. **[Castle Metal Products]**
 - e. **[Cheney Flashing Company]**
 - f. **[Drexel Metals Corp.]**
 - g. **[Englert, Inc.]**
 - h. **[EXCEPTIONAL Metals]**
 - i. **[FlashCo Manufacturing Inc.]**
 - j. **[Hickman; an MTL Company]**
 - k. **[Merchant & Evans Inc.]**
 - l. **[Metal-Era, Inc.]**
 - m. **[OMG Roofing Products; a Division of OMG, Inc.]**
 - n. **[PAC-CLAD; Petersen; a Carlisle company]**
 - o. **[SAF (Southern Aluminum Finishing Company, Inc.)]**
 - p. **[Sentrigard; NB Handy Company]**

- q. <Insert manufacturer's name>
3. Metallic-Coated Steel Coping Caps: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, nominal [0.028-inch (0.71-mm) thickness][0.034-inch (0.86-mm) thickness][thickness as required to meet performance requirements]<Insert thickness>.
 - a. Surface: [Smooth, flat][Embossed] finish.
 - b. Finish: [Two-coat fluoropolymer][Three-coat fluoropolymer][Two-coat mica fluoropolymer][Three-coat metallic fluoropolymer]<Insert finish>.
 - c. Color: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.
 4. Formed Aluminum Coping Caps: Aluminum sheet, [0.040 inch (1.02 mm) thick][0.050 inch (1.27 mm) thick][0.063 inch (1.60 mm) thick][thickness as required to meet performance requirements]<Insert thickness>.
 - a. Surface: [Smooth, flat][Embossed] finish.
 - b. Finish: [Two-coat fluoropolymer][Three-coat fluoropolymer][Two-coat mica fluoropolymer][Three-coat metallic fluoropolymer][Clear anodic][Color anodic]<Insert finish>.
 - c. Color: [Light bronze][Medium bronze][Dark bronze][Black][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.
 5. Extruded-Aluminum Coping Caps: Extruded aluminum, [0.080 inch (2.03 mm) thick][0.125 inch (3.18 mm) thick][thickness as required to meet performance requirements]<Insert thickness>.
 - a. Finish: [Two-coat fluoropolymer][Three-coat fluoropolymer][Two-coat mica fluoropolymer][Three-coat metallic fluoropolymer][Clear anodic][Color anodic]<Insert finish>.
 - b. Color: [Light bronze][Medium bronze][Dark bronze][Black][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.
 6. Formed Stainless Steel Coping Caps: Stainless steel sheet, nominal [0.0313-inch (0.795-mm) thickness][thickness as required to meet performance requirements]<Insert thickness>.
 - a. Finish: [ASTM A480/A480M No. 2B (bright, cold rolled)][ASTM A480/A480M No. 3 (coarse, polished directional satin)][ASTM A480/A480M No. 4 (bright, polished directional satin)]<Insert finish>.
 7. Formed Copper Coping Caps: Copper sheet, [16 oz./sq. ft. (0.55 mm)][20 oz./sq. ft. (0.68 mm)][24 oz./sq. ft. (0.82 mm)][Thickness as required to meet performance requirements].
 - a. Copper Finish: [Non-patinated, mill][Pre-patinated dark brown][Pre-patinated verdigris]<Insert finish>.
 8. Corners: Factory mitered and [soldered][continuously welded][mechanically clinched and sealed watertight].
 9. Special Fabrications: [Radiused sections][Arched sections][Bullnose-face leg][Two-way sloped coping cap]<Insert description>.
 10. Coping-Cap Attachment Method: [Snap-on][or][face leg hooked to continuous cleat with back leg fastener exposed], fabricated from coping-cap material.

- a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, **12 inches (300 mm)** wide, with integral cleats.
- b. Face-Leg Cleats: Concealed, continuous **[galvanized-steel sheet][stainless steel]**.

2.4 ROOF-EDGE SPECIALTIES

- A. Canted Roof-Edge Fascia and Gravel Stop : Manufactured, two-piece, roof-edge fascia consisting of **[snap-on][compression-clamped]** metal fascia cover in section lengths not exceeding **[12 ft. (3.6 m)]<Insert dimension>** and a continuous formed galvanized-steel sheet cant, **0.028 inch (0.71 mm)** thick, minimum, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Architectural Products Company]**
 - b. **[ATAS International, Inc.]**
 - c. **[Berridge Manufacturing Company]**
 - d. **[Castle Metal Products]**
 - e. **[Cheney Flashing Company]**
 - f. **[Drexel Metals Corp.]**
 - g. **[Englert, Inc.]**
 - h. **[FlashCo Manufacturing Inc.]**
 - i. **[Merchant & Evans Inc.]**
 - j. **[Metal-Era, Inc.]**
 - k. **[OMG Roofing Products; a Division of OMG, Inc.]**
 - l. **[PAC-CLAD; Petersen; a Carlisle company]**
 - m. **[SAF (Southern Aluminum Finishing Company, Inc.)]**
 - n. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Products Company]**
 - b. **[ATAS International, Inc.]**
 - c. **[Berridge Manufacturing Company]**
 - d. **[Castle Metal Products]**
 - e. **[Cheney Flashing Company]**
 - f. **[Drexel Metals Corp.]**
 - g. **[Englert, Inc.]**
 - h. **[FlashCo Manufacturing Inc.]**
 - i. **[Merchant & Evans Inc.]**
 - j. **[Metal-Era, Inc.]**
 - k. **[OMG Roofing Products; a Division of OMG, Inc.]**
 - l. **[PAC-CLAD; Petersen; a Carlisle company]**
 - m. **[SAF (Southern Aluminum Finishing Company, Inc.)]**
 - n. **<Insert manufacturer's name>**
 - 3. Metallic-Coated Steel Fascia Covers: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, nominal **[0.028-inch (0.71-mm) thickness][0.034-inch (0.86-mm) thickness][thickness as required to meet performance requirements]<Insert thickness>**.

- a. Surface: **[Smooth, flat][Embossed]** finish.
 - b. Finish: **[Two-coat fluoropolymer][Three-coat fluoropolymer][Two-coat mica fluoropolymer][Three-coat metallic fluoropolymer]<Insert finish>**.
 - c. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.
 4. Formed Aluminum Fascia Covers: Aluminum sheet, **[0.040 inch (1.02 mm) thick][0.050 inch (1.27 mm) thick][0.063 inch (1.60 mm) thick][thickness as required to meet performance requirements]<Insert thickness>**.
 - a. Surface: **[Smooth, flat][Embossed]** finish.
 - b. Finish: **[Two-coat fluoropolymer][Three-coat fluoropolymer][Two-coat mica fluoropolymer][Three-coat metallic fluoropolymer][Clear anodic][Color anodic]<Insert finish>**.
 - c. Color: **[Light bronze][Medium bronze][Dark bronze][Black][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.
 5. Extruded-Aluminum Fascia Covers: Extruded aluminum, **[0.080 inch (2.03 mm) thick][0.125 inch (3.18 mm) thick][thickness as required to meet performance requirements]<Insert thickness>**.
 - a. Finish: **[Two-coat fluoropolymer][Three-coat fluoropolymer][Two-coat mica fluoropolymer][Three-coat metallic fluoropolymer][Clear anodic][Color anodic]<Insert finish>**.
 - b. Color: **[Light bronze][Medium bronze][Dark bronze][Black][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.
 6. Corners: Factory mitered and **[soldered][continuously welded][mechanically clinched and sealed watertight]**.
 7. Splice Plates: **[Concealed][Exposed]**, of same material, finish, and shape as fascia cover.
 8. Special Fabrications: **[Radiused sections][Arched sections][Bullnose fascia cover][Cornice fascia cover][Cove fascia cover]<Insert description>**.
 9. Fascia Accessories: **[Fascia extenders with continuous hold-down cleats][Wall cap][Soffit trim][Overflow scuppers][Overflow scuppers with perforated screens][Spillout scuppers][Downspout scuppers with integral conductor head and downspout adapters][Downspout scuppers with integral conductor head and downspout adapters and perforated screens]<Insert description>**.
- B. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding **[12 ft. (3.6 m)]<Insert dimension>** and a continuous metal receiver with integral drip-edge cleat to engage fascia cover **[and secure single-ply roof membrane]**. Provide matching corner units.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ATAS International, Inc.]**
 - b. **[Berridge Manufacturing Company]**
 - c. **[Drexel Metals Corp.]**
 - d. **[Englert, Inc.]**
 - e. **[EXCEPTIONAL Metals]**

- f. [Fabral; a brand of Flack Global Metals]
 - g. [FlashCo Manufacturing Inc.]
 - h. [Hickman; an MTL Company]
 - i. [Metal-Era, Inc.]
 - j. [OMG Roofing Products; a Division of OMG, Inc.]
 - k. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [ATAS International, Inc.]
 - b. [Berridge Manufacturing Company]
 - c. [Drexel Metals Corp.]
 - d. [Englert, Inc.]
 - e. [EXCEPTIONAL Metals]
 - f. [Fabral; a brand of Flack Global Metals]
 - g. [FlashCo Manufacturing Inc.]
 - h. [Hickman; an MTL Company]
 - i. [Metal-Era, Inc.]
 - j. [OMG Roofing Products; a Division of OMG, Inc.]
 - k. <Insert manufacturer's name>
3. Metallic-Coated Steel Fascia Covers: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, nominal [0.028-inch (0.71-mm) thickness][0.034-inch (0.86-mm) thickness][thickness as required to meet performance requirements]<Insert thickness>.
 - a. Surface: [Smooth, flat][Embossed] finish.
 - b. Finish: [Two-coat fluoropolymer][Three-coat fluoropolymer][Two-coat mica fluoropolymer][Three-coat metallic fluoropolymer]<Insert finish>.
 - c. Color: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.
4. Formed Aluminum Fascia Covers: Aluminum sheet, [0.040 inch (1.02 mm) thick][0.050 inch (1.27 mm) thick][0.063 inch (1.60 mm) thick][thickness as required to meet performance requirements]<Insert thickness>.
 - a. Surface: [Smooth, flat][Embossed] finish.
 - b. Finish: [Two-coat fluoropolymer][Three-coat fluoropolymer][Two-coat mica fluoropolymer][Three-coat metallic fluoropolymer][Clear anodic][Color anodic]<Insert finish>.
 - c. Color: [Light bronze][Medium bronze][Dark bronze][Black][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.
5. Corners: Factory mitered and [soldered][continuously welded][mechanically clinched and sealed watertight].
6. Splice Plates: [Concealed][Exposed], of same material, finish, and shape as fascia cover.
7. Receiver: [Galvanized-steel sheet, nominal 0.040-inch (1.02-mm) thickness][Aluminum sheet, 0.050 inch (1.27 mm) thick][Extruded aluminum, 0.080 inch (2.03 mm) thick][Manufacturer's standard material and thickness].
8. Special Fabrications: [Radiused sections][Arched sections][Bullnose fascia cover][Cornice fascia cover][Cove fascia cover]<Insert description>.
9. Fascia Accessories: [Fascia extenders with continuous hold-down cleats][Wall cap][Soffit trim][Overflow scuppers][Overflow scuppers with perforated screens][Spillout scuppers][Downspout scuppers with integral conductor head and downspout]

adapters][Downspout scuppers with integral conductor head and downspout adapters and perforated screens]<Insert description>.

- C. One-Piece Gravel Stops: Manufactured, one-piece, metal gravel stop in section lengths not exceeding **[12 ft. (3.6 m)]<Insert dimension>**, with a horizontal flange and vertical leg[, **drain-through**] fascia[**terminating in a drip edge**], and concealed splice plates of same material, finish, and shape as gravel stop. Provide matching corner units.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Architectural Products Company]**
 - b. **[Berridge Manufacturing Company]**
 - c. **[Castle Metal Products]**
 - d. **[Cheney Flashing Company]**
 - e. **[Drexel Metals Corp.]**
 - f. **[OMG Roofing Products; a Division of OMG, Inc.]**
 - g. **[PAC-CLAD; Petersen; a Carlisle company]**
 - h. **[SAF (Southern Aluminum Finishing Company, Inc.)]**
 - i. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Products Company]**
 - b. **[Berridge Manufacturing Company]**
 - c. **[Castle Metal Products]**
 - d. **[Cheney Flashing Company]**
 - e. **[Drexel Metals Corp.]**
 - f. **[OMG Roofing Products; a Division of OMG, Inc.]**
 - g. **[PAC-CLAD; Petersen; a Carlisle company]**
 - h. **[SAF (Southern Aluminum Finishing Company, Inc.)]**
 - i. **<Insert manufacturer's name>**
 3. Metallic-Coated Steel Gravel Stops: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, nominal **[0.028-inch (0.71-mm) thickness][0.034-inch (0.86-mm) thickness][thickness as required to meet performance requirements]<Insert thickness>**.
 - a. Surface: **[Smooth, flat][Embossed]** finish.
 - b. Finish: **[Two-coat fluoropolymer][Three-coat fluoropolymer][Two-coat mica fluoropolymer][Three-coat metallic fluoropolymer]<Insert finish>**.
 - c. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.
 4. Formed Aluminum Gravel Stops: Aluminum sheet, **[0.040 inch (1.02 mm) thick][0.050 inch (1.27 mm) thick][0.063 inch (1.60 mm) thick][thickness as required to meet performance requirements]<Insert thickness>**.
 - a. Surface: **[Smooth, flat][Embossed]** finish.
 - b. Finish: **[Two-coat fluoropolymer][Three-coat fluoropolymer][Two-coat mica fluoropolymer][Three-coat metallic fluoropolymer][Clear anodic][Color anodic]<Insert finish>**.

- c. Color: [Light bronze][Medium bronze][Dark bronze][Black][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.
5. Extruded-Aluminum Gravel Stops: Extruded aluminum, [0.080 inch (2.03 mm) thick][0.125 inch (3.18 mm) thick][thickness as required to meet performance requirements]<Insert thickness>.
 - a. Finish: [Two-coat fluoropolymer][Three-coat fluoropolymer][Two-coat mica fluoropolymer][Three-coat metallic fluoropolymer][Clear anodic][Color anodic]<Insert finish>.
 - b. Color: [Light bronze][Medium bronze][Dark bronze][Black][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.
6. Formed Stainless Steel Gravel Stops: Stainless steel sheet, nominal [0.0313-inch (0.795-mm) thickness][thickness as required to meet performance requirements]<Insert thickness>.
 - a. Finish: [ASTM A480/A480M No. 2B (bright, cold rolled)][ASTM A480/A480M No. 3 (coarse, polished directional satin)][ASTM A480/A480M No. 4 (bright, polished directional satin)]<Insert finish>.
7. Formed Copper Gravel Stops: Copper sheet, [16 oz./sq. ft. (0.55 mm)][20 oz./sq. ft. (0.68 mm)][24 oz./sq. ft. (0.82 mm)][Thickness as required to meet performance requirements].
 - a. Copper Finish: [Non-patinated, mill][Pre-patinated dark brown][Pre-patinated verdigris]<Insert finish>.
8. Corners: Factory mitered and [soldered][continuously welded][mechanically clinched and sealed watertight].
9. Accessories: [Fascia extenders with continuous hold-down cleats][Wall cap][Soffit trim]<Insert description>.

2.5 ROOF-EDGE DRAINAGE SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 1. [Architectural Products Company]
 2. [ATAS International, Inc.]
 3. [Berger; division of OmniMax International, Inc.]
 4. [Castle Metal Products]
 5. [Cheney Flashing Company]
 6. [CopperCraft by Fabral]
 7. [Drexel Metals Corp.]
 8. [EXCEPTIONAL Metals]
 9. [Hickman; an MTL Company]
 10. [Merchant & Evans Inc.]
 11. [Metal-Era, Inc.]
 12. [OMG Roofing Products; a Division of OMG, Inc.]
 13. [RDCA; Roof Drainage Components & Accessories]
 14. [SAF (Southern Aluminum Finishing Company, Inc.)]
 15. <Insert manufacturer's name>

- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Architectural Products Company]**
 2. **[ATAS International, Inc.]**
 3. **[Berger; division of OmniMax International, Inc.]**
 4. **[Castle Metal Products]**
 5. **[Cheney Flashing Company]**
 6. **[CopperCraft by Fabral]**
 7. **[Drexel Metals Corp.]**
 8. **[EXCEPTIONAL Metals]**
 9. **[Hickman; an MTL Company]**
 10. **[Merchant & Evans Inc.]**
 11. **[Metal-Era, Inc.]**
 12. **[OMG Roofing Products; a Division of OMG, Inc.]**
 13. **[RDCA; Roof Drainage Components & Accessories]**
 14. **[SAF (Southern Aluminum Finishing Company, Inc.)]**
 15. **<Insert manufacturer's name>**
- C. Gutters: Manufactured in uniform section lengths not exceeding **[12 ft. (3.6 m)]<Insert dimension>**, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least **1 inch (25 mm)** above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
1. Metallic-Coated Steel Sheet: Nominal **[0.028-inch (0.71-mm)][0.034-inch (0.86-mm)]<Insert dimension>** thickness.
 2. Formed Aluminum Sheet: **[0.032 inch (0.81 mm)][0.040 inch (1.02 mm)][0.050 inch (1.27 mm)][0.063 inch (1.60 mm)]<Insert dimension>** thick.
 3. Formed Copper Sheet: **[16-oz./sq. ft. (0.55-mm)][20-oz./sq. ft. (0.68-mm)][24-oz./sq. ft. (0.82-mm)]** thickness.
 4. Gutter Profile: **[Style A][Style B][Style F][Style G][Style H][Style I][Style K][Style K highback][Half-round single bead][Half-round highback][Quarter round][Ogee][As indicated]<Insert style>** in accordance with SMACNA's "Architectural Sheet Metal Manual."
 5. Embossed Surface: Embossed with design **[as indicated by manufacturer's designations][As selected by Architect from manufacturer's full range]<Insert description>**.
 6. Applied Fascia Cover (Concealed Gutter): Exposed, formed **[copper, 16 oz./sq. ft. (0.55 mm thick)][aluminum, 0.040 inch (1.02 mm) thick]<Insert material and weight or thickness>**, with factory-mitered corners, ends, and concealed splice joints.
 7. Corners: Factory mitered and **[soldered][continuously welded][mechanically clinched and sealed watertight]**.
 8. Gutter Supports: **[Gutter brackets][Straps][Spikes and ferrules][Manufacturer's standard supports as selected by Architect]<Insert description>** with finish matching the gutters.
 9. Special Fabrications: **[Radiused sections]<Insert description>**.
 10. Gutter Accessories: **[Continuous screened leaf guard with sheet metal frame][Continuous hinged leaf guard of solid metal designed to shed leaves][Continuous snap-in plastic leaf guard][Bronze wire ball downspout strainer][Wire ball downspout strainer][Flat ends][Bullnose ends for half-round gutter]<Insert description>**.
- D. Downspouts: **[Plain round][Corrugated round][Plain rectangular][Corrugated rectangular][Open-face rectangular]<Insert shape>** complete with **[machine-crimped][mitered][smooth-curve]** elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
1. Metallic-Coated Steel Sheet: Nominal **[0.028-inch (0.71-mm)][0.034-inch (0.86-mm)]<Insert dimension>** thickness.

2. Formed Aluminum Sheet: [0.032 inch (0.81 mm)][0.040 inch (1.02 mm)][0.050 inch (1.27 mm)][0.063 inch (1.60 mm)]<Insert dimension> thick.
 3. Extruded Aluminum: [0.125 inch (3.18 mm)]<Insert dimension> thick.
 4. Formed Copper Sheet: [16 oz./sq. ft. (0.55 mm)][20 oz./sq. ft. (0.68 mm)][24 oz./sq. ft. (0.82 mm)][Thickness as required to meet performance requirements].
 5. Size: [As indicated on Drawings]<Insert value>.
- E. Parapet Scuppers: Manufactured with closure flange trim to exterior, **4-inch- (100-mm-)** wide wall flanges to interior, and base extending **4 inches (100 mm)** beyond cant or tapered strip into field of roof.[**Fasten gravel guard angles to base of scuppers.**]
1. Metallic-Coated Steel Sheet: Nominal [0.028-inch (0.71-mm)]<Insert dimension> thickness.
 2. Formed Aluminum Sheet: [0.032 inch (0.81 mm)]<Insert dimension> thick.
 3. Formed Stainless Steel Sheet: [0.0188 inch (0.477 mm)]<Insert dimension> thick.
 4. Formed Copper Sheet: [16 oz./sq. ft. (0.55 mm)][20 oz./sq. ft. (0.68 mm)][24 oz./sq. ft. (0.82 mm)][Thickness as required to meet performance requirements].
 5. Size: [As indicated on Drawings]<Insert value>.
- F. Conductor Heads: Manufactured conductor heads, each with flanged back and stiffened top edge, and of dimensions and shape indicated, complete with outlet tube that nests into upper end of downspout[, **exterior flange trim,**][and][**built-in overflow**].
1. Metallic-Coated Steel Sheet: Nominal [0.028-inch (0.71-mm)]<Insert dimension> thickness.
 2. Formed Aluminum Sheet: [0.032 inch (0.81 mm)]<Insert dimension> thick.
 3. Formed Stainless Steel Sheet: [0.0156 inch (0.396 mm)]<Insert dimension> thick.
 4. Formed Copper Sheet: [16 oz./sq. ft. (0.55 mm)][20 oz./sq. ft. (0.68 mm)][24 oz./sq. ft. (0.82 mm)][Thickness as required to meet performance requirements].
 5. Size: [As indicated on Drawings]<Insert value>.
- G. Splash Pans: Fabricate from the following exposed metal:
1. Metallic-Coated Steel Sheet: Nominal [0.028-inch (0.71-mm)]<Insert dimension> thickness.
 2. Formed Aluminum Sheet: [0.040 inch (1.02 mm)]<Insert dimension> thick.
 3. Formed Stainless Steel Sheet: [0.0188 inch (0.477 mm)]<Insert dimension> thick.
 4. Formed Copper Sheet: [16 oz./sq. ft. (0.55 mm)][20 oz./sq. ft. (0.68 mm)][24 oz./sq. ft. (0.82 mm)][Thickness as required to meet performance requirements].
 5. Size: [As indicated on Drawings]<Insert value>.
- H. Finishes:
1. Metallic-Coated Steel: [Two-coat fluoropolymer][Three-coat fluoropolymer][Two-coat mica fluoropolymer][Three-coat metallic fluoropolymer]<Insert finish>.
 - a. Color: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.
 2. Aluminum: [Two-coat fluoropolymer][Three-coat fluoropolymer][Two-coat mica fluoropolymer][Three-coat metallic fluoropolymer][Clear anodic][Color anodic]<Insert finish>.
 - a. Color: [Light bronze][Medium bronze][Dark bronze][Black][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.
 3. Stainless Steel: [ASTM A480/A480M No. 2B (bright, cold rolled, unpolished)][ASTM A480/A480M No. 3 (coarse, polished directional satin)][ASTM A480/A480M No. 4 (bright,

- polished directional satin)]<Insert finish>.
4. Copper: [Non-patinated, mill][Pre-patinated dark brown][Pre-patinated verdigris]<Insert finish>.

2.6 REGLETS AND COUNTERFLASHINGS

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. [ATAS International, Inc.]
2. [Berridge Manufacturing Company]
3. [Castle Metal Products]
4. [Cheney Flashing Company]
5. [Drexel Metals Corp.]
6. [EXCEPTIONAL Metals]
7. [Fry Reglet Corporation]
8. [Heckmann Building Products, Inc.]
9. [Hickman; an MTL Company]
10. [Keystone Flashing Company, Inc]
11. [Metal-Era, Inc.]
12. [OMG Roofing Products; a Division of OMG, Inc.]
13. <Insert manufacturer's name>

- B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [ATAS International, Inc.]
2. [Berridge Manufacturing Company]
3. [Castle Metal Products]
4. [Cheney Flashing Company]
5. [Drexel Metals Corp.]
6. [EXCEPTIONAL Metals]
7. [Fry Reglet Corporation]
8. [Heckmann Building Products, Inc.]
9. [Hickman; an MTL Company]
10. [Keystone Flashing Company, Inc]
11. [Metal-Era, Inc.]
12. [OMG Roofing Products; a Division of OMG, Inc.]
13. <Insert manufacturer's name>

- C. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:

1. Metallic-Coated Steel Sheet: Nominal [0.022-inch (0.56-mm)][0.028-inch (0.71-mm)]<Insert dimension> thickness.
2. Formed Aluminum Sheet: [0.024 inch (0.61 mm)][0.050 inch (1.27 mm)]<Insert dimension> thick.
3. Formed Stainless Steel Sheet: [0.0188 inch (0.477 mm)][0.0250 inch (0.635 mm)]<Insert dimension> thick.
4. Formed Copper Sheet: [16 oz./sq. ft. (0.55 mm)][20 oz./sq. ft. (0.68 mm)][24 oz./sq. ft. (0.82 mm)][Thickness as required to meet performance requirements].
5. Corners: Factory mitered and [soldered][continuously welded][mechanically clinched and sealed watertight].

6. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 7. Stucco Type, Embedded: Provide reglets with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
 8. Concrete Type, Embedded: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
 9. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.
 10. Multiuse Type, Embedded: For multiuse embedment in **[cast-in-place concrete][masonry mortar joints]**.
- D. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by **4 inches (100 mm)** and in lengths not exceeding **[12 ft. (3.6 m)]<Insert dimension>** designed to snap into **[reglets][or][through-wall-flashing receiver]** and compress against base flashings with joints lapped, from the following exposed metal:
1. Metallic-Coated Steel Sheet: Nominal **[0.022-inch (0.56-mm)][0.028-inch (0.71-mm)]<Insert dimension>** thickness.
 2. Formed Aluminum Sheet: **[0.024 inch (0.61 mm)][0.032 inch (0.81 mm)]<Insert dimension>** thick.
 3. Formed Stainless Steel Sheet: **[0.0188 inch (0.477 mm)][0.0250 inch (0.635 mm)]<Insert dimension>** thick.
 4. Formed Copper Sheet: **[16 oz./sq. ft. (0.55 mm)][20 oz./sq. ft. (0.68 mm)][24 oz./sq. ft. (0.82 mm)][Thickness as required to meet performance requirements]**.
- E. Accessories:
1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
 2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
- F. Finishes:
1. Metallic-Coated Steel: **[Two-coat fluoropolymer][Three-coat fluoropolymer][Two-coat mica fluoropolymer][Three-coat metallic fluoropolymer]<Insert finish>**.
 - a. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.
 2. Aluminum: **[Two-coat fluoropolymer][Three-coat fluoropolymer][Two-coat mica fluoropolymer][Three-coat metallic fluoropolymer][Clear anodic][Color anodic]<Insert finish>**.
 - a. Color: **[Light bronze][Medium bronze][Dark bronze][Black][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.
 3. Stainless Steel: **[ASTM A480/A480M No. 2B (bright, cold rolled, unpolished)][ASTM A480/A480M No. 3 (coarse, polished directional satin)][ASTM A480/A480M No. 4 (bright, polished directional satin)]<Insert finish>**.
 4. Copper: **[Non-patinated, mill][Pre-patinated verdigris]<Insert finish>**.

2.7 SHEET METAL MATERIALS

- A. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with minimum ASTM A653/A653M, **G90 (Z275)** coating designation, or aluminum-zinc alloy-coated steel sheet complying with minimum ASTM A792/A792M, **Class AZ50 (Class AZM150)** coating designation; structural quality. [**Mill phosphatized for field painting where indicated**].
1. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
 2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of **0.2 mil (0.005 mm)**.
 3. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A755/A755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer Finish: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight in color coat.
 4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of **0.5 mil (0.013 mm)**.
- B. Aluminum Sheet: ASTM B209/B209M, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
1. Mill Finish: As manufactured.
 2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of **0.2 mil (0.005 mm)**.
 3. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**][**AA-M12C22A31, Class II, 0.010 mm**] or thicker.
 4. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**][**AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.
 5. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A755/A755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer Finish: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight in color coat.
 6. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of **0.5 mil (0.013 mm)**.
- C. Aluminum Extrusions and Tubes: **ASTM B221 (ASTM B221M)**, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise, mill finished.
- D. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
- E. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.

2.8 UNDERLAYMENT

- A. Synthetic Underlayment: Provide laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures greater than **220 deg F (111 deg C)**; and complying with physical requirements of ASTM D226/D226M for Type I and Type II felts.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ATAS International, Inc.]**
 - b. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - c. **[GCP Applied Technologies Inc.]**
 - d. **[Kirsch Building Products]**
 - e. **[Owens Corning]**
 - f. **[Palisade; Brand of Intertape Polymer Group (IPG)]**
 - g. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ATAS International, Inc.]**
 - b. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - c. **[GCP Applied Technologies Inc.]**
 - d. **[Kirsch Building Products]**
 - e. **[Owens Corning]**
 - f. **[Palisade; Brand of Intertape Polymer Group (IPG)]**
 - g. **<Insert manufacturer's name>**
- B. Self-Adhering, High-Temperature Sheet Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum **30 mils (0.76 mm)** thick, specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: Stable after testing at **240 deg F (116 deg C)**; ASTM D1970/D1970M.
 2. Low-Temperature Flexibility: Passes after testing at **minus 20 deg F (minus 29 deg C)** or lower; ASTM D1970/D1970M.
 3. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ATAS International, Inc.]**
 - b. **[Carlisle WIP Products; a brand of Carlisle Construction Materials]**
 - c. **[GCP Applied Technologies Inc.]**
 - d. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
 - e. **[Palisade; Brand of Intertape Polymer Group (IPG)]**
 - f. **[Polyglass U.S.A., Inc.]**
 - g. **[Protecto Wrap Company]**
 - h. **<Insert manufacturer's name>**
 4. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert**

manufacturer's name; product name or designation> or comparable product by one of the following:

- a. **[ATAS International, Inc.]**
- b. **[Carlisle WIP Products; a brand of Carlisle Construction Materials]**
- c. **[GCP Applied Technologies Inc.]**
- d. **[Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]**
- e. **[Palisade; Brand of Intertape Polymer Group (IPG)]**
- f. **[Polyglass U.S.A., Inc.]**
- g. **[Protecto Wrap Company]**
- h. **<Insert manufacturer's name>**

C. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

D. Slip Sheet: Rosin-sized building paper, **3-lb/100 sq. ft. (0.16-kq/sq. m)** minimum.

2.9 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Roof specialty manufacturer's recommended fasteners, designed to meet performance requirements, suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

- 1. Fasteners for Metallic-Coated Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.
- 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- 3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
- 4. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
- 5. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.

C. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

D. Elastomeric Sealant: ASTM C920, elastomeric **[polyurethane][silicone]** polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

G. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

H. Solder for Copper: ASTM B32, **[lead-free solder][Grade Sn50, 50 percent tin and 50 percent lead]**<Insert solder grade>.

2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

- A. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, in accordance with manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.
 - 1. Lap horizontal joints not less than **4 inches (100 mm)**.
- B. Self-Adhering, High-Temperature Sheet Underlayment:
 - 1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
 - 2. Prime substrate if recommended by underlayment manufacturer.
 - 3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
 - 4. Apply in shingle fashion to shed water, with end laps of not less than **6 inches (150 mm)** staggered **24 inches (600 mm)** between courses.
 - 5. Overlap side edges not less than **3-1/2 inches (90 mm)**. Roll laps and edges with roller.
 - 6. Roll laps and edges with roller.
 - 7. Cover underlayment within 14 days.
- C. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim.
 - 1. Install in shingle fashion to shed water.
 - 2. Lap joints not less than **2 inches (50 mm)**.

- D. Slip Sheet: Install slip sheet, wrinkle free, **[over underlayment][directly on substrate]<Insert requirement>** before installing sheet metal flashing and trim.

1. Install in shingle fashion to shed water.
2. Lapp joints not less than **4 inches (100 mm)**.

3.3 INSTALLATION, GENERAL

- A. Install roof specialties in accordance with manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 4. Torch cutting of roof specialties is not permitted.
 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer's written installation instructions.
1. Coat concealed side of **[uncoated aluminum][and][stainless steel]** roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
1. Space movement joints at a maximum of **[12 ft. (3.6 m)]<Insert dimension>** with no joints within **[18 inches (450 mm)]<Insert dimension>** of corners or intersections unless otherwise indicated on Drawings.
 2. When ambient temperature at time of installation is between **40 and 70 deg F (4 and 21 deg C)**, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that penetrate **[wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws][substrate not less than recommended in writing by fastener manufacturer to achieve maximum pull-out resistance]<Insert size requirement>**.
- E. Seal concealed joints with butyl sealant as required by roof specialty manufacturer.
- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below **40 deg F (4 deg C)**.
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of **1-1/2 inches (38 mm)**; however, reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.4 INSTALLATION OF COPINGS

- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.
 - 1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at **[30-inch (762-mm) centers][40-inch (1016-mm) centers][manufacturer's required spacing that meets performance requirements]<Insert spacing>**.
 - 2. Interlock face-leg drip edge into continuous cleat anchored to substrate at **[24-inch (610-mm) centers][16-inch (406-mm) centers][manufacturer's required spacing that meets performance requirements]<Insert spacing>**. Anchor back leg of coping with screw fasteners and elastomeric washers at **[24-inch (610-mm) centers][16-inch (406-mm) centers][manufacturer's required spacing that meets performance requirements]<Insert spacing>**.

3.5 INSTALLATION OF ROOF-EDGE SPECIALTIES

- A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.6 INSTALLATION OF ROOF-EDGE DRAINAGE SYSTEMS

- A. Install components to produce a complete roof-edge drainage system in accordance with manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
- B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than **[12 inches (305 mm)][24 inches (610 mm)][30 inches (762 mm)]<Insert dimension>** apart. Attach ends with rivets and **[seal with sealant][solder]** to make watertight. Slope to downspouts.
 - 1. Install gutter with expansion joints at locations indicated but not exceeding **[50 ft. (15.2 m)]<Insert dimension>** apart. Install expansion-joint caps.
 - 2. Install continuous leaf guards on gutters with noncorrosive fasteners, **[removable][hinged to swing open]** for cleaning gutters.
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and **1 inch (25 mm)** away from walls; locate fasteners at top and bottom and at approximately **[60 inches (1500 mm)]<Insert dimension>** o.c.
 - 1. Provide elbows at base of downspouts at grade to direct water away from building.
 - 2. Connect downspouts to underground drainage system indicated.
- D. Splash Pans: Install where downspouts discharge on **[low-slope roofs]<Insert surface>**. Set in **[asphalt roofing cement][elastomeric sealant]**.
- E. Parapet Scuppers: Install scuppers through parapet where indicated. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under

roofing membrane.

1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
2. Loosely lock front edge of scupper with conductor head.
3. Seal or solder exterior wall scupper flanges into back of conductor head.

- F. Conductor Heads: Anchor securely to wall with elevation of conductor top edge **1 inch (25 mm)** below **[scupper][gutter]** discharge.

3.7 INSTALLATION OF REGLETS AND COUNTERFLASHINGS

- A. Coordinate installation of reglets and counterflashings with installation of base flashings.
- B. Embedded Reglets: See **[Section 033000 "Cast-in-Place Concrete"]** and **[Section 042000 "Unit Masonry"]** for installation of reglets.
- C. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap **4 inches (100 mm)** over top edge of base flashings.
- D. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap **4 inches (100 mm)** over top edge of base flashings. Lap counterflashing joints a minimum of **4 inches (100 mm)** and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.8 CLEANING AND PROTECTION

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing in accordance with ASTM A780/A780M.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Section 099113 "Exterior Painting."
- C. Clean and neutralize flux materials. Clean off excess solder and sealants.
- D. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- E. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 07 71 00 00



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 71 13 00	07 71 00 00	Roof Specialties
07 71 19 00	07 71 00 00	Roof Specialties
07 71 23 00	01 11 19 00	No Specification Required
07 71 23 00	07 62 00 00	Sheet Metal Flashing And Trim
07 71 23 00	07 71 00 00	Roof Specialties
07 71 26 00	07 62 00 00	Sheet Metal Flashing And Trim
07 71 26 00	07 71 00 00	Roof Specialties



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SECTION 07 72 00 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Manufactured units for the following applications:

1. Roof curbs.
2. Equipment supports.
3. Roof hatches.
4. Heat and smoke vents.
5. Gravity ventilators.
6. Pipe and duct supports.
7. Pipe portals.
8. Preformed flashing sleeves.
9. Roof walkways.
10. Underlayment.
11. Miscellaneous materials.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
2. Section 061000 "Rough Carpentry" for roof cants, nailers, blocking, and other pressure-preservative-treated wood.
3. Section 077100 "Roof Specialties" for manufactured copings, roof-edge specialties, roof-edge drainage systems, reglets, and counterflashing.
4. Section 077253 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface, allowing it to melt and drain off slowly.
5. Section 079200 "Joint Sealants" for field-applied sealants between roof accessories and adjacent materials.
6. Section 099113 "Exterior Painting" for field painting of roof accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Delegated Design Submittals: For **[roof curbs][equipment supports][and][walkways]** indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail mounting, securing, and flashing of roof-mounted items to roof structure. Indicate

- coordinating requirements with roof membrane system.
2. Wind-Restraint Details: Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

- D. Samples: For each type of roof accessory and for each color and texture specified.
- E. Samples for Initial Selection: For each type of roof accessory indicated with factory-applied color finishes.
- F. Samples for Verification: Include Samples of each type of roof accessory to verify finish and color selection, in manufacturer's standard sizes.
- G. Sustainable Design Submittals:
 1. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 1. Size and location of roof accessories specified in this Section.
 2. Method of attaching roof accessories to roof or building structure.
 3. Other roof-mounted items, including mechanical and electrical equipment, ductwork, piping, and conduit.
 4. Required clearances.
- B. Qualification Statements: For **[manufacturer][fabricator][Installer][specialist][testing agency][manufacturer's technical representative][factory-authorized service representative]<Insert entity or specialist>**.
- C. Delegated Design Engineer Qualifications: For **[Insert product]**.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories.

1.5 QUALITY ASSURANCE

- A. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in **[state]<Insert jurisdiction>** where Project is located and who is experienced in providing engineering services of the type indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof accessories in contact with other materials that might cause staining, denting, or other surface damage. Store roof accessories in accordance with manufacturer's instructions.
- B. Store materials off ground in dry location and in accordance with manufacturer's instructions in well-

ventilated area.

- C. Store and protect roof accessories from nicks, scratches, and blemishes.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-accessory substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.8 COORDINATION

- A. Coordinate layout and installation of roof accessories with **[roofing membrane and base flashing and]**interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories to withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design **[roof curbs][and][equipment supports]** to comply with wind performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Wind-Restraint Performance: **[As indicated on Drawings]<Insert requirements>**.

2.2 ROOF CURBS

- A. Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, **[straight sides,][integral metal cant,][stepped integral metal cant to raise the thickness of roof insulation,]** and integrally formed deck-mounting flange at perimeter bottom.
- B. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **[AES Industries, Inc]**
 - 2. **[AES Sunoptics; Acuity Brands International, Inc.]**
 - 3. **[Air Balance; MESTEK, Inc.]**
 - 4. **[ATAS International, Inc.]**
 - 5. **[Conn-Fab Sales, Inc]**
 - 6. **[Curbs Plus, Inc]**
 - 7. **[Custom Solution Roof and Metal Products, a division of Colony Heating]**
 - 8. **[Greenheck Fan Corporation]**

9. [KCC Manufacturing]
10. [Lloyd Industries, Inc.]
11. [LMCurbs]
12. [Louvers & Dampers, Inc.; Mestek, Inc.]
13. [Metallic Products Corporation]
14. [Pate Company (The)]
15. [Plenums of Florida Incorporated]
16. [RCS Fabrications Inc.]
17. [Roof Products and Systems (RPS); Duravent Group]
18. [Roof Products, Inc.]
19. [Thybar Corporation]
20. [Vent Products Co., Inc]
21. <Insert manufacturer's name>

C. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [AES Industries, Inc]
2. [AES Sunoptics; Acuity Brands International, Inc.]
3. [Air Balance; MESTEK, Inc.]
4. [ATAS International, Inc.]
5. [Conn-Fab Sales, Inc]
6. [Curbs Plus, Inc]
7. [Custom Solution Roof and Metal Products, a division of Colony Heating]
8. [Greenheck Fan Corporation]
9. [KCC Manufacturing]
10. [Lloyd Industries, Inc.]
11. [LMCurbs]
12. [Louvers & Dampers, Inc.; Mestek, Inc.]
13. [Metallic Products Corporation]
14. [Pate Company (The)]
15. [Plenums of Florida Incorporated]
16. [RCS Fabrications Inc.]
17. [Roof Products and Systems (RPS); Duravent Group]
18. [Roof Products, Inc.]
19. [Thybar Corporation]
20. [Vent Products Co., Inc]
21. <Insert manufacturer's name>

D. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

E. Supported Load Capacity: [Coordinate load capacity with information on Shop Drawings of equipment to be supported]<Insert load requirements>.

F. Steel: [Zinc-coated (galvanized)][Aluminum-zinc alloy-coated] steel sheet, [0.052 inch (1.32 mm)][0.064 inch (1.63 mm)][0.079 inch (2.01 mm)]<Insert dimension> thick.

1. Finish: [Mill phosphatized][Factory prime coating][Powder coat]<Insert finish>.
2. Color: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.

G. Aluminum: [0.090 inch (2.28 mm)][0.125 inch (3.17 mm)]<Insert dimension> thick sheet.

1. Finish: [Mill][Factory prime coating][Clear anodic][Color anodic][Powder coat]<Insert

- finish>.**
2. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range][Light bronze][Medium bronze][Dark bronze]<Insert color>.**
- H. Stainless Steel: **[0.0781 inch (1.983 mm)]<Insert dimension>** thick sheet.
1. Finish: **[Manufacturer's standard]<Insert finish>.**
- I. Construction:
1. Curb Profile: **[Manufacturer's standard][Profile as indicated on Drawings]** compatible with roofing system.
 2. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
 3. Fabricate curbs to minimum height of **[12 inches (305 mm)]<Insert dimension>** above roofing surface unless otherwise indicated.
 4. Top Surface: Level top of curb, with roof slope accommodated **[by sloping deck-mounting flange][or][by use of leveler frame].**
 5. Sloping Roofs: Where roof slope exceeds **1/4 inch per 12 inches (1:48)**, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.
 6. Insulation: Factory insulated with **[1-1/2-inch- (38-mm-)]<Insert dimension>** thick glass-fiber board insulation.
 7. Liner: Same material as curb, of manufacturer's standard thickness and finish.
 8. Nailer: Factory-installed wood nailer **[along top flange of curb][under top flange on side of curb]**, continuous around curb perimeter.
 9. Wind-Restraint Straps and Base Flange Attachment: Provide wind-restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing required to comply with wind-uplift requirements.
 10. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from **3/4-inch- (19-mm-)** thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
 11. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.
 12. Security Grille: **[Provide for all units][Provide where indicated].**
 13. Damper Tray: Provide damper tray or shelf with opening **[3 inches (76 mm)]<Insert dimension>[less than interior curb dimensions indicated][of size indicated].**

2.3 EQUIPMENT SUPPORTS

- A. **[Internally reinforced perimeter][Rail-type]** metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded **[or mechanically fastened and sealed]** corner joints, **[integral metal cant,][stepped integral metal cant to raise the thickness of roof insulation,]** and integrally formed structure-mounting flange at bottom.
- B. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
1. **[AES Industries, Inc]**
 2. **[Air Balance; MESTEK, Inc.]**
 3. **[Conn-Fab Sales, Inc]**

4. [Curbs Plus, Inc]
5. [Greenheck Fan Corporation]
6. [JL Industries; Activar Construction Products Group, Inc.]
7. [KCC Manufacturing]
8. [Lloyd Industries, Inc.]
9. [LMCurbs]
10. [Louvers & Dampers, Inc.; Mestek, Inc.]
11. [Pate Company (The)]
12. [Plenums of Florida Incorporated]
13. [Portals Plus; Duravent Group]
14. [RCS Fabrications Inc.]
15. [Roof Products and Systems (RPS); Duravent Group]
16. [Roof Products, Inc.]
17. [Thybar Corporation]
18. [Vent Products Co., Inc]
19. <Insert manufacturer's name>

C. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

1. [AES Industries, Inc]
2. [Air Balance; MESTEK, Inc.]
3. [Conn-Fab Sales, Inc]
4. [Curbs Plus, Inc]
5. [Greenheck Fan Corporation]
6. [JL Industries; Activar Construction Products Group, Inc.]
7. [KCC Manufacturing]
8. [Lloyd Industries, Inc.]
9. [LMCurbs]
10. [Louvers & Dampers, Inc.; Mestek, Inc.]
11. [Pate Company (The)]
12. [Plenums of Florida Incorporated]
13. [Portals Plus; Duravent Group]
14. [RCS Fabrications Inc.]
15. [Roof Products and Systems (RPS); Duravent Group]
16. [Roof Products, Inc.]
17. [Thybar Corporation]
18. [Vent Products Co., Inc]
19. <Insert manufacturer's name>

D. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

E. Supported Load Capacity: **[Coordinate load capacity with information on Shop Drawings of equipment to be supported]<Insert load requirements>**.

F. Steel: **[Zinc-coated (galvanized)][Aluminum-zinc alloy-coated]** steel sheet, **[0.052 inch (1.32 mm)][0.064 inch (1.63 mm)][0.079 inch (2.01 mm)]<Insert dimension>** thick.

1. Finish: **[Mill phosphatized][Factory prime coating][Powder coat]<Insert finish>**.
2. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.

G. Aluminum: **[0.090 inch (2.28 mm)][0.125 inch (3.17 mm)]<Insert dimension>** thick sheet.

1. Finish: [Mill][Factory prime coating][Clear anodic][Color anodic][Powder coat]<Insert finish>.
2. Color: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range][Light bronze][Medium bronze][Dark bronze]<Insert color>.

H. Stainless Steel: [0.0781 inch (1.983 mm)]<Insert dimension> thick sheet.

1. Finish: [Manufacturer's standard]<Insert finish>.

I. Construction:

1. Curb Profile: [Manufacturer's standard][Profile as indicated on Drawings] compatible with roofing system.
2. Insulation: Factory insulated with [1-1/2-inch- (38-mm-)]<Insert dimension> thick glass-fiber board insulation.
3. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
4. Nailer: Factory-installed continuous wood nailers [3-1/2 inches (90 mm)][5-1/2 inches (140 mm)]<Insert dimension> wide [on top flange of equipment supports][under top flange on side of curb], continuous around support perimeter.
5. Wind-Restraint Straps and Base Flange Attachment: Provide wind-restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb of size and spacing required to comply with wind-uplift requirements.
6. Platform Cap: Where portion of equipment support is not covered by equipment, provide weathertight platform cap formed from 3/4-inch- (19-mm-) thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
7. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
8. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
9. Fabricate equipment supports to minimum height of [12 inches (305 mm)]<Insert dimension> above roofing surface unless otherwise indicated.
10. Sloping Roofs: Where roof slope exceeds 1/4 inch per 12 inches (1:48), fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.
11. Security Grille: [Provide for all units][Provide where indicated on Drawings].

2.4 ROOF HATCHES

- A. Metal roof-hatch units with lids and insulated [single][double]-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, [straight sides,][integral metal cant,][stepped integral metal cant to raise the thickness of roof insulation,] and integrally formed deck-mounting flange at perimeter bottom.
- B. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 1. [ACUDOR Products, Inc]
 2. [AES Industries, Inc]
 3. [Architectural Specialties, Inc.]
 4. [Babcock-Davis]
 5. [BILCO Company (The)]
 6. [Dur-Red Products]
 7. [JL Industries; Activar Construction Products Group, Inc.]

8. [KCC Manufacturing]
9. [Kingspan Light + Air LLC]
10. [Lexcor; a division of Luxsuco corp.]
11. [Metallic Products Corporation]
12. [Milcor by Duravent; Duravent Group.]
13. [Nystrom, Inc.]
14. [O'Keeffe's Inc.]
15. [Pate Company (The)]
16. [Precision Ladders, LLC]
17. [Williams Brothers Corporation of America]
18. <Insert manufacturer's name>

C. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [ACUDOR Products, Inc]
2. [AES Industries, Inc]
3. [Architectural Specialties, Inc.]
4. [Babcock-Davis]
5. [BILCO Company (The)]
6. [Dur-Red Products]
7. [JL Industries; Activar Construction Products Group, Inc.]
8. [KCC Manufacturing]
9. [Kingspan Light + Air LLC]
10. [Lexcor; a division of Luxsuco corp.]
11. [Metallic Products Corporation]
12. [Milcor by Duravent; Duravent Group.]
13. [Nystrom, Inc.]
14. [O'Keeffe's Inc.]
15. [Pate Company (The)]
16. [Precision Ladders, LLC]
17. [Williams Brothers Corporation of America]
18. <Insert manufacturer's name>

D. Type and Size:

1. Single-leaf lid, [30 by 36 inches (750 by 900 mm)][36 by 36 inches (900 by 900 mm)][30 by 54 inches (750 by 1370 mm)][30 by 96 inches (750 by 2438 mm)]<Insert dimensions>.
2. Double-leaf lid, [72 by 96 inches (1830 by 2438 mm)]<Insert dimensions>.

E. Loads: Minimum [40 lbf/sq. ft. (1.9 kPa)]<Insert value> external live load and [20 lbf/sq. ft. (0.95 kPa)]<Insert value> internal uplift load.

1. Dome Glazing: Minimum [40 lbf/sq. ft. (1.9 kPa)]<Insert value> external live load and [20 lbf/sq. ft. (0.95 kPa)]<Insert value> internal uplift load.

F. Hatch Material, Steel: [Zinc-coated (galvanized)][Aluminum-zinc alloy-coated] steel sheet.

1. Thickness: [Manufacturer's standard thickness for hatch size indicated][0.079 inch (2.01 mm)]<Insert dimension>.
2. Finish: [Mill phosphatized][Factory prime coating][Powder coat]<Insert finish>.
3. Color: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.

G. Hatch Material, Aluminum:

1. Thickness: **[Manufacturer's standard thickness for hatch size indicated][0.079 inch (2.01 mm)]<Insert dimension>**.
2. Finish: **[Mill][Factory prime coating][Clear anodic][Color anodic][Powder coat]<Insert finish>**.
3. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range][Light bronze][Medium bronze][Dark bronze]<Insert color>**.

H. Hatch Material, Stainless Steel:

1. Thickness: **[Manufacturer's standard thickness for hatch size indicated][0.0781 inch (1.983 mm)]<Insert dimension>**.
2. Finish: **[Manufacturer's standard]<Insert finish>**.

I. Construction:

1. Insulation: **[1-inch- (25-mm-) thick, cellulosic-fiber board][1-inch- (25-mm-) thick, glass-fiber board][2-inch- (50-mm-) thick, polyisocyanurate board]**.
 - a. R-Value: **[2.78][4.3][12.0]<Insert R-value>** in accordance with ASTM C1363.
2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
3. Hatch Lid: **[Opaque][Glazed]**, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
5. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
6. Fabricate curbs to minimum height of **[12 inches (305 mm)]<Insert dimension>** above roofing surface unless otherwise indicated.
7. Sloping Roofs: Where slope or roof deck exceeds **1/4 inch per 12 inches (1:48)**, fabricate curb with perimeter curb height that is **[constant][tapered to accommodate roof slope so that top surfaces of perimeter curb are level]**. Equip hatch with water diverter or cricket on side that obstructs water flow.

J. Hatch-Lid Glazing: **[Single][Double][acrylic][polycarbonate]** glazing of thickness capable of resisting indicated loads.

1. Single-Dome Color: **[Colorless, transparent][White, translucent][Gray tinted, transparent][Bronze tinted, transparent]<Insert requirement>**.
2. Outer Double-Dome Color: **[Colorless, transparent][White, translucent][Gray tinted, transparent][Bronze tinted, transparent]<Insert requirement>**.
3. Inner Double-Dome Color: **[Colorless, transparent][White, translucent][Gray tinted, transparent][Bronze tinted, transparent]<Insert requirement>**.

K. Hardware: Spring operators, hold-open arm, **[galvanized][stainless]** steel spring latch with turn handles, **[galvanized][stainless]** steel butt- or pintle-type hinge system, and padlock hasps inside and outside.

1. Provide two-point latch on lids larger than **84 inches (2130 mm)**.
2. Provide remote-control operation.

L. Safety Railing System: Roof-hatch manufacturer's standard system, including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.

1. Height: **[42 inches (1060 mm)]<Insert dimension>** above finished roof deck.
2. Posts and Rails: Galvanized-steel pipe, **1-1/4 inches (31 mm)** in diameter or galvanized-steel tube, **1-5/8 inches (41 mm)** in diameter.
3. Flat Bar: Galvanized steel, **2 inches (50 mm)** high by **3/8 inch (9 mm)** thick.
4. Maximum Opening Size: System constructed to prevent passage of a sphere **21 inches (533 mm)** in diameter.
5. Chain Passway Barrier: Galvanized proof coil chain with quick link on fixed end.
6. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
7. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
8. Provide weep holes or another means to drain-entrapped water in hollow sections of handrail and railing members.
9. Fabricate joints exposed to weather to be watertight.
10. Fasteners: Manufacturer's standard, finished to match railing system.
11. Finish: **[Manufacturer's standard]<Insert finish>**.

- a. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.

M. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
2. Height: **[42 inches (1060 mm)]<Insert dimension>** above finished roof deck.
3. Material: **[Steel tube][Stainless steel][Aluminum]**.
4. Post: **[1-5/8-inch- (41-mm-)]<Insert dimension>** diameter pipe.
5. Finish: **[Manufacturer's standard]<Insert finish>**.
- a. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.

2.5 HEAT AND SMOKE VENTS

A. Hatch-Type Heat and Smoke Vents: Manufacturer's standard, with **[single][double]**-walled insulated curbs, welded or mechanically fastened and sealed corner joints, integral condensation gutter, and cap flashing. Fabricate with insulated double-walled lid and continuous weathertight perimeter lid gaskets, and equip with automatic self-lifting mechanisms and UL-listed **[fusible links rated at 165 deg F (74 deg C)]<Insert temperature rating>****[fire-suppression system][smoke-detection system]**.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ACUDOR Products, Inc]**
 - b. **[AES Sunoptics; Acuity Brands International, Inc.]**
 - c. **[Babcock-Davis]**
 - d. **[BILCO Company (The)]**
 - e. **[Dur-Red Products]**
 - f. **[JL Industries; Activar Construction Products Group, Inc.]**
 - g. **[KCC Manufacturing]**
 - h. **[Kingspan Light + Air LLC]**
 - i. **[Lexcor; a division of Luxsuo corp.]**

- j. **[Milcor by Duravent; Duravent Group.]**
 - k. **[Nystrom, Inc.]**
 - l. **[O'Keeffe's Inc.]**
 - m. **[Pate Company (The)]**
 - n. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ACUDOR Products, Inc]**
 - b. **[AES Sunoptics; Acuity Brands International, Inc.]**
 - c. **[Babcock-Davis]**
 - d. **[BILCO Company (The)]**
 - e. **[Dur-Red Products]**
 - f. **[JL Industries; Activar Construction Products Group, Inc.]**
 - g. **[KCC Manufacturing]**
 - h. **[Kingspan Light + Air LLC]**
 - i. **[Lexcor; a division of Luxsuo corp.]**
 - j. **[Milcor by Duravent; Duravent Group.]**
 - k. **[Nystrom, Inc.]**
 - l. **[O'Keeffe's Inc.]**
 - m. **[Pate Company (The)]**
 - n. **<Insert manufacturer's name>**
3. Type and Size:
 - a. Single-leaf lid, **[size as indicated on Drawings][30 by 36 inches (750 by 900 mm)][30 by 54 inches (750 by 1370 mm)][30 by 96 inches (750 by 2438 mm)]<Insert dimensions>**.
 - b. Double-leaf lid, **[72 by 96 inches (1830 by 2438 mm)]<Insert dimensions>**.
4. Loads: Minimum **[40 lbf/sq. ft. (1.9 kPa)]<Insert value>** external live load and **[30 lbf/sq. ft. (1.4 kPa)]<Insert value>** internal uplift load.
 - a. When release is actuated, lid to open against **[10 lbf/sq. ft. (0.5 kPa)]<Insert value>** snow or wind load and lock in position.
 - b. Hatch-Lid Glazing: Minimum **[40 lbf/sq. ft. (1.9 kPa)]<Insert value>** external live load and **[20 lbf/sq. ft. (0.95 kPa)]<Insert value>** internal uplift load.
5. Heat and Smoke Vent Standard: Provide units that have been tested and **[listed to comply with ANSI/CAN/UL 793][and][are FM Approved]**.
6. Curb, Framing, and Lid Material, Steel: **[Zinc-coated (galvanized)][Aluminum-zinc alloy-coated]** steel sheet.
 - a. Thickness: **[Manufacturer's standard thickness for hatch size indicated][0.079 inch (2.01 mm)]<Insert dimension>**.
 - b. Finish: **[Mill phosphatized][Factory prime coating][Powder coat]<Insert finish>**.
 - c. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.
7. Curb, Framing, and Lid Material, Aluminum:
 - a. Thickness: **[Manufacturer's standard thickness for hatch size indicated][0.079 inch (2.01 mm)]<Insert dimension>**.
 - b. Finish: **[Mill][Factory prime coating][Clear anodic][Color anodic][Powder coat]<Insert**

- finish>.
- c. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range][Light bronze][Medium bronze][Dark bronze]<Insert color>**.
8. Construction:
- a. Insulation: **[1-inch- (25-mm-) thick, cellulosic-fiber board][or][1-inch- (25-mm-) thick, glass-fiber board][2-inch- (50-mm-) thick, polyisocyanurate board]**.
 - 1) R-Value: **[2.78][4.3][12.0]<Insert R-value>** in accordance with ASTM C1363.
 - b. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
 - c. Hatch Lid: **[Opaque][Glazed]**, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
 - d. Exterior Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 - e. Fabricate curbs to minimum height of **[12 inches (305 mm)]<Insert dimension>** above roofing surface unless otherwise indicated.
 - f. Sloping Roofs: Where slope or roof deck exceeds **1/4 inch per 12 inches (1:48)**, fabricate curb with perimeter curb height that is **[constant][tapered to accommodate roof slope so that top surfaces of perimeter curb are level]**. Equip hatch with water diverter or cricket on side that obstructs water flow.
 - g. Security Grille: **[Provide for all units][Provide where indicated on Drawings]**.
9. Hatch-Lid Glazing: **[Single][Double][acrylic][polycarbonate]** glazing of thickness capable of resisting indicated loads; **[colorless, transparent][white, translucent]<Insert color requirement>**.
10. Hardware: Manufacturer's standard **[corrosion resistant][stainless steel]**; with hinges, hold-open devices, and independent manual-release devices for **[inside][and][outside]** operation of lids.
- B. Dropout-Type Heat and Smoke Vents: Manufacturer's standard, gravity operated and automatic; with **[single][double]**-walled insulated curbs and frame, welded or mechanically fastened and sealed corner joints, integral condensation gutter, cap flashing, and heat-sensitive dome glazing that will deform and drop out of vent opening in accordance with heat and smoke vent standard indicated.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Construction Specialties, Inc.]**
 - b. **[Kingspan Light + Air LLC]**
 - c. **[Pate Company (The)]**
 - d. **[Plasteco, Inc]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Construction Specialties, Inc.]**
 - b. **[Kingspan Light + Air LLC]**
 - c. **[Pate Company (The)]**
 - d. **[Plasteco, Inc]**

- e. <Insert manufacturer's name>
3. Size: [As indicated on Drawings][48 by 48 inches (1219 by 1219 mm)][48 by 60 inches (1219 by 1524 mm)][48 by 72 inches (1219 by 1829 mm)][48 by 90 inches (1219 by 2286 mm)][48 by 96 inches (1219 by 2438 mm)]<Insert dimensions>.
4. Loads: Minimum [40 lbf/sq. ft. (1.9 kPa)]<Insert value> external live load and [30 lbf/sq. ft. (1.4 kPa)]<Insert value> internal uplift load.
 - a. Dome Glazing: Minimum [40 lbf/sq. ft. (1.9 kPa)]<Insert value> external live load and [20 lbf/sq. ft. (0.95 kPa)]<Insert value> internal uplift load.
5. Heat and Smoke Vent Standard: Provide units that have been tested and [listed to comply with ANSI/CAN/UL 793][and][are FM Approved].
6. Curb and Framing Material: Aluminum sheet.
 - a. Thickness: [Manufacturer's standard thickness for vent size indicated][0.079 inch (2.01 mm)]<Insert dimension>.
 - b. Finish: [Mill][Factory prime coating][Clear anodic][Color anodic][Powder coat]<Insert finish>.
 - c. Color: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range][Light bronze][Medium bronze][Dark bronze]<Insert color>.
7. Construction:
 - a. Insulation: Manufacturer's standard.
 - b. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
 - c. Exterior Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
 - d. Fabricate curbs to minimum height of [12 inches (305 mm)]<Insert dimension> above roofing surface unless otherwise indicated.
 - e. Sloping Roofs: Where slope of roof deck exceeds 1/4 inch per 12 inches (1:48), fabricate curb with perimeter curb height that is [constant][tapered to accommodate roof slope so that top surfaces of perimeter curb are level]. Equip unit with water diverter or cricket on side that obstructs water flow.
8. Dome Glazing: [Single][Double][acrylic][polycarbonate] glazing of thickness capable of resisting indicated loads.
 - a. Single-Dome Color: [Colorless, transparent][White, translucent][Gray tinted, transparent][Bronze tinted, transparent]<Insert requirement>.
 - b. Outer Double-Dome Color: [Colorless, transparent][White, translucent][Gray tinted, transparent][Bronze tinted, transparent]<Insert requirement>.
 - c. Inner Double-Dome Color: [Colorless, transparent][White, translucent][Gray tinted, transparent][Bronze tinted, transparent]<Insert requirement>.
9. Fall Protection Safety Structure: Manufacturer's standard meeting impact load requirements of 29 CFR 1910.23 and authorities having jurisdiction, [equipped with hail protection galvanized steel wire mesh screen,] and manually openable from exterior without special tools.
10. Hardware: Manufacturer's standard, corrosion resistant; with hinges, hold-open devices, and independent manual-release devices for [inside][and][outside] operation of lids.

2.6 GRAVITY VENTILATORS

- A. Low-Profile, Cylindrical-Style Gravity Ventilators: Manufacturer's standard, fabricated as indicated, with manufacturer's standard welded or sealed mechanical joints.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Active Ventilation Products, Inc.]**
 - b. **[Air Vent, Inc.; Gibraltar Industries, Inc.]**
 - c. **[Dur-Red Products]**
 - d. **[Greenheck Fan Corporation]**
 - e. **[Loren Cook Company]**
 - f. **[Metallic Products Corporation]**
 - g. **[Moffitt Corporation]**
 - h. **[PennBarry; division of Air System Components]**
 - i. **[Romlair Ventilator Co.]**
 - j. **[Thaler Metal Industries Ltd.]**
 - k. **[Vent Products Co., Inc]**
 - l. **<Insert manufacturer's name>**

 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Active Ventilation Products, Inc.]**
 - b. **[Air Vent, Inc.; Gibraltar Industries, Inc.]**
 - c. **[Dur-Red Products]**
 - d. **[Greenheck Fan Corporation]**
 - e. **[Loren Cook Company]**
 - f. **[Metallic Products Corporation]**
 - g. **[Moffitt Corporation]**
 - h. **[PennBarry; division of Air System Components]**
 - i. **[Romlair Ventilator Co.]**
 - j. **[Thaler Metal Industries Ltd.]**
 - k. **[Vent Products Co., Inc]**
 - l. **<Insert manufacturer's name>**

 3. Construction: Integral base flange, vent cylinder, cylinder bird screen, and **[rain cap][hood]**.
 4. Dimensions: **[As indicated on Drawings]<Insert dimensions>**.
 5. Configuration: **[As indicated on Drawings]<Insert requirements>**.
 6. Bird Screens: Manufacturer's standard mesh with rewireable frame.
 7. Insect Screens: Manufacturer's standard mesh with rewireable frame.
 8. Security Grille: **[Provide for all units][Provide where indicated on Drawings]**.
 9. Vent Cylinder, Base Flange, Rain-Cap, and Hood Material: **[Zinc-coated (galvanized) steel][Aluminum-zinc alloy-coated][Aluminum][Stainless steel]** sheet, of manufacturer's standard thickness.
 10. Finish: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert finish>**.
- B. Louvered Penthouse-Style Gravity Ventilators: Manufacturer's standard, fabricated as indicated, with manufacturer's standard welded or sealed mechanical joints.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. [Dur-Red Products]
 - b. [FlashCo Manufacturing Inc.]
 - c. [Greenheck Fan Corporation]
 - d. [Loren Cook Company]
 - e. [PennBarry; division of Air System Components]
 - f. [Romlair Ventilator Co.]
 - g. [Vent Products Co., Inc]
 - h. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Dur-Red Products]
 - b. [FlashCo Manufacturing Inc.]
 - c. [Greenheck Fan Corporation]
 - d. [Loren Cook Company]
 - e. [PennBarry; division of Air System Components]
 - f. [Romlair Ventilator Co.]
 - g. [Vent Products Co., Inc]
 - h. <Insert manufacturer's name>
 3. Construction: Integral frame with base flange, weathertight cap[**with clear acrylic dome**][**with white translucent acrylic dome**], and weatherproof sidewall louvers.
 4. Dimensions: [As indicated on Drawings]<Insert dimensions>.
 5. Configuration: [As indicated on Drawings]<Insert requirements>.
 6. Bird Screens: Manufacturer's standard mesh with rewirable frame.
 7. Insect Screens: Manufacturer's standard mesh with rewirable frame.
 8. Security Grille: [Provide for all units][Provide where indicated on Drawings].
 9. Frame, Base Flange, Cap, and Louver Material: [Zinc-coated (galvanized) steel][Aluminum-zinc alloy-coated][Aluminum][Stainless steel] sheet, of manufacturer's standard thickness.
 10. Finish: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert finish>.
- C. Turbine-Style Gravity Ventilators: Manufacturer's standard, fabricated as indicated, with manufacturer's standard welded or sealed mechanical joints:
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Air Vent, Inc.; Gibraltar Industries, Inc.]
 - b. [Metallic Products Corporation]
 - c. [Moffitt Corporation]
 - d. [PennBarry; division of Air System Components]
 - e. [Romlair Ventilator Co.]
 - f. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Air Vent, Inc.; Gibraltar Industries, Inc.]
 - b. [Metallic Products Corporation]
 - c. [Moffitt Corporation]

- d. **[PennBarry; division of Air System Components]**
 - e. **[Romlair Ventilator Co.]**
 - f. **<Insert manufacturer's name>**
3. Provide integral weathertight base cap, outlet duct, and rotating louvered turbine.
 4. Throat Size and Height: **[As indicated on Drawings]<Insert dimensions>**.
 5. Configuration: **[As indicated on Drawings]<Insert requirements>**.
 6. Bird Screens: Manufacturer's standard mesh with rewireable frame.
 7. Insect Screens: Manufacturer's standard mesh with rewireable frame.
 8. Security Grille: **[Provide for all units][Provide where indicated on Drawings]**.
 9. Weathertight Base Cap, Outlet Duct, and Turbine Material: **[Manufacturer's standard][Zinc-coated (galvanized) steel][Aluminum-zinc alloy-coated][Aluminum]** sheet, of manufacturer's standard thickness.
 10. Finish: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert finish>**.

2.7 PIPE AND DUCT SUPPORTS

- A. Fixed-Height Cradle-Type Pipe Supports: Polycarbonate pipe stand accommodating up to **[1-1/2-inch- (38-mm-)]<Insert dimension>** diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.
- B. Fixed-Height Roller-Bearing Pipe Supports: Polycarbonate pipe stand with **[polycarbonate][stainless steel]** roller carrying assembly accommodating up to **[7-inch- (178-mm-)]<Insert dimension>** diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.
- C. Adjustable-Height Roller-Bearing Pipe Supports: Polycarbonate pipe stand base, pipe support, and roller housing, with stainless steel threaded rod designed for adjusting support height, accommodating up to **[18-inch (457-mm)]<Insert dimension>** diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.
- D. Adjustable-Height Structure-Mounted Pipe Supports: Extruded-aluminum tube, filled with urethane insulation; **[2 inches (50 mm)]<Insert dimension>** in diameter; accommodating up to **[7-inch- (178-mm-)]<Insert dimension>** diameter pipe or conduit, with provision for pipe retainer; with aluminum baseplate, EPDM base seal, manufacturer's recommended hardware for mounting to structure or structural roof deck as indicated, stainless steel roller and retainer, and extruded-aluminum carrier assemblies; as required for quantity of pipe runs and sizes.
- E. Curb-Mounted Pipe Supports: Galvanized-steel support with welded or mechanically fastened and sealed corner joints, **[straight sides,][integral metal cant,][stepped integral metal cant to raise the thickness of roof insulation,]** and integrally formed deck-mounting flange at perimeter bottom; with adjustable-height roller-bearing pipe support accommodating up to **[20-inch- (508-mm-)]<Insert dimension>** diameter pipe or conduit and with provision for pipe retainer; as required for quantity of pipe runs and sizes.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. [MIRO Industries Inc.]
 - b. [Pate Company (The)]
 - c. [PHP Systems/Design]
 - d. [Portals Plus; Duravent Group]
 - e. [Roof Products and Systems (RPS); Duravent Group]
 - f. [Thaler Metal Industries Ltd.]
 - g. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [MIRO Industries Inc.]
 - b. [Pate Company (The)]
 - c. [PHP Systems/Design]
 - d. [Portals Plus; Duravent Group]
 - e. [Roof Products and Systems (RPS); Duravent Group]
 - f. [Thaler Metal Industries Ltd.]
 - g. <Insert manufacturer's name>
- F. Duct Supports: Extruded-aluminum, urethane-insulated supports, [2 inches (50 mm)]<Insert dimension> in diameter; with manufacturer's recommended hardware for mounting to structure or structural roof deck.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Roof Products and Systems (RPS); Duravent Group]
 - b. [Thaler Metal Industries Ltd.]
 - c. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Roof Products and Systems (RPS); Duravent Group]
 - b. [Thaler Metal Industries Ltd.]
 - c. <Insert manufacturer's name>
 3. Finish: [Manufacturer's standard]<Insert finish>.

2.8 PIPE PORTALS

- A. Curb-Mounted Pipe Portal: Insulated roof-curb units with welded or mechanically fastened and sealed corner joints,[straight sides],[integral metal cant],[stepped integral metal cant to raise the thickness of roof insulation,] and integrally formed deck-mounting flange at perimeter bottom; with weathertight curb cover with single or multiple collared openings and pressure-sealed conically shaped EPDM protective rubber caps sized for piping indicated, with stainless steel snaplock swivel clamps.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. **[Portals Plus; Duravent Group]**
 - b. **[Roof Products and Systems (RPS); Duravent Group]**
 - c. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[Portals Plus; Duravent Group]**
 - b. **[Roof Products and Systems (RPS); Duravent Group]**
 - c. **<Insert manufacturer's name>**

B. Flashing Pipe Portal: Formed aluminum membrane-mounting flashing flange and sleeve with collared opening and pressure-sealed conically shaped EPDM protective rubber cap sized for piping indicated, with stainless steel snaplock swivel clamps.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
- a. **[Portals Plus; Duravent Group]**
 - b. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[Portals Plus; Duravent Group]**
 - b. **<Insert manufacturer's name>**

2.9 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, **[12 inches (300 mm)]<Insert dimension>** high, with removable metal hood and **[slotted][perforated]** metal collar.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
- a. **[Custom Solution Roof and Metal Products, a division of Colony Heating]**
 - b. **[Menzies Metal Products]**
 - c. **[Thaler Metal Industries Ltd.]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[Custom Solution Roof and Metal Products, a division of Colony Heating]**
 - b. **[Menzies Metal Products]**
 - c. **[Thaler Metal Industries Ltd.]**

- d. <Insert manufacturer's name>
 - 3. Metal: Aluminum sheet, [0.063 inch (1.60 mm)]<Insert thickness> thick.
 - 4. Diameter: [As indicated on Drawings][3 inches (76 mm)][4 inches (100 mm)][5 inches (125 mm)][6 inches (150 mm)][7 inches (178 mm)][8 inches (200 mm)][9 inches (225 mm)][10 inches (250 mm)]<Insert dimension>.
 - 5. Finish: [Manufacturer's standard]<Insert finish>.
- B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.
- 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Custom Solution Roof and Metal Products, a division of Colony Heating]
 - b. [Menzies Metal Products]
 - c. [Milcor by Duravent; Duravent Group.]
 - d. [Thaler Metal Industries Ltd.]
 - e. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Custom Solution Roof and Metal Products, a division of Colony Heating]
 - b. [Menzies Metal Products]
 - c. [Milcor by Duravent; Duravent Group.]
 - d. [Thaler Metal Industries Ltd.]
 - e. <Insert manufacturer's name>
 - 3. Metal: [Aluminum sheet, 0.063 inch (1.60 mm) thick]<Insert material and thickness>.
 - 4. Height: [7 inches (178 mm)][13 inches (330 mm)][19 inches (480 mm)]<Insert dimension>.
 - 5. Diameter: [As indicated on Drawings][2 inches (50 mm)][3 inches (76 mm)][4 inches (100 mm)][5 inches (125 mm)][6 inches (150 mm)]<Insert dimension>.
 - 6. Finish: [Manufacturer's standard]<Insert finish>.

2.10 ROOF WALKWAYS

- A. Roof Walkway: Metal planking formed from multiple C-shaped channels with upper surface punched in serrated diamond or rectangular shapes to produce raised slip-resistant surface and drainage holes. Provide support framing, brackets, connectors, nosings, and other accessories and components needed for complete installation.
- 1. Include step units or stairs of similar construction for changes in elevation. Comply with ASCE/SEI 7, 29 CFR 1910.23, and requirements of authorities having jurisdiction.
 - 2. Equip walkways with safety railings where required.
 - 3. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Atkore Unistrut]
 - b. [Cooper B-line; brand of Eaton, Electrical Sector]
 - c. [Kee Safety, Inc.]

- d. **[MIRO Industries Inc.]**
 - e. **[PHP Systems/Design]**
 - f. **<Insert manufacturer's name>**
4. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[Atkore Unistrut]**
 - b. **[Cooper B-line; brand of Eaton, Electrical Sector]**
 - c. **[Kee Safety, Inc.]**
 - d. **[MIRO Industries Inc.]**
 - e. **[PHP Systems/Design]**
 - f. **<Insert manufacturer's name>**
5. Plank Width: **[4-3/4 inches (121 mm)][7 inches (178 mm)][9-1/2 inches (241 mm)][11-3/4 inches (298 mm)][18-3/4 inches (476 mm)][24 inches (610 mm)][As indicated]**.
6. Walkway Width: **[As indicated]<Insert dimension>**.
7. Channel Depth: **[1-1/2 inches (38 mm)][2 inches (50 mm)][2-1/2 inches (64 mm)][3 inches (76 mm)][As indicated]**.
8. Metal Material: **[0.079-inch- (2.01-mm-) thick zinc-coated (galvanized) steel sheet][0.108-inch- (2.74-mm-) thick zinc-coated (galvanized) steel sheet][0.0625-inch- (1.587-mm-) thick stainless steel sheet][0.0781-inch- (1.983-mm-) thick stainless steel sheet][0.080-inch- (2.03-mm-) thick aluminum sheet][0.100-inch- (2.54-mm-) thick aluminum sheet]<Insert material and thickness>**, perforated, with serrated slip-resistant walking surface.
9. Support Stands: Manufacturer's standard, with protective pads compatible with roofing material.
10. Support Pads: Continuous wood isolation pads, pressure-preservative treated as specified in Section 061000 "Rough Carpentry"; attach roof-walkway supports to pads so that supports are separated from roof membrane surface and walkway support loads are distributed evenly.
11. Wind Restraint: Provide wind-restraint attachment to roof structure of size and spacing required to comply with wind-uplift requirements.
12. Finish: **[Manufacturer's standard]<Insert finish>**.

2.11 METAL MATERIALS

- A. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheer complying with minimum ASTM A653/A653M, **G90 (Z275)** coating designation or aluminum-zinc alloy-coated steel sheet complying with minimum ASTM A792/A792M, **Class AZ50 (Class AZM150)** coating designation; structural quality.
- 1. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
 - 2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of **0.2 mil (0.005 mm)**.
 - 3. Powder Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of **2 mils (0.05 mm)**.
 - 4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of **0.5 mil (0.013 mm)**.
- B. Aluminum Sheet: ASTM B209/B209M, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
- 1. Mill Finish: As manufactured.

2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of **0.2 mil (0.005 mm)**.
 3. Clear Anodic Finish: AAMA 611, **[AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm]** or thicker.
 4. Color Anodic Finish: AAMA 611, **[AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm]** or thicker.
 5. Powder Coat Finish: AAMA 2603. After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of **2 mils (0.05 mm)**.
 6. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of **0.5 mil (0.013 mm)**.
- C. Aluminum Extrusions and Tubes: **ASTM B221 (ASTM B221M)**, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.
 - D. Stainless Steel Sheet and Shapes: ASTM A240/A240M or ASTM A666, Type 304.
 - E. Steel Shapes: ASTM A36/A36M, hot-dip galvanized in accordance with ASTM A123/A123M unless otherwise indicated.
 - F. Steel Tube: ASTM A500/A500M, round tube.
 - G. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized in accordance with ASTM A123/A123M.
 - H. Steel Pipe: ASTM A53/A53M, galvanized.

2.12 UNDERLAYMENT

- A. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over **220 deg F (111 deg C)**; and complying with physical requirements of ASTM D226/D226M for Type I and Type II felts.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ATAS International, Inc.]**
 - b. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**
 - c. **[GCP Applied Technologies Inc.]**
 - d. **[Kirsch Building Products]**
 - e. **[Owens Corning]**
 - f. **[Palisade; Brand of Intertape Polymer Group (IPG)]**
 - g. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ATAS International, Inc.]**
 - b. **[Atlas Molded Products, a division of Atlas Roofing Corporation]**

- c. [GCP Applied Technologies Inc.]
- d. [Kirsch Building Products]
- e. [Owens Corning]
- f. [Palisade; Brand of Intertape Polymer Group (IPG)]
- g. <Insert manufacturer's name>

B. Self-Adhering, High-Temperature Sheet Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of **30 mils (0.76 mm)** thick, specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at **240 deg F (116 deg C)**; ASTM D1970/D1970M.
2. Low-Temperature Flexibility: Passes after testing at **minus 20 deg F (minus 29 deg C)** or lower; ASTM D1970/D1970M.
3. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. [ATAS International, Inc.]
- b. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
- c. [GCP Applied Technologies Inc.]
- d. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
- e. [Palisade; Brand of Intertape Polymer Group (IPG)]
- f. [Polyglass U.S.A., Inc.]
- g. [Protecto Wrap Company]
- h. <Insert manufacturer's name>

4. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. [ATAS International, Inc.]
- b. [Carlisle WIP Products; a brand of Carlisle Construction Materials]
- c. [GCP Applied Technologies Inc.]
- d. [Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)]
- e. [Palisade; Brand of Intertape Polymer Group (IPG)]
- f. [Polyglass U.S.A., Inc.]
- g. [Protecto Wrap Company]
- h. <Insert manufacturer's name>

C. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

D. Slip Sheet: Rosin-sized building paper, **3 lb/100 sq. ft. (0.16 kg/sq. m)** minimum.

2.13 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Acrylic Glazing: ASTM D4802, thermoformable, monolithic sheet, manufacturer's standard, Type UVA (formulated with UV absorber), Finish 1 (smooth or polished).

- C. Polycarbonate Glazing: Thermoformable, monolithic polycarbonate sheets manufactured by extrusion process, burglar-resistance rated in accordance with UL 972 with an average impact strength of [12 to 16 ft. lbf/in. (640 to 854 J/m)]<Insert value> of width when tested in accordance with ASTM D256, Method A (Izod).
- D. Cellulosic-Fiber Board Insulation: ASTM C208, Type II, Grade 1, thickness as indicated.
- E. Glass-Fiber Board Insulation: ASTM C726, nominal density of 3 lb/cu. ft. (48 kg/cu. m), thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C), thickness as indicated.
- F. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.
- G. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, [containing no arsenic or chromium,] and complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.
- H. Security Grilles: [3/4-inch (19-mm)]<Insert dimension> diameter, ASTM A1011/A1011M steel bars spaced [6 inches (150 mm)]<Insert dimension> o.c. in one direction and [12 inches (300 mm)]<Insert dimension> o.c. in the other; factory finished as follows:
 - 1. Surface Preparation: Remove mill scale and rust, if any, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
 - 2. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment.
 - 3. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, universal primer; selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats under prolonged exposure.
- I. Fasteners: Roof accessory manufacturer's recommended fasteners, designed to comply with performance requirements, suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 - 1. Fasteners for Metallic-Coated Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
- J. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- K. Elastomeric Sealant: ASTM C920, elastomeric [polyurethane][silicone] polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
- L. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
- M. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- N. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.14 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA AMP 500, "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

- A. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, in accordance with manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.
 - 1. Lap horizontal joints not less than **4 inches (100 mm)**.
- B. Self-Adhering, High-Temperature Sheet Underlayment:
 - 1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
 - 2. Prime substrate if recommended by underlayment manufacturer.
 - 3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
 - 4. Apply in shingle fashion to shed water, with end laps of not less than **6 inches (150 mm)** staggered **24 inches (600 mm)** between courses.
 - 5. Overlap side edges not less than **3-1/2 inches (90 mm)**. Roll laps and edges with roller.
 - 6. Roll laps and edges with roller.
 - 7. Cover underlayment within 14 days.
- C. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim.
 - 1. Install in shingle fashion to shed water.
 - 2. Lap joints not less than **2 inches (50 mm)**.

- D. Slip Sheet: Install slip sheet, wrinkle free, **[over underlayment][directly on substrate]<Insert requirement>** before installing sheet metal flashing and trim.

1. Install in shingle fashion to shed water.
2. Lapp joints not less than **4 inches (100 mm)**.

3.3 INSTALLATION, GENERAL

- A. Install roof accessories in accordance with manufacturer's written instructions.
1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended in writing by manufacturer's written installation instructions.
1. Coat concealed side of **[uncoated aluminum][and][stainless steel]** roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

3.4 INSTALLATION OF ROOF ACCESSORIES

- A. Roof Curb: Install each roof curb so top surface is level.
- B. Equipment Support: Install equipment supports so top surfaces are level with each other.
- C. Roof-Hatch:
1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
 2. Attach safety railing system to roof-hatch curb.
 3. Attach ladder-assist post in accordance with manufacturer's written instructions.
- D. Heat and Smoke Vent:
1. Install heat and smoke vent so top perimeter surfaces are level.
 2. Install and test heat and smoke vents and their components for proper operation in accordance with NFPA 204.
- E. Gravity Ventilator: Verify that gravity ventilators operate properly and have unrestricted airflow. Clean, lubricate, and adjust operating mechanisms.
- F. Pipe and Duct Support: Comply with MSS SP-58. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.

1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
- G. Preformed Flashing-Sleeve and Flashing-Pipe Portal: Secure flashing sleeve to roof membrane in accordance with flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane in accordance with roof membrane manufacturer's instructions.
- H. Security Grilles: Weld bar intersections and[, **using tamper-resistant bolts, attach the**] ends of bars to structural frame or primary curb walls.
- I. Roof Walkway:
 1. Verify that locations of access and servicing points for roof-mounted equipment are served by locations of roof walkways.
 2. Remove ballast from top surface of low-slope roofing at locations of contact with roof-walkway supports.
 3. Install roof-walkway support pads prior to placement of roof-walkway support stands onto low-slope roofing.
 4. Redistribute removed ballast after installation of support pads.
- J. Seal joints with [**elastomeric**][or][**butyl**] sealant as required by roof accessory manufacturer.

3.5 CLEANING AND PROTECTION

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing in accordance with ASTM A780/A780M.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Section 099113 "Exterior Painting."
- C. On completion of installation, clean exposed surfaces in according with manufacturer's written instructions. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as roof accessories are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof accessories in a clean condition during construction.
- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 07 72 00 00



Task	Specification	Specification Description
07 72 13 00	07 72 00 00	Roof Accessories
07 72 13 00	23 37 23 00	HVAC Gravity Ventilators
07 72 23 00	07 72 00 00	Roof Accessories
07 72 26 00	07 31 13 00	Asphalt Shingles
07 72 26 00	07 72 00 00	Roof Accessories
07 72 29 00	07 72 00 00	Roof Accessories
07 72 33 00	07 72 00 00	Roof Accessories
07 72 36 00	07 72 00 00	Roof Accessories
07 72 38 00	07 72 00 00	Roof Accessories
07 72 38 13	07 72 00 00	Roof Accessories
07 72 46 00	07 72 00 00	Roof Accessories
07 72 63 00	01 11 19 00	No Specification Required
07 72 63 00	07 72 00 00	Roof Accessories
07 73 00 00	07 51 13 00	Built-Up Asphalt Roofing
07 73 00 00	07 01 50 81	Built-Up Coal Tar Roofing
07 73 00 00	07 52 13 00	Atactic-Polypropylene (APP) Modified Bituminous Membrane Roofing
07 73 00 00	07 52 16 00	Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing
07 73 00 00	07 53 16 00	Chlorosulfonate-Polyethylene (CSPE) Roofing
07 73 00 00	07 53 23 00	Ethylene-Propylene-Diene-Monomer (EPDM) Roofing
07 76 16 00	01 11 19 00	No Specification Required



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SECTION 07 81 00 00 - APPLIED FIRE PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Sprayed fire-resistive materials.
- B. Related Requirements:
 - 1. Section 078123 "Intumescent Fire Protection" for mastic and intumescent fire-resistive coatings.
 - 2. Section 099646 "Intumescent Painting" for intumescent paints that are fire retarding but not fire resistive.

1.2 DEFINITIONS

- A. SFRM: Sprayed fire-resistive materials.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.
 - 1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Framing plans or schedules, or both, indicating the following:
 - 1. Extent of applied fire protection for each construction and fire-resistance rating.
 - 2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - 3. Minimum applied fire protection material thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
 - 4. Treatment of sprayed fire-resistive material after application.
- C. Samples: For each exposed product and for each color and texture specified, **[in manufacturer's standard dimensions][4 inches (102 mm) square]<Insert dimensions>** in size.
- D. Sustainable Design Submittals:
 - 1. Product Data: For paints and coatings, indicating VOC content.
 - 2. Laboratory Test Reports: For paints and coatings, indicating compliance with requirements for low-emitting materials.
 - 3. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 4. Health Product Declaration (HPD): Provide documentation confirming product compliance with

one of the following:

- a. Inventory or HPD to at least 0.01 percent by weight, with at least 95 percent assessed using GreenScreen Benchmark assessment.
- b. Cradle to Cradle v3 certification with minimum Silver level of Material Health.
- c. Living Product Challenge certification indicating achievement of Imperative 09, "Transparent Material Health."

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of applied fire protection material for tests performed by **[a qualified testing agency][manufacturer and witnessed by a qualified testing agency]**.
- B. Research Reports: For each type of applied fire protection material, from **[an agency acceptable to authorities having jurisdiction][ICC-ES]<Insert evaluation agency>**.
- C. Preconstruction Test Reports: For each type of applied fire protection material.
- D. Field Quality-Control Reports: For each type of applied fire protection material.
- E. Qualification Statements: For **[Installer][and]} [testing agency]**.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by applied fire protection material manufacturer as experienced and with sufficient trained staff to install manufacturer's products in accordance with specified requirements.

1.7 MOCKUPS

- A. Build mockups **[to verify selections made under Sample submittals and to demonstrate aesthetic effects][to set quality standards for materials and execution][and][for preconstruction testing]**.
 1. Build mockup of **[each type of applied fire protection and different substrate][and][each required finish]<Insert description>** as indicated on Drawings.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: **[Owner will engage][Engage]** a qualified testing agency to perform preconstruction testing on **[field mockups of]** applied fire protection.
 1. Field Mockup: **<Insert sizes and configurations of assemblies>**.
 2. Provide test specimens and assemblies representative of proposed materials and construction.
- B. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.

1. Bond Strength: Test for cohesive and adhesive strength in accordance with ASTM E736/E736M. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
2. Density: Test for density in accordance with ASTM E605/E605M. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with applied fire protection material.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain applied fire protection material manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply applied fire protection when ambient or substrate temperature is **[44 deg F (7 deg C)]<Insert temperature>** or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fire protection, providing complete air exchanges in accordance with manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fire protection dries thoroughly.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain applied fire protection[**for each fire-resistance design**] from single source.

2.2 PERFORMANCE REQUIREMENTS

- A. Assemblies: Provide applied fire protection, including auxiliary materials, in accordance with requirements of each fire-resistance design and manufacturer's written instructions.
- B. Fire-Resistance Design: Indicated on Drawings, tested in accordance with **[ASTM E119 or UL 263]<Insert requirement>**; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
- C. VOC Content: For field applications, coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
 1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 50 g/L.
 3. Primers, Sealers, and Undercoaters: 100 g/L.
- D. Low-Emitting Materials: For field applications, coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

- E. Material Emissions and Pollutant Control: Field-applied coatings shall comply with either of the following:
1. Low-Emitting Materials: VOC emissions shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 2. VOC content shall not exceed limits of authorities having jurisdiction and the following:
 - a. Flat Coatings: 50 g/L.
 - b. Nonflat Coatings: 100 g/L.
 - c. Primers, Sealers, and Undercoaters: 100 g/L.
- F. Asbestos: Provide products containing no detectable asbestos.

2.3 SPRAYED FIRE-RESISTIVE MATERIALS

- A. Sprayed Fire-Resistive Material: **<Insert drawing designation or UL-design number>** Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and **[mixed with water at Project site to form a slurry or mortar before conveyance and application][or][conveyed in a dry state and mixed with atomized water at place of application]**.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Carboline Company; a subsidiary of RPM International]**
 - b. **[GCP Applied Technologies Inc.]**
 - c. **[Isolatek International]**
 - d. **[Southwest Fireproofing Products Co.]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Carboline Company; a subsidiary of RPM International]**
 - b. **[GCP Applied Technologies Inc.]**
 - c. **[Isolatek International]**
 - d. **[Southwest Fireproofing Products Co.]**
 - e. **<Insert manufacturer's name>**
 3. Application: Designated for exterior use by a qualified testing agency acceptable to authorities having jurisdiction.
 4. Bond Strength: Minimum **[150-lbf/sq. ft. (7.18-kPa)][430-lbf/sq. ft. (20.59-kPa)][1000-lbf/sq. ft. (47.88-kPa)]<Insert value>** cohesive and adhesive strength based on field testing in accordance with ASTM E736/E736M.
 5. Density: Not less than density specified in the approved fire-resistance design, in accordance with ASTM E605/E605M.
 6. Thickness: As required for fire-resistance design indicated, measured in accordance with requirements of fire-resistance design or ASTM E605/E605M, whichever is thicker, but not less than **0.375 inch (9 mm)**.
 7. Combustion Characteristics: ASTM E136.

8. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: **[10]<Insert number>** or less.
 - b. Smoke-Developed Index: **[10]<Insert number>** or less.
9. Compressive Strength: Minimum **[10 lbf/sq. in. (68.9 kPa)][100 lbf/sq. in. (689 kPa)][300 lbf/sq. in. (2068 kPa)]<Insert value>** in accordance with ASTM E761/E761M.
10. Corrosion Resistance: No evidence of corrosion in accordance with ASTM E937/E937M.
11. Deflection: No cracking, spalling, or delamination in accordance with ASTM E759/E759.
12. Effect of Impact on Bonding: No cracking, spalling, or delamination in accordance with ASTM E760/E760M.
13. Air Erosion: Maximum weight loss of **[0.025 g/sq. ft. (0.270 g/sq. m)]<Insert value>** in 24 hours in accordance with ASTM E859/E859M.
14. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in **[no growth on specimens per ASTM G21][or][rating of 10 in accordance with ASTM D3274 when tested in accordance with ASTM D3273]**.
15. Sound Absorption: **[NRC][or][SAA]** of **[0.50 to 0.75][0.60 to 0.70][0.65 to 0.75][not less than 0.60]<Insert range or single value>** in accordance with ASTM C423 for Type A mounting in accordance with ASTM E795.
16. Finish: **[As selected by Architect from manufacturer's standard finishes][Spray-textured finish][Rolled, spray-textured finish][Skip-troweled finish][Skip-troweled finish with corner beads]<Insert requirement>.** **[Apply separate, colored topcoat after finishing.]**
 - a. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.**

2.4 AUXILIARY MATERIALS

- A. Provide auxiliary materials that are compatible with sprayed fire-resistive material and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved in writing by sprayed fire-resistive material manufacturer and complying with one or both of the following requirements:
 1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 2. Primer's bond strength in required fire-resistance design complies with specified bond strength for sprayed fire-resistive material and with requirements in UL's "Product iQ" online directory or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests in accordance with ASTM E736/E736M.
- C. Bonding Agent: Product approved in writing by sprayed fire-resistive material manufacturer and complying with requirements in UL's "Product iQ" online directory or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.
- D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, in accordance with fire-resistance designs indicated and sprayed fire-resistive material manufacturer's written instructions. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive sprayed fire-resistive material.
- E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by sprayed fire-resistive material manufacturer.

- F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by sprayed fire-resistive material manufacturer. Include pins and attachment.
- G. Sealer: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by sprayed fire-resistive material manufacturer for each fire-resistance design.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Isolatek International]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Isolatek International]**
 - b. **<Insert manufacturer's name>**
- H. Topcoat: Suitable for application over sprayed fire-resistive material; of type recommended in writing by sprayed fire-resistive material manufacturer for each fire-resistance design.
1. Cement-Based Topcoat: Factory-mixed, cementitious hard-coat formulation for trowel or spray application over SFRM.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1) **[Carboline Company; a subsidiary of RPM International]**
 - 2) **[Isolatek International]**
 - 3) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[Carboline Company; a subsidiary of RPM International]**
 - 2) **[Isolatek International]**
 - 3) **<Insert manufacturer's name>**
 2. Water-Based Permeable Topcoat: Factory-mixed formulation for brush, roller, or spray application over applied SFRM. Provide application at a rate of **[30 sq. ft./gal. (0.75 sq. m/L)][60 sq. ft./gal. (1.5 sq. m/L)][120 sq. ft./gal. (3 sq. m/L)]<Insert value>**.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1) **[Isolatek International]**

2) <Insert manufacturer's name>

- b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1) [Isolatek International]

2) <Insert manufacturer's name>

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and in accordance with each fire-resistance design.
1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of applied fire protection with substrates under conditions of normal use or fire exposure.
 2. Verify that objects penetrating applied fire protection, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 3. Verify that substrates receiving applied fire protection are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fire protection application.
- B. Verify that concrete work on steel deck is complete before beginning Work.
- C. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are complete before beginning Work.
- D. Conduct tests in accordance with sprayed fire-resistive material manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.
- E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of applied fire protection materials during application.
- B. Clean substrates of substances that could impair bond of applied fire protection.
- C. Prime substrates where included in fire-resistance design and where recommended in writing by sprayed fire-resistive material manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive applied fire protection.
- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of applied fire protection. Remove minor projections and fill voids that would telegraph through applied fire protection after application.

3.3 APPLICATION

- A. Construct applied fire protection assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting applied fire protection Work.
- B. Comply with sprayed fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fire protection; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fire protection with other construction to minimize need to cut or remove applied fire protection.
 - 1. Do not begin applying fire protection until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
 - 2. Defer installing ducts, piping, and other items that would interfere with applying fire protection until application of fire protection is completed.
- D. Metal Decks:
 - 1. Do not apply fire protection to underside of metal deck substrates until concrete topping, if any, is completed.
 - 2. Do not apply fire protection to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fire protection.
- E. Install auxiliary materials as required, as detailed, and in accordance with fire-resistance design and sprayed fire-resistive material manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by sprayed fire-resistive material manufacturer.
- F. Spray apply fire protection to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by sprayed fire-resistive material manufacturer.
- G. Extend applied fire protection in full thickness over entire area of each substrate to be protected.
- H. Install body of applied fire protection in a single course unless otherwise recommended in writing by sprayed fire-resistive material manufacturer.
- I. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fire protection that differs in color from that of encapsulant over which it is applied.
- J. Where sealers are used, apply products that are tinted to differentiate them from applied fire protection over which they are applied.
- K. Provide a uniform finish complying with description indicated for each type of applied fire protection material and matching finish approved for required mockups.
- L. Cure applied fire protection in accordance with sprayed fire-resistive material manufacturer's written instructions.
- M. Do not install enclosing or concealing construction until after applied fire protection has been inspected, tested, and corrections have been made to deficient applications.

N. Finishes: Where indicated, apply fire protection to produce the following finishes:

1. Manufacturer's Standard Finishes: Finish in accordance with manufacturer's written instructions for each finish selected.
2. Spray-Textured Finish: Finish left as spray applied with no further treatment.
3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.
4. Skip-Troweled Finish: Even leveled surface produced by troweling spray-applied finish to smooth out the texture and neaten edges.
5. Skip-Troweled Finish with Corner Beads: Even, leveled surface produced by troweling spray-applied finish to smooth out the texture, eliminate surface markings, and square off edges.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: **[Owner will engage][Engage]** a qualified special inspector to perform the following special inspections:

1. Test and inspect as required by the IBC[, **Subsection 1705.15, "Sprayed Fire-Resistant Materials."**][, **as indicated on Schedule of Special Inspections.**]**<Insert requirement.>**

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fire protection for the next area until test results for previously completed applications of fire protection show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Applied fire protection will be considered defective if it does not pass tests and inspections.

1. Remove and replace applied fire protection that does not pass tests and inspections, and retest.
2. Apply additional applied fire protection, in accordance with manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.5 CLEANING

A. Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

3.6 PROTECTION

A. Protect applied fire protection from damage resulting from construction operations or other causes in accordance with manufacturer's and Installer's written instructions, so applied fire protection is without damage or deterioration at time of Substantial Completion.

3.7 REPAIRS

A. As installation of other adjacent construction proceeds, inspect applied fire protection and repair damaged areas due to work of other trades before concealing it with other construction.

B. Repair applied fire protection using same method and materials as original installation or using



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manufacturer's recommended trowel-applied repair product.

END OF SECTION 07 81 00 00



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Task	Specification	Specification Description
07 81 16 00	07 81 00 00	Applied Fire Protection



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SECTION 07 81 23 00 - INTUMESCENT FIRE PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mastic and intumescent fire-resistive coatings.

B. Related Requirements:

1. Section 078100 "Applied Fire Protection" for sprayed fire-resistive materials (SFRM).
2. Section 099646 "Intumescent Painting" for intumescent paints that are fire retarding, but not fire resistive.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1. Review products, design ratings, restrained and unrestrained conditions, thicknesses, and other performance requirements.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Mastic and intumescent fire-resistive coatings.
2. Substrate primers.
3. Reinforcing fabric.
4. Reinforcing mesh.
5. Topcoat.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Health Product Declaration (HPD): Provide documentation confirming product compliance with one of the following:
 - a. Inventory or HPD to at least 0.01 percent by weight, with at least 95 percent assessed using GreenScreen Benchmark assessment.
 - b. Cradle to Cradle v3 certification with minimum Silver level of Material Health.
 - c. Living Product Challenge certification indicating achievement of Imperative 09, "Transparent Material Health."

C. Shop Drawings: Framing plans or schedules, or both, indicating the following:

1. Extent of fire protection for each construction and fire-resistance rating.
2. Applicable fire-resistance design designations of a qualified testing and inspecting agency

- acceptable to authorities having jurisdiction.
- 3. Minimum mastic and intumescent fire-resistive coating thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
- 4. Treatment of mastic and intumescent fire-resistive coating after application.

- D. Samples: For each exposed product and for each color and texture specified, **[in manufacturer's standard dimensions][4 inches (102 mm) square]<Insert dimensions>** in size.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[Installer][and][testing agency]**.
- B. Product Certificates: For each type of mastic and intumescent fire-resistive coating.
- C. Evaluation Reports: For mastic and intumescent fire-resistive coating, from ICC-ES.
- D. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by mastic and intumescent fire-resistive coating manufacturer as experienced and with sufficient trained staff to install manufacturer's products in accordance with specified requirements.
- B. Mockups: Build mockups **[to verify selections made under Sample submittals and to demonstrate aesthetic effects][and][to set quality standards for materials and execution]**.
 - 1. Build mockup of **[each type of fire protection and different substrate][and][each required finish]<Insert description>** as shown on Drawings.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fire protection when ambient or substrate temperature is **[50 deg F (10 deg C)]<Insert temperature>** or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fire protection, providing complete air exchanges in accordance with manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fire protection dries thoroughly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Assemblies: Provide fire protection, including auxiliary materials, in accordance with requirements of each fire-resistance design and manufacturer's written instructions.
- B. Source Limitations: Obtain fire protection[**for each fire-resistance design**] from single source.
- C. Fire-Resistance Design: Indicated on Drawings, tested in accordance with **[ASTM E119 or UL 263]<Insert requirement>**; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
- D. VOC Content, LEED 2009: For field applications, coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 150 g/L.
 - 3. Primers, Sealers, and Undercoaters: 200 g/L.
- E. Low-Emitting Materials, LEED 2009: Coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- F. VOC Content, LEED v4: For field applications, coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 50 g/L.
 - 3. Primers, Sealers, and Undercoaters: 100 g/L.
- G. Low-Emitting Materials, LEED v4: For field applications, coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- H. Material Emissions and Pollutant Control: Field-applied coatings shall comply with either of the following:
 - 1. Low-Emitting Materials: VOC emissions shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 - 2. VOC content shall not exceed limits of authorities having jurisdiction and the following:
 - a. Flat Coatings: 50 g/L.
 - b. Nonflat Coatings: 100 g/L.
 - c. Primers, Sealers, and Undercoaters: 100 g/L.
- I. Emissions Requirements: Field-applied coatings shall comply with either of the following:
 - 1. Low-Emitting Materials: VOC emissions shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile

- Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
2. VOC content shall not exceed limits of authorities having jurisdiction and the following:

- a. Flat Coatings: 50 g/L.
- b. Nonflat Coatings: 100 g/L.
- c. Primers, Sealers, and Undercoats: 100 g/L.

- J. Asbestos: Provide products containing no detectable asbestos.

2.2 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

- A. Mastic and Intumescent Fire-Resistive Coating: **<Insert drawing designation or UL-design number>** Manufacturer's standard, **[factory-mixed formulation][or][factory-mixed, multicomponent system consisting of intumescent base coat and topcoat]**, and complying with indicated fire-resistance design.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. **[Albi Protective Coatings]**
- b. **[Carboline Company; a subsidiary of RPM International]**
- c. **[Contego International, Inc.]**
- d. **[FlameOff Coatings, Inc.]**
- e. **[Hilti, Inc.]**
- f. **[International Protective Coatings; AkzoNobel]**
- g. **[Isolatek International]**
- h. **[PPG Paints; PPG Industries, Inc.]**
- i. **[Sherwin-Williams Company (The)]**
- j. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Albi Protective Coatings]**
- b. **[Carboline Company; a subsidiary of RPM International]**
- c. **[Contego International, Inc.]**
- d. **[FlameOff Coatings, Inc.]**
- e. **[Hilti, Inc.]**
- f. **[International Protective Coatings; AkzoNobel]**
- g. **[Isolatek International]**
- h. **[PPG Paints; PPG Industries, Inc.]**
- i. **[Sherwin-Williams Company (The)]**
- j. **<Insert manufacturer's name>**

3. Application: Designated for **["exterior"]["interior general purpose"][and]["conditioned interior space purpose"]** use by a qualified testing agency acceptable to authorities having jurisdiction.
4. Thickness: As required for fire-resistance design indicated, measured in accordance with requirements of fire-resistance design.
5. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

- a. Flame-Spread Index: [25]<Insert number> or less.
 - b. Smoke-Developed Index: [50][450]<Insert number> or less.
6. Hardness: Not less than [45][65][80]<Insert value>, Type D durometer, in accordance with ASTM D2240.
7. Finish: [As selected by Architect from manufacturer's standard finishes][Spray-textured finish][Rolled, spray-textured finish]<Insert requirement>.
- a. Color and Gloss: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.

2.3 AUXILIARY MATERIALS

- A. Provide auxiliary materials that are compatible with mastic and intumescent fire-resistive coating and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by mastic and intumescent fire-resistive coating manufacturer and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by mastic and intumescent fire-resistive coating manufacturer.
- D. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by mastic and intumescent fire-resistive coating manufacturer. Include pins and attachment.
- E. Topcoat: Suitable for application over mastic and intumescent fire-resistive coating; of type recommended in writing by mastic and intumescent fire-resistive coating manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and in accordance with each fire-resistance design.
 - 1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fire protection with substrates under conditions of normal use or fire exposure.
 - 2. Verify that objects penetrating fire protection, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 - 3. Verify that substrates receiving fire protection are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fire protection application.
- B. Conduct tests in accordance with mastic and intumescent fire-resistive coating manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.



- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fire protection materials during application.
- B. Clean substrates of substances that could impair bond of fire protection.
- C. Prime substrates where included in fire-resistance design and where recommended in writing by mastic and intumescent fire-resistive coating manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fire protection.
- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fire protection. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

- A. Construct fire protection assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, topcoats, finishing, and other materials and procedures affecting fire protection Work.
- B. Comply with mastic and intumescent fire-resistive coating manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fire protection; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fire protection with other construction to minimize need to cut or remove fire protection.
 - 1. Do not begin applying fire protection until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
 - 2. Defer installing ducts, piping, and other items that would interfere with applying fire protection until application of fire protection is completed.
- D. Install auxiliary materials as required, as detailed, and in accordance with fire-resistance design and mastic and intumescent fire-resistive coating manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by mastic and intumescent fire-resistive coating manufacturer.
- E. Spray apply fire protection to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by mastic and intumescent fire-resistive coating manufacturer.
- F. Extend fire protection in full thickness over entire area of each substrate to be protected.
- G. Install body of fire protection in a single course unless otherwise recommended in writing by mastic and intumescent fire-resistive coating manufacturer.

- H. Provide a uniform finish complying with description indicated for each type of fire protection material and matching finish approved for required mockups.
- I. Cure fire protection in accordance with mastic and intumescent fire-resistive coating manufacturer's written instructions.
- J. Do not install enclosing or concealing construction until after fire protection has been applied, inspected, and tested and corrections have been made to deficient applications.
- K. Finishes: Where indicated, apply fire protection to produce the following finishes:
 - 1. Manufacturer's Standard Finishes: Finish in accordance with manufacturer's written instructions for each finish selected.
 - 2. Spray-Textured Finish: Finish left as spray applied with no further treatment.
 - 3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: **[Owner will engage][Engage]** a qualified special inspector to perform the following special inspections:
 - 1. Test and inspect as required by the IBC[, **Subsection 1705.14, "Mastic and Intumescent Fire-Resistant Coatings."**][**as indicated on Schedule of Special Inspections.**]**<Insert requirement.>**
- B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fire protection for the next area until test results for previously completed applications of fire protection show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
- C. Fire protection will be considered defective if it does not pass tests and inspections.
 - 1. Remove and replace fire protection that does not pass tests and inspections, and retest.
 - 2. Apply additional fire protection, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- D. Prepare test and inspection reports.

3.5 CLEANING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

3.6 PROTECTION

- A. Protect fire protection, in accordance with advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fire protection is without damage or deterioration at time of Substantial Completion.



3.7 REPAIRS

- A. As installation of other construction proceeds, inspect fire protection and repair damaged areas and fire protection removed due to work of other trades.
- B. Repair fire protection damaged by other work before concealing it with other construction.
- C. Repair fire protection by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 07 81 23 00



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Task	Specification	Specification Description
07 81 23 00	07 81 00 00	Applied Fire Protection
07 81 33 00	07 81 00 00	Applied Fire Protection



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SECTION 07 84 13 00 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Penetration firestopping systems.
 - 1. Penetration firestopping systems in fire-resistance-rated walls.
 - 2. Penetration firestopping systems in horizontal assemblies.
 - 3. Penetration firestopping systems in smoke barriers.
 - 4. Exposed penetration firestopping systems.
- B. Related Requirements:
 - 1. Section 078443 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.
 - 2. Section 079200 "Joint Sealants" for non-fire-resistance-rated joint sealants.
 - 3. Section 079219 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
- C. Unlisted Firestopping Systems: Obtain an Engineering Judgment (EJ) from firestopping manufacturer where no UL, FM Approvals, or other listed assembly is available for particular firestop configuration. Follow International Firestop Council (IFC) recommended guidelines for evaluating firestopping systems in EJs.
 - 1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly developed in accordance with current International Firestop Council (IFC) recommended guidelines. Obtain approval of authorities having jurisdiction prior to submittal.
- D. Sustainable Design Submittals:
 - 1. Product Data: For sealants, indicating VOC content.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Listed System Designs: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Entity that has been approved by FM Approvals in accordance with FM Approvals 4991 or been evaluated by UL Solutions and found to comply with "UL Solutions Qualified Firestop Contractor Program."
- B. Manufacturer Qualifications: Entity that has received UL Solutions' "Firestop Movement Certification," which demonstrates that manufacturer's firestopping products designated with M-Ratings are based on exposure to cyclic movement and UL 1479 fire test evaluation when tested in accordance with ASTM E3037.

1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup of each penetration firestopping system type required for Project, including supporting construction substrates, attachments, and accessories.
 - 2. Where one penetration firestopping system type may be used for different penetrating items or in different wall or floor constructions, install one assembly for each different combination.
 - 3. Obtain approval of mockups from authorities having jurisdiction before proceeding.
 - 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping systems when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping system materials in accordance with manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be accessed and installed in accordance with specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain penetration firestopping systems for each type of opening indicated from single manufacturer.

2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

1. **[3M Building and Construction]**
2. **[Balco; a CSW Industrials Company]**
3. **[Everkem Diversified Products, Inc.]**
4. **[FireShield; Fire Rated Solutions LLC]**
5. **[Grabber Construction Products, Inc.]**
6. **[Hilti, Inc.]**
7. **[Holdrite; a division of Reliance Worldwide Corporation]**
8. **[International Fireproof Technology Inc]**
9. **[NUCO Inc]**
10. **[Passive Fire Protection Partners]**
11. **[Roxtec Inc.]**
12. **[Specified Technologies Inc.]**
13. **[STC Sound Control]**
14. **[Tremco Incorporated]**
15. **[Unique Fire Stop Products]**
16. **<Insert manufacturer's name>**

- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

1. **[3M Building and Construction]**
2. **[Balco; a CSW Industrials Company]**
3. **[Everkem Diversified Products, Inc.]**
4. **[FireShield; Fire Rated Solutions LLC]**
5. **[Grabber Construction Products, Inc.]**
6. **[Hilti, Inc.]**
7. **[Holdrite; a division of Reliance Worldwide Corporation]**
8. **[International Fireproof Technology Inc]**
9. **[NUCO Inc]**
10. **[Passive Fire Protection Partners]**
11. **[Roxtec Inc.]**
12. **[Specified Technologies Inc.]**
13. **[STC Sound Control]**

14. [Tremco Incorporated]
15. [Unique Fire Stop Products]
16. <Insert manufacturer's name>

- C. Penetration firestopping systems must be compatible with one another, with the substrates forming openings, and with penetrating items if any.
1. Penetration firestopping systems must be installed with products bearing the classification marking of a qualified testing agency.
 - a. UL Solutions in its online directory "Product iQ."
 - b. Intertek Group in its "Directory of Building Products."
 - c. FM Approvals in its "Approval Guide."
 - d. <Insert name of qualified testing and inspecting agency>.
 2. Provide components for each penetration firestopping system that, upon curing, do not re-emulsify, dissolve, leach, break down, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water, or other forms of moisture characteristic during and after construction.
 3. Provide components for each penetration firestopping system that do not contain ethylene glycol.
 4. Provide components for each penetration firestopping system that are sufficiently flexible to accommodate movement, such as pipe vibration, water hammer, thermal expansion, and other normal building movement without damage.
 5. Provide components for each penetration firestopping system that are appropriately tested for the thickness and type of insulation utilized.
- D. Provide penetration firestopping systems that resist spread of fire, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- E. Penetration Firestopping Systems in Fire-Resistance-Rated Walls: Systems with ratings determined in accordance with ASTM E814 or UL 1479.
1. F-Rating: Not less than the fire-resistance rating of the wall assembly penetrated.
 2. Membrane Penetrations: Install recessed fixtures such that the required fire resistance will not be reduced.
 3. M-Rating: Provide penetration firestopping systems meeting specified F-Rating after being tested in accordance with ASTM E3037.
- F. Penetration Firestopping Systems in Horizontal Assemblies: Systems with ratings determined in accordance with ASTM E814 or UL 1479.
1. F-Rating: At least one hour, but not less than the fire-resistance rating of the floor/ceiling assembly penetrated.
 2. T-Rating: At least one hour, but not less than the fire-resistance rating of the floor/ceiling assembly. The following horizontal penetrations do not require a T-rating:
 - a. Those within the cavity of a wall.
 - b. Floor, tub, or shower drains within a concealed space.
 - c. 4-inch (200-mm) or smaller metal conduit penetrating directly into metal-enclosed electrical switchgear.
 3. W-Rating: Provide penetration firestopping systems with a Class 1 W-rating in accordance with UL 1479.
 4. M-Rating: Provide penetration firestopping systems meeting specified [F-Rating],[T-Rating],[and][W-Rating] after being tested in accordance with ASTM E3037.

- G. Penetration Firestopping Systems in Smoke Barriers: Systems with ratings determined in accordance with UL 1479.
 - 1. L-Rating: Not exceeding **5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m)** of penetration opening and no more than **50-cfm (0.024-cu. m/s)** cumulative total for any **100 sq. ft. (9.3 sq. m)** at both ambient and elevated temperatures.
 - 2. M-Rating: Provide penetration firestopping systems meeting specified L-Rating after being tested in accordance with ASTM E3037.
- H. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance with ASTM E84 or UL 723.
 - 1. Product Data: Verify architectural sealant has a VOC content of 250 g/L or less.
 - 2. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 3. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 - 4. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify the building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.

2.3 ACCESSORIES

- A. Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated, including but not limited to:
 - 1. Permanent forming/damming/backing materials.
 - 2. Substrate primers.
 - 3. Collars.
 - 4. Steel sleeves.

2.4 FILL MATERIALS

- A. Cast-in-Place Firestopping Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestopping Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or

inorganic fibers.

- F. Intumescent Wrap Strips: Single-component intumescent elastomeric strips for use around combustible penetrants.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Compressible, removable, and reusable intumescent pillows encased in fire-retardant polyester or glass-fiber cloth. Where exposed, and when required by a listed system, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed or dislodged.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.
- K. Thermal and Endothermic Wraps: Flexible, insulating, and fire-resistant protective wraps tested and listed for up to 2-hour fire ratings in accordance with ASTM E814 or UL 1479; for protecting membrane penetrations of utility boxes, critical electrical circuits, communications lines, and fuel lines, and for thermal barrier and circuit integrity protection in accordance with ASTM E1725 or UL 1724.
- L. Fire-Rated Cable Sleeve Kits: Complete kits designed for new or existing cable penetrations through walls which accept standard accessories.
- M. Fire-Rated Cable Pathways: Single or gangable device modules composed of a steel raceway with integral intumescent material and requiring no additional action in the form of plugs, twisting closure, putty, pillows, sealant, or otherwise to achieve fire and air-leakage ratings.
 - 1. Fire-rated cable pathway devices are the preferred product for data, video, and communications cable penetrations. Install these devices in locations where frequent cable moves, add-ons, and changes will occur. Such devices must be:
 - a. Capable of retrofit around existing cables.
 - b. Designed so that two or more devices can be ganged together.
 - c. Maintenance-free so no action is required to activate the smoke- and fire-sealing mechanism.
 - 2. Where fire-rated cable pathway devices are not practical, openings within walls and floors designed to accommodate data, video, and communications cabling must be provided with re-enterable products specifically designed for retrofit, such as retrofit devices for cable bundles, firestopping putty, plugs, or pillows.
- N. Retrofit Device for Cable Bundles: Factory-made, intumescent, collar-like device for firestopping existing over-filled cable sleeves and capable of being installed around projecting sleeves and cable bundles.
- O. Wall-Opening Protective Materials: Intumescent, non-curing putty pads or self-adhesive inserts for protection of electrical switch and receptacle boxes.
- P. Fire-Rated HVAC Retaining Angles: Steel angle system with integral intumescent firestopping gasket for use around rectangular steel HVAC ducts without fire dampers.
- Q. Firestopping Plugs: Flexible, re-enterable, intumescent, foam-rubber plug for use in blank round openings and cable sleeves.

- R. Fire-Rated Cable Grommet: Molded two-piece grommet made of plenum-grade polymer and foam inner core for sealing small cable penetrations in gypsum walls up to **1/2 inch (13 mm)** in diameter.
- S. Closet Flange Gasket: Molded, single-component, flexible, intumescent gasket for use beneath a water closet (toilet) flange in floor applications.

2.5 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings in accordance with manufacturer's written instructions and with the following requirements:
 - 1. Remove foreign materials from substrate surfaces that could interfere with adhesion of penetration firestopping materials.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates in accordance with penetration firestopping system manufacturer's written installation instructions, using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION OF PENETRATION FIRESTOPPING SYSTEMS

- A. General: Install penetration firestopping systems in accordance with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

- C. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items to achieve required fire-resistance ratings.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than **3 inches (76 mm)** high and with minimum **0.375-inch (9.5-mm)** strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at **15 ft. (4.57 m)** from end of wall and at intervals not exceeding **30 ft. (9.14 m)**.
- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within **6 inches (150 mm)** of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified inspection agency to conduct and report on inspections in accordance with ASTM E2174.
- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration



firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 84 13 00



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07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 84 13 16	07 84 13 00	Penetration Firestopping
07 84 13 16	07 84 43 00	Joint Firestopping
07 84 13 19	07 84 13 00	Penetration Firestopping
07 84 13 19	07 84 43 00	Joint Firestopping
07 84 16 00	03 30 00 00	Cast-In-Place Concrete



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SECTION 07 84 43 00 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Intumescent gypsum wall framing gaskets.
2. Perimeter fire-barrier system.
3. Joints in or between fire-resistance-rated construction.
4. Joints at exterior curtain-wall/floor intersections.
5. Joints in smoke barriers.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers[**and for wall identification**].
2. Section 079513.13 "Interior Expansion Joint Cover Assemblies" for fire-resistive manufactured expansion-joint cover assemblies for interior floors, walls, and ceilings.
3. Section 079513.16 "Exterior Expansion Joint Cover Assemblies" for fire-resistive manufactured expansion-joint cover assemblies for exterior building walls, soffits, and parapets.
4. Section 079513.19 "Parking Deck Expansion Joint Cover Assemblies" for fire-resistive manufactured expansion-joint cover assemblies subject to vehicular traffic.
5. Section 092216 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.2 PREINSTALLATION MEETINGS

- ##### A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

- ##### B. Unlisted Firestopping Systems: Obtain an Engineering Judgment (EJ) from firestop manufacturer where no UL, FM Approvals, or other listed assembly is available for particular firestop configuration. Follow International Firestop Council (IFC) recommended guidelines for evaluating firestop systems in EJs.

- ##### C. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an EJ or equivalent fire-resistance-rated assembly developed in accordance with current IFC guidelines.

D. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Listed System Designs: For each joint firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written installation instructions.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Approvals in accordance with FM Approvals 4991 or been evaluated by UL and found to comply with UL's "UL Solutions Qualified Firestop Contractor Program."

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure joint firestopping systems in accordance with manufacturer's written installation instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of joints to ensure that joint firestopping systems can be installed in accordance with specified firestopping system design.
- B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain joint firestop systems for each type of joint opening indicated from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. A qualified testing agency, acceptable to authorities having jurisdiction, will perform joint firestopping system tests.
2. Test in accordance with testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Joint firestop systems installed with products bearing the classification marking of a qualified product certification agency in accordance with listed system designs published by a qualified testing agency.
 - 1) UL in its online directory "Product iQ."
 - 2) Intertek Group in its "Directory of Building Products."
 - 3) **<Insert name of qualified testing agency>**.

- ### B. Rain/Water Resistance:
- For perimeter fire-barrier system applications, where inclement weather or greater-than-transient water exposure is expected, use products that dry rapidly and cure in the presence of atmospheric moisture sufficient to pass ASTM D6904 early rain-resistance test (24-hour exposure).

2.3 JOINT FIRESTOPPING SYSTEM TYPES

- ### A. General:
- Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems must accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

1. Joint firestopping systems that are compatible with one another, with the substrates forming openings, and with penetrating items, if any.
2. Provide products that, upon curing, do not re-emulsify, dissolve, leach, break down, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture.
3. Provide firestop products that do not contain ethylene glycol.

- ### B. Intumescent Gypsum Wall Framing Gaskets:
- Applied to steel tracks, runners, and studs prior to framing installation. Provide products with fire, smoke, and acoustical ratings that allow movement of up to 100 percent compression and/or extension when tested in accordance with UL 2079 or ASTM E1966; have an L Rating of less than **1 cfm/ft. (0.00115 cu. m/s x m)** when tested in accordance with UL 2079; and a minimum Sound Transmission Class (STC) rating of 56 when tested in accordance with ASTM E90 or ASTM C919.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[CEMCO; California Expanded Metal Products Co.]**
 - b. **[ClarkDietrich]**
 - c. **[International Fireproof Technology Inc]**
 - d. **[Specified Technologies Inc.]**
 - e. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert**

manufacturer's name; product name or designation> or comparable product by one of the following:

- a. **[CEMCO; California Expanded Metal Products Co.]**
- b. **[ClarkDietrich]**
- c. **[International Fireproof Technology Inc]**
- d. **[Specified Technologies Inc.]**
- e. **<Insert manufacturer's name>**

- C. Perimeter Fire-Barrier System: Provide perimeter fire-barrier system that does not require direct screw attachment to mullions and transoms to support and fasten curtain-wall insulation for aluminum curtain-wall assemblies with one- or two-piece rectangular mullions at least **2-1/2 by 5 inches (64 by 127 mm)**. System will be tested in accordance with ASTM E2307 for up to two-hour fire resistance and with ASTM E1233/E1233M for wind cycling equivalent to **108 mph (174 km/h)** wind for 500 cycles.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. **[CEMCO; California Expanded Metal Products Co.]**
- b. **[Grabber Construction Products, Inc.]**
- c. **[Specified Technologies Inc.]**
- d. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[CEMCO; California Expanded Metal Products Co.]**
- b. **[Grabber Construction Products, Inc.]**
- c. **[Specified Technologies Inc.]**
- d. **<Insert manufacturer's name>**

- D. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined in accordance with ASTM E1966 or UL 2079, with published L-Ratings for ambient and elevated temperatures as evidence of the ability of the fire-resistive joint system to restrict the movement of smoke.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. **[3M Building and Construction]**
- b. **[Balco; a CSW Industrials Company]**
- c. **[CEMCO; California Expanded Metal Products Co.]**
- d. **[ClarkDietrich]**
- e. **[Everkem Diversified Products, Inc.]**
- f. **[Grabber Construction Products, Inc.]**
- g. **[Hilti, Inc.]**
- h. **[International Fireproof Technology Inc]**
- i. **[MarinoWARE]**
- j. **[Nelson; Emerson Electric Co., Automation Solutions]**
- k. **[NUCO Inc]**

- l. [Owens Corning]
 - m. [Passive Fire Protection Partners]
 - n. [RectorSeal Firestop; a CSW Industrials Company]
 - o. [ROCKWOOL]
 - p. [Specified Technologies Inc.]
 - q. [Tremco Incorporated]
 - r. [Willseal LLC, part of Tremco CPG]
 - s. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [3M Building and Construction]
 - b. [Balco; a CSW Industrials Company]
 - c. [CEMCO; California Expanded Metal Products Co.]
 - d. [ClarkDietrich]
 - e. [Everkem Diversified Products, Inc.]
 - f. [Grabber Construction Products, Inc.]
 - g. [Hilti, Inc.]
 - h. [International Fireproof Technology Inc]
 - i. [MarinoWARE]
 - j. [Nelson; Emerson Electric Co., Automation Solutions]
 - k. [NUCO Inc]
 - l. [Owens Corning]
 - m. [Passive Fire Protection Partners]
 - n. [RectorSeal Firestop; a CSW Industrials Company]
 - o. [ROCKWOOL]
 - p. [Specified Technologies Inc.]
 - q. [Tremco Incorporated]
 - r. [Willseal LLC, part of Tremco CPG]
 - s. <Insert manufacturer's name>
 - 3. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.
- E. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined in accordance with ASTM E2307.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [3M Building and Construction]
 - b. [Balco; a CSW Industrials Company]
 - c. [Everkem Diversified Products, Inc.]
 - d. [Grabber Construction Products, Inc.]
 - e. [Hilti, Inc.]
 - f. [Johns Manville; a Berkshire Hathaway company]
 - g. [Nelson; Emerson Electric Co., Automation Solutions]
 - h. [NUCO Inc]
 - i. [Owens Corning]
 - j. [RectorSeal Firestop; a CSW Industrials Company]
 - k. [ROCKWOOL]
 - l. [Specified Technologies Inc.]

- m. **[Tremco Incorporated]**
 - n. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[3M Building and Construction]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Everkem Diversified Products, Inc.]**
 - d. **[Grabber Construction Products, Inc.]**
 - e. **[Hilti, Inc.]**
 - f. **[Johns Manville; a Berkshire Hathaway company]**
 - g. **[Nelson; Emerson Electric Co., Automation Solutions]**
 - h. **[NUCO Inc]**
 - i. **[Owens Corning]**
 - j. **[RectorSeal Firestop; a CSW Industrials Company]**
 - k. **[ROCKWOOL]**
 - l. **[Specified Technologies Inc.]**
 - m. **[Tremco Incorporated]**
 - n. **<Insert manufacturer's name>**
 3. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
- F. Joints in Smoke Barriers: Provide joint firestopping systems with ratings determined in accordance with UL 2079 based on testing at a positive pressure differential of **0.30 inch wg (74.7 Pa)**.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[3M Building and Construction]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[CEMCO; California Expanded Metal Products Co.]**
 - d. **[Everkem Diversified Products, Inc.]**
 - e. **[Grabber Construction Products, Inc.]**
 - f. **[Hilti, Inc.]**
 - g. **[International Fireproof Technology Inc]**
 - h. **[MarinoWARE]**
 - i. **[Nelson; Emerson Electric Co., Automation Solutions]**
 - j. **[NUCO Inc]**
 - k. **[Owens Corning]**
 - l. **[Passive Fire Protection Partners]**
 - m. **[Polyset]**
 - n. **[RectorSeal Firestop; a CSW Industrials Company]**
 - o. **[Specified Technologies Inc.]**
 - p. **[Tremco Incorporated]**
 - q. **[Willseal LLC, part of Tremco CPG]**
 - r. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. [3M Building and Construction]
 - b. [Balco; a CSW Industrials Company]
 - c. [CEMCO; California Expanded Metal Products Co.]
 - d. [Everkem Diversified Products, Inc.]
 - e. [Grabber Construction Products, Inc.]
 - f. [Hilti, Inc.]
 - g. [International Fireproof Technology Inc]
 - h. [MarinoWARE]
 - i. [Nelson; Emerson Electric Co., Automation Solutions]
 - j. [NUCO Inc]
 - k. [Owens Corning]
 - l. [Passive Fire Protection Partners]
 - m. [Polyset]
 - n. [RectorSeal Firestop; a CSW Industrials Company]
 - o. [Specified Technologies Inc.]
 - p. [Tremco Incorporated]
 - q. [Willseal LLC, part of Tremco CPG]
 - r. <Insert manufacturer's name>
3. L-Rating: Not exceeding **5.0 cfm/ft. (0.00775 cu. m/s x m)** of joint at both ambient and elevated temperatures.
- G. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined in accordance with ASTM E84.
1. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 3. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 4. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 5. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

2.4 ACCESSORIES

- A. Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing joint firestopping systems, clean joints in accordance with fire-resistive joint system manufacturer's written installation instructions and the following requirements:
 - 1. Remove foreign materials from substrate surfaces that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates in accordance with joint firestopping system manufacturer's written installation instructions, using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Apply a suitable bond breaker to prevent three-sided adhesion in applications where condition occurs.

3.3 INSTALLATION

- A. General: Install joint firestopping systems in accordance with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- C. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:
 - 1. Apply elastomeric fill in voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
 - 3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than **3 inches (76 mm)** high and with minimum **0.375-inch (9.5-mm)** strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at **15 ft. (4.57 m)** from end of wall and at intervals not exceeding **30 ft. (9.14 m)**.
- B. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within **6 inches (150 mm)** of joint edge, so labels are visible to anyone seeking to remove joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections in accordance with ASTM E2393.
- B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.
- C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

3.7 JOINT FIRESTOPPING SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's online directory "Product iQ" under product [**Category XHBN**][or][**Category XHDG**].
- B. Where Intertek Group-listed systems are indicated, they refer to design numbers in Intertek Group's

"Directory of Building Products" under product category [Expansion/Seismic Joints][or][Firestop Systems].

C. Floor-to-Floor, Joint Firestopping Systems: .

1. UL-Classified Systems: FF-[D][S]-<Insert four-digit number>[0000-0999][1000-1999][2000-2999][3000-3999][4000-4999].
2. Assembly Rating: [One hour][Two hours]<Insert number of hours>.
3. Nominal Joint Width: [As indicated]<Insert dimension>.
4. Movement Capabilities: [Class I][Class II][Class III] - <Insert number> percent [compression or extension][compression, extension, or horizontal shear].
5. L-Rating at Ambient: Less than <Insert cfm/ft. (cu. m/s x m)>.
6. L-Rating at 400 Deg F (204 Deg C): Less than <Insert cfm/ft. (cu. m/s x m)>.
7. W-Rating: No leakage of water at completion of water-leakage testing.

D. Wall-to-Wall, Joint Firestopping Systems: .

1. UL-Classified Systems: WW-[D][S]-<Insert four-digit number>[0000-0999][1000-1999][2000-2999][3000-3999][4000-4999].
2. Assembly Rating: [One hour][Two hours]<Insert number of hours>.
3. Nominal Joint Width: [As indicated]<Insert dimension>.
4. Movement Capabilities: [Class I][Class II][Class III] - <Insert number> percent [compression or extension].
5. L-Rating at Ambient: Less than <Insert cfm/ft. (cu. m/s x m)>.
6. L-Rating at 400 Deg F (204 Deg C): Less than <Insert cfm/ft. (cu. m/s x m)>.

E. Floor-to-Wall, Joint Firestopping Systems: .

1. UL-Classified Systems: FW-[D][S]-<Insert four-digit number>[0000-0999][1000-1999][2000-2999][3000-3999][4000-4999].
2. Assembly Rating: [One hour][Two hours]<Insert number of hours>.
3. Nominal Joint Width: [As indicated]<Insert dimension>.
4. Movement Capabilities: [Class I][Class II][Class III] - <Insert number> percent [compression or extension][compression, extension, or horizontal shear].
5. L-Rating at Ambient: Less than <Insert cfm/ft. (cu. m/s x m)>.
6. L-Rating at 400 Deg F (204 Deg C): Less than <Insert cfm/ft. (cu. m/s x m)>.

F. Head-of-Wall, Fire-Resistive Joint Firestopping Systems: .

1. UL-Classified Systems: HW-[D][S]-<Insert four-digit number>[0000-0999][1000-1999][2000-2999][3000-3999][4000-4999].
2. Intertek Group-Listed Systems: <Insert design number>.
3. Assembly Rating: [One hour][Two hours]<Insert number of hours>.
4. Nominal Joint Width: [As indicated]<Insert dimension>.
5. Movement Capabilities: [Class I][Class II][Class III] - <Insert number> percent [compression or extension].
6. L-Rating at Ambient: Less than <Insert cfm/ft. (cu. m/s x m)>.
7. L-Rating at 400 Deg F (204 Deg C): Less than <Insert cfm/ft. (cu. m/s x m)>.

G. Bottom-of-Wall, Joint Firestopping Systems: .

1. UL-Classified Systems: BW-[D][S]-<Insert four-digit number>[0000-0999][1000-1999][2000-2999][3000-3999][4000-4999].
2. Assembly Rating: [One hour][Two hours]<Insert number of hours>.
3. Nominal Joint Width: [As indicated]<Insert dimension>.

4. Movement Capabilities: [Class I][Class II][Class III] - <Insert number> percent[compression or extension].
 5. L-Rating at Ambient: Less than <Insert cfm/ft. (cu. m/s x m)>.
 6. L-Rating at 400 Deg F (204 Deg C): Less than <Insert cfm/ft. (cu. m/s x m)>.
- H. Wall-to-Wall, Joint Firestopping Systems Intended for Use as Corner Guards: .
1. UL-Classified Systems: CG-[D][S]-<Insert four-digit number>[0000-0999][1000-1999][2000-2999][3000-3999][4000-4999].
 2. Assembly Rating: [One hour][Two hours]<Insert number of hours>.
 3. Nominal Joint Width: [As indicated]<Insert dimension>.
 4. Movement Capabilities: [Class I][Class II][Class III] - <Insert number> percent[compression or extension].
 5. L-Rating at Ambient: Less than <Insert cfm/ft. (cu. m/s x m)>.
 6. L-Rating at 400 Deg F (204 Deg C): Less than <Insert cfm/ft. (cu. m/s x m)>.
- I. Perimeter Joint Firestopping Systems: .
1. UL-Classified Perimeter Fire-Containment Systems: CW-[D][S]-<Insert four-digit number>[0000-0999][1000-1999][2000-2999].
 2. Intertek Group-Listed, Perimeter Fire-Barrier Systems: <Insert design number>.
 3. Integrity Rating: [One hour][Two hours]<Insert number of hours>.
 4. Insulation Rating: [Zero hour][1/4 hour][3/4 hour][1 hour]<Insert number of hours>.
 5. Linear Opening Width: [2-1/2 inches (64 mm)][8 inches (203 mm)][As indicated]<Insert dimension>, maximum.
 6. Movement Capabilities: [Class I][Class II][Class III] - <Insert number> percent[compression or extension].
 7. F-Rating: [One hour][Two hours]<Insert number of hours>.

END OF SECTION 07 84 43 00



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07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 84 43 00	07 84 13 00	Penetration Firestopping



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SECTION 07 84 56 13 - BOARD FIRE PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Calcium-silicate board fire protection.
2. Mineral-fiber board fire protection.

B. Related Requirements:

1. Section 230713 "Duct Insulation" for fire-rated duct insulation.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:** Conduct conference at **[Project site]<Insert location>**.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Calcium-silicate board.
2. Mineral-fiber board.
3. Joint treatment and finishing materials.

B. Shop Drawings:

1. Locations and types of surface preparations required before applying board fire protection.
2. Structural framing plan showing extent of board fire protection for each location and fire-resistance rating, including the following:
 - a. Applicable fire-resistance design designations of qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1) For steel joist assemblies, include applicable fire-resistance design designations, with each steel joist tested with same maximum tensile stress as each steel joist indicated **[on Drawings][in a schedule]**. Design designations with steel joists tested at lower maximum tensile stress than those indicated are not permitted.
 - b. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.

C. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Data and Certification: For bio-based materials. Include statement of costs.
3. Laboratory Test Reports: For ceiling and wall materials, indicating compliance with requirements

- for low-emitting materials.
- 4. Laboratory Test Reports: For ceiling and wall materials, indicating compliance with requirements for low-emitting materials.
- 5. Laboratory Test Reports: For ceiling and wall materials, indicating compliance with requirements for low-emitting materials.
- 6. Laboratory Test Reports: For ceiling and wall materials, indicating compliance with requirements for low-emitting materials.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain board fire protection[**for each fire-resistance design**] from single source.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: Indicated by design designations from **[UL's "Fire Resistance Directory"]****[UL's "Fire Resistance Directory" or from listings of another testing and inspecting agency acceptable to authorities having jurisdiction,]****<Insert testing agency>** for board fire protection serving as direct-applied protection tested in accordance with ASTM E119.

2.3 BOARD FIRE PROTECTION

- A. Calcium-Silicate Board: Rigid board containing no asbestos and consisting primarily of lime, silica, inert fillers, and cellulosic reinforcing fibers; of thickness required to produce fire-resistance rating indicated; with flame-spread and smoke-developed indexes of zero in accordance with ASTM E84; passing ASTM E136 for combustion characteristics.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following]****[provide products by one of the following]****[available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[BNZ Materials, Inc.]**
 - b. **[Johns Manville; a Berkshire Hathaway company]**
 - c. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[BNZ Materials, Inc.]**
 - b. **[Johns Manville; a Berkshire Hathaway company]**
 - c. **<Insert manufacturer's name>**
 - 3. Finish: Sanded finish on **[both sides]****[one side]**.
- B. Mineral-Fiber Board: **[Unfaced]****[Foil-faced]****[Fiberglass mat-faced]** rigid board produced by combining slag-wool/rock-wool fibers with thermosetting resin binders passing ASTM E136 for combustion characteristics; of thickness required to produce fire-resistance rating indicated.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Albi Protective Coatings]**
 - b. **[Isolatek International]**
 - c. **[ROCKWOOL]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Albi Protective Coatings]**
 - b. **[Isolatek International]**
 - c. **[ROCKWOOL]**
 - d. **<Insert manufacturer's name>**
3. Maximum Density: **[8 lb/cu. ft. (128 kg/cu. m)][10 lb/cu. ft. (160 kg/cu. m)][12 lb/cu. ft. (192 kg/cu. m)]<Insert value>**.
4. Surface-Burning Characteristics: Flame-spread and smoke-developed indexes of **[15][zero]** and **[5][zero]**, respectively, in accordance with ASTM E84.

2.4 ACCESSORIES

- A. Anchorage Accessories: Provide manufacturer's standard board-anchorage components complying with related design of UL or of another testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Joint Treatment and Finishing Materials: For calcium-silicate board applications exposed to view, provide joint treatment tape and joint compounds recommended in writing by board manufacturer for finishing surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions of construction to receive fire protection, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of the Work.
- B. Reject fire-protection materials that are wet, moisture damaged, or mold damaged.
- C. Examine walls, floors, and other construction for suitable conditions where fire-protection materials will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Install board fire protection on structural members after piping and other construction behind fire-resistive materials have been completed.

3.3 INSTALLATION

- A. Install board fire protection in accordance with manufacturer's written instructions.
- B. Install board fire protection to comply with requirements for layer thicknesses and number, construction of joints and corners, and anchorage methods applicable to fire-resistance-rated assemblies indicated.
- C. Install enclosing or concealing construction only after board fire protection has been applied and inspected by authorities having jurisdiction.
- D. Finish calcium-silicate board [**exposed to view**][**where indicated on Drawings**] to comply with board manufacturer's written instructions and as follows:
 - 1. At joints in calcium-silicate board, embed tape in joint compound and apply first, fill, and finish coats of joint compounds over tape, fastener heads, and accessories.
 - 2. Apply a thin, uniform skim coat of joint compound over entire surface.
 - 3. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects, tool marks, and ridges.

3.4 PROTECTION

- A. Replace or repair board fire protection that has been cut away to facilitate other construction. Maintain complete coverage of full thickness on members and substrates protected by board fire protection.
 - 1. Provide final protection and maintain conditions in a manner acceptable to Installer, manufacturer, and authorities having jurisdiction to ensure that board fire protection is without damage or deterioration at time of Substantial Completion.

END OF SECTION 07 84 56 13



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 86 00 00	07 84 13 00	Penetration Firestopping
07 86 00 00	07 84 43 00	Joint Firestopping



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SECTION 07 91 00 00 - PREFORMED JOINT SEALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preformed, foam joint seals.
2. Extruded-silicone joint seals.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for liquid sealants applied over preformed seals in dual-seal systems.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:** Conduct conference at **[Project site]<Insert location>**.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Preformed, foam joint seals.
2. Extruded-silicone joint seals.

- B. Samples for Initial Selection:** Manufacturer's color sheets, showing full range of available colors for each type of exposed preformed joint seal.

- C. Samples for Verification:** Actual samples of each type and color of exposed preformed joint seal.

1. Size: **1/2-inch- (13-mm-)** wide joints formed between two **6-inch- (150-mm-)** long strips of material matching the appearance of exposed surfaces adjacent to joint seals.

- D. Preformed Joint Seal Schedule:** Include the following information:

1. Joint seal location and designation.
2. Joint width and movement capability.
3. Joint seal manufacturer and product name.
4. Joint seal color.

1.4 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Product Test Reports: For each preformed joint seal, for tests performed by **[qualified testing agency][manufacturer and witnessed by a qualified testing agency]**.

- B. Sample warranties.

1.5 MOCKUPS

- A. Build mockups **[to verify selections made under Sample submittals][to demonstrate aesthetic effects][and][to set quality standards for materials and execution].**
 - 1. Build mockup **[as indicated on Drawings]<Insert mockup requirements>.**
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace preformed joint seals that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish preformed joint seals to repair or replace those that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: **[Five]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. For preformed joint seals, obtain each color, type, and variety of joint seal from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 PREFORMED, FOAM JOINT SEALS

- A. Preformed, Foam Joint Seals : Manufacturer's standard joint seal manufactured from urethane or EVA (ethylene vinyl acetate) foam with minimum density of **10 lb/cu. ft. (160 kg/cu. m)** and impregnated with a nondrying, water-repellent agent. Factory produce them in precompressed sizes in roll or stick form to fit joint widths based on design criteria indicated, with factory- or field-applied adhesive for bonding to substrates.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[EMSEAL; a Sika Company]**
 - b. **[LymTal International, Inc.]**
 - c. **[MM Systems Corporation]**
 - d. **[Nystrom, Inc.]**

- e. [Pecora Corporation]
 - f. [Schul International Company, LLC]
 - g. [Watson Bowman Acme Corp.]
 - h. [Willseal LLC, part of Tremco CPG]
 - i. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [EMSEAL; a Sika Company]
 - b. [LymTal International, Inc.]
 - c. [MM Systems Corporation]
 - d. [Nystrom, Inc.]
 - e. [Pecora Corporation]
 - f. [Schul International Company, LLC]
 - g. [Watson Bowman Acme Corp.]
 - h. [Willseal LLC, part of Tremco CPG]
 - i. <Insert manufacturer's name>
3. Design Criteria:
- a. Nominal Joint Width: [As indicated on Drawings]<Insert dimension>.
 - b. Minimum Joint Width: [As indicated on Drawings]<Insert dimension>.
 - c. Maximum Joint Width: [As indicated on Drawings]<Insert dimension>.
 - d. Movement Capability: [As indicated on Drawings][<-25 percent/+25 percent>]<Insert percentage>.
4. Joint Seal Color: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from full range of industry colors]<Insert color>.

2.3 EXTRUDED-SILICONE JOINT SEALS

- A. Extruded-Silicone Joint Seals : Manufacturer's standard seal consisting of precured low-modulus silicone extrusion, with a neutral-curing silicone sealant for bonding extrusions to substrates.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- a. [GE Construction Sealants; Momenive Performance Materials Inc.]
 - b. [Nystrom, Inc.]
 - c. [Pecora Corporation]
 - d. [Sika Corporation]
 - e. [The Dow Chemical Company]
 - f. [Tremco Incorporated]
 - g. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [GE Construction Sealants; Momenive Performance Materials Inc.]
 - b. [Nystrom, Inc.]

- c. [Pecora Corporation]
 - d. [Sika Corporation]
 - e. [The Dow Chemical Company]
 - f. [Tremco Incorporated]
 - g. <Insert manufacturer's name>
- 3. Joint Seal Width: [4 inches (102 mm)][Joint size indicated on Drawings plus 3/4 inch (19 mm)][Joint size indicated on Drawings plus 1 inch (25 mm)]<Insert dimension>.
 - 4. Joint Seal Color: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from full range of industry colors]<Insert color>.

2.4 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by preformed joint seal manufacturer for joint substrates indicated.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to preformed joint seal manufacturer, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces, and formulated to promote best adhesion to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with preformed joint seals and surfaces adjacent to joints.
- D. Sealant for Adhering Extruded-Silicone Joint Seals: Silicone adhesive sealant recommended by extruded-silicone joint seal manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive preformed joint seals, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting preformed joint seal performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing preformed joint seals to comply with preformed joint seal manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of preformed joint seal, including dust, paints (except for permanent protective coatings tested and approved for seal adhesion and compatibility by seal manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimal bond with preformed joint seals. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

- a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint seals. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by preformed joint seal manufacturer or as indicated by tests or prior experience. Apply primer to comply with joint seal manufacturer's written instructions. Confine primers to areas of joint seal bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of adhesive or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF PREFORMED, FOAM JOINT SEALS

- A. General: Comply with preformed joint seal manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
 1. Install each length of seal immediately after removing protective wrapping.
 2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
 3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
 4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.

3.4 INSTALLATION OF EXTRUDED-SILICONE JOINT SEALS

- A. General: Comply with preformed joint seal manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
 1. Apply masking tape to each side of joint, outside of area to be covered by seal system.
 2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone seal system manufacturer's written instructions and covering a bonding area of not less than **3/8 inch (10 mm)**. Hold edge of sealant bead **1/4 inch (6 mm)** inside masking tape.
 3. Press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact with substrate.
 4. Complete installation of seal system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.



07 - Thermal And Moisture Protection

3.5 PROTECTION

- A. Protect preformed joint seals from damage resulting from construction operations or other causes so seals are without deterioration or damage at time of Substantial Completion.
- B. Cut out, remove, and repair damaged or deteriorated seals so repaired areas are indistinguishable from original work.

END OF SECTION 07 91 00 00



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 91 23 00	07 91 00 00	Preformed Joint Seals
07 91 23 00	07 92 00 00	Joint Sealants
07 91 26 00	07 91 00 00	Preformed Joint Seals
07 91 26 00	07 92 00 00	Joint Sealants
07 91 33 00	07 91 00 00	Preformed Joint Seals



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SECTION 07 92 00 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Immersible joint sealants.
5. Silane-modified polymer joint sealants.
6. Mildew-resistant joint sealants.
7. Polysulfide joint sealants.
8. Butyl joint sealants.
9. Latex joint sealants.

B. Related Requirements:

1. Section 079100 "Preformed Joint Seals" for preformed compressible foam and precured joint seals.
2. Section 079219 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.
3. Section 321373 "Concrete Paving Joint Sealants" for sealing joints in paved roads, parking lots, walkways, and curbing.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:** Conduct conference at **[Project site]<Insert location>**.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Urethane joint sealants.
4. Immersible joint sealants.
5. Silane-modified polymer joint sealants.
6. Mildew-resistant joint sealants.
7. Polysulfide joint sealants.
8. Butyl joint sealants.
9. Latex joint sealants.

- B. Samples for Initial Selection:** Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

- C. Samples for Verification:** For each type and color of joint sealant required, provide Samples with joint sealants in **1/2-inch- (13-mm-)** wide joints formed between two **6-inch- (150-mm-)** long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:

1. Joint-sealant location and designation.
2. Manufacturer and product name.
3. Type of substrate material.
4. Proposed test.
5. Number of samples required.

B. Preconstruction Laboratory Test Reports: For each joint sealant and substrate material to be tested from sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

C. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

D. Field Quality-Control Reports: For field-adhesion-test reports, for each sealant application tested.

E. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Manufacturers' special warranties.

B. Installer's special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.7 MOCKUPS

A. Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint

sealants specified in this Section. Use materials and installation methods specified in this Section.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
 3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with **[stone][masonry]<Insert substrate>** substrates.
 4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
 5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
 7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 2. Conduct field tests for each kind of sealant and joint substrate.
 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 5. Test Method: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 6. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 7. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.9 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer[**or are below 40 deg F (5 deg C)**].
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.10 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: **[Five]<Insert number>** years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain joint sealants from single manufacturer[**for each sealant type**].

2.2 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range]**.

2.3 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Adfast]**

- b. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - c. **[Sika Corporation - Building Components]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[Adfast]**
 - b. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - c. **[Sika Corporation - Building Components]**
 - d. **<Insert manufacturer's name>**
- B. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
- a. **[Adfast]**
 - b. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - c. **[Pecora Corporation]**
 - d. **[Sika Corporation - Building Components]**
 - e. **[The Dow Chemical Company]**
 - f. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[Adfast]**
 - b. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - c. **[Pecora Corporation]**
 - d. **[Sika Corporation - Building Components]**
 - e. **[The Dow Chemical Company]**
 - f. **<Insert manufacturer's name>**
- C. Silicone, S, NS, 35, NT: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability. nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 35, Use NT.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
- a. **[Adfast]**
 - b. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - c. **[Premier Building Solutions]**
 - d. **[Sika Corporation - Building Components]**
 - e. **[The Dow Chemical Company]**
 - f. **<Insert manufacturer's name>**

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2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- [Adfast]**
 - [GE Construction Sealants; Momentive Performance Materials Inc.]**
 - [Premier Building Solutions]**
 - [Sika Corporation - Building Components]**
 - [The Dow Chemical Company]**
 - <Insert manufacturer's name>**
- D. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
- [GE Construction Sealants; Momentive Performance Materials Inc.]**
 - [Pecora Corporation]**
 - [Permathane; a Holcim brand]**
 - [Polymeric Systems, Inc.; PPG Industries, Inc.]**
 - [Sherwin-Williams Company (The)]**
 - [Sika Corporation - Building Components]**
 - [The Dow Chemical Company]**
 - <Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- [GE Construction Sealants; Momentive Performance Materials Inc.]**
 - [Pecora Corporation]**
 - [Permathane; a Holcim brand]**
 - [Polymeric Systems, Inc.; PPG Industries, Inc.]**
 - [Sherwin-Williams Company (The)]**
 - [Sika Corporation - Building Components]**
 - [The Dow Chemical Company]**
 - <Insert manufacturer's name>**
- E. Silicone, Acid Curing, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
- [Adfast]**
 - [Bostik; Arkema]**
 - [Everkem Diversified Products, Inc.]**
 - [Pecora Corporation]**

- e. [Polymeric Systems, Inc.; PPG Industries, Inc.]
 - f. [PPG Paints; PPG Industries, Inc.]
 - g. [Premier Building Solutions]
 - h. [Sika Corporation - Building Components]
 - i. [The Dow Chemical Company]
 - j. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Adfast]
 - b. [Bostik; Arkema]
 - c. [Everkem Diversified Products, Inc.]
 - d. [Pecora Corporation]
 - e. [Polymeric Systems, Inc.; PPG Industries, Inc.]
 - f. [PPG Paints; PPG Industries, Inc.]
 - g. [Premier Building Solutions]
 - h. [Sika Corporation - Building Components]
 - i. [The Dow Chemical Company]
 - j. <Insert manufacturer's name>
- F. Silicone, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- a. [Pecora Corporation]
 - b. [The Dow Chemical Company]
 - c. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Pecora Corporation]
 - b. [The Dow Chemical Company]
 - c. <Insert manufacturer's name>
- G. Silicone, S, NS, 50, T, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- a. [Soudal Accumetric]
 - b. [The Dow Chemical Company]
 - c. <Insert manufacturer's name>

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2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- [Soudal Accumetric]**
 - [The Dow Chemical Company]**
 - <Insert manufacturer's name>**
- H. Silicone, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
- [Pecora Corporation]**
 - [Sika Corporation - Building Components]**
 - <Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- [Pecora Corporation]**
 - [Sika Corporation - Building Components]**
 - <Insert manufacturer's name>**
- I. Silicone, S, P, 100/50, T, NT: Single-component, pourable, plus 100 percent and minus 50 percent movement capability traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 100/50, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
- [Pecora Corporation]**
 - <Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- [Pecora Corporation]**
 - <Insert manufacturer's name>**
- J. Silicone, M, P, 100/50, T, NT: Multicomponent, pourable, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type M, Grade P, Class 100/50, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the**

following]:

- a. [The Dow Chemical Company]
 - b. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [The Dow Chemical Company]
 - b. <Insert manufacturer's name>

2.4 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.
- B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Adfast]
 - b. [Pecora Corporation]
 - c. [Sika Corporation - Building Components]
 - d. [Tremco Incorporated]
 - e. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Adfast]
 - b. [Pecora Corporation]
 - c. [Sika Corporation - Building Components]
 - d. [Tremco Incorporated]
 - e. <Insert manufacturer's name>
- C. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Adfast]
 - b. [GE Construction Sealants; Momenive Performance Materials Inc.]
 - c. [Pecora Corporation]
 - d. [Sika Corporation - Building Components]
 - e. [Soudal Accumetric]

- f. **[The Dow Chemical Company]**
 - g. **[Tremco Incorporated]**
 - h. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Adfast]**
 - b. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - c. **[Pecora Corporation]**
 - d. **[Sika Corporation - Building Components]**
 - e. **[Soudal Accumetric]**
 - f. **[The Dow Chemical Company]**
 - g. **[Tremco Incorporated]**
 - h. **<Insert manufacturer's name>**
- D. Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[The Dow Chemical Company]**
 - b. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[The Dow Chemical Company]**
 - b. **<Insert manufacturer's name>**
- E. Silicone, Nonstaining, M, NS, 50, NT: Nonstaining, multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Tremco Incorporated]**
 - b. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Tremco Incorporated]**
 - b. **<Insert manufacturer's name>**

2.5 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Adfast]**
 - b. **[Bostik; Arkema]**
 - c. **[Everkem Diversified Products, Inc.]**
 - d. **[Master Builders Solutions]**
 - e. **[Pecora Corporation]**
 - f. **[Permthane; a Holcim brand]**
 - g. **[Polymeric Systems, Inc.; PPG Industries, Inc.]**
 - h. **[PPG Paints; PPG Industries, Inc.]**
 - i. **[Sherwin-Williams Company (The)]**
 - j. **[Sika Corporation - Building Components]**
 - k. **[Tower Sealants, Inc.]**
 - l. **[Tremco Incorporated]**
 - m. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Adfast]**
 - b. **[Bostik; Arkema]**
 - c. **[Everkem Diversified Products, Inc.]**
 - d. **[Master Builders Solutions]**
 - e. **[Pecora Corporation]**
 - f. **[Permthane; a Holcim brand]**
 - g. **[Polymeric Systems, Inc.; PPG Industries, Inc.]**
 - h. **[PPG Paints; PPG Industries, Inc.]**
 - i. **[Sherwin-Williams Company (The)]**
 - j. **[Sika Corporation - Building Components]**
 - k. **[Tower Sealants, Inc.]**
 - l. **[Tremco Incorporated]**
 - m. **<Insert manufacturer's name>**
- B. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **<Insert manufacturer's name>**
- C. Urethane, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T and NT.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[LymTal International, Inc.]**
 - b. **[Master Builders Solutions]**
 - c. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[LymTal International, Inc.]**
 - b. **[Master Builders Solutions]**
 - c. **<Insert manufacturer's name>**
- D. Urethane, S, P, 35, T, NT: Single-component, pourable, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 35, Uses T and NT.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Bostik; Arkema]**
 - b. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Bostik; Arkema]**
 - b. **<Insert manufacturer's name>**
- E. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Master Builders Solutions]**
 - b. **[Pecora Corporation]**
 - c. **[Polymeric Systems, Inc.; PPG Industries, Inc.]**
 - d. **[Sherwin-Williams Company (The)]**

- e. <Insert manufacturer's name>
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Master Builders Solutions]
 - b. [Pecora Corporation]
 - c. [Polymeric Systems, Inc.; PPG Industries, Inc.]
 - d. [Sherwin-Williams Company (The)]
 - e. <Insert manufacturer's name>
- F. Urethane, M, NS, 50, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Pecora Corporation]
 - b. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Pecora Corporation]
 - b. <Insert manufacturer's name>
- G. Urethane, M, NS, 25, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Use NT.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Master Builders Solutions]
 - b. [Sherwin-Williams Company (The)]
 - c. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Master Builders Solutions]
 - b. [Sherwin-Williams Company (The)]
 - c. <Insert manufacturer's name>
- H. Urethane, M, NS, 50, T, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Uses T and NT.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering

products that may be incorporated into the Work include, but are not limited to, the following]:

- a. **[Tremco Incorporated]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Tremco Incorporated]**
 - b. **<Insert manufacturer's name>**
- I. Urethane, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Bostik; Arkema]**
 - b. **[LymTal International, Inc.]**
 - c. **[Master Builders Solutions]**
 - d. **[Pecora Corporation]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Bostik; Arkema]**
 - b. **[LymTal International, Inc.]**
 - c. **[Master Builders Solutions]**
 - d. **[Pecora Corporation]**
 - e. **<Insert manufacturer's name>**
- J. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 50, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[LymTal International, Inc.]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[LymTal International, Inc.]**

- b. <Insert manufacturer's name>
- K. Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Bostik; Arkema]**
 - b. **[LymTal International, Inc.]**
 - c. **[Master Builders Solutions]**
 - d. **[Pecora Corporation]**
 - e. **[Sherwin-Williams Company (The)]**
 - f. **[Tremco Incorporated]**
 - g. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. **[Bostik; Arkema]**
 - b. **[LymTal International, Inc.]**
 - c. **[Master Builders Solutions]**
 - d. **[Pecora Corporation]**
 - e. **[Sherwin-Williams Company (The)]**
 - f. **[Tremco Incorporated]**
 - g. <Insert manufacturer's name>
- 2.6 IMMERSIBLE JOINT SEALANTS
- A. Immersible Joint Sealants: Suitable for immersion in liquids; ASTM C1247, **[Class 1][Class 2]**; tested in deionized water unless otherwise indicated.
- B. Urethane, Immersible, S, NS, 100/50, NT, I: Immersible, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses NT and I.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Tremco Incorporated]**
 - b. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. **[Tremco Incorporated]**
 - b. <Insert manufacturer's name>

- C. Urethane, Immersible, S, NS, 35, NT, I: Immersible, single-component, nonsag, plus 35 percent and minus 35 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 35, Uses NT and I.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Master Builders Solutions]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Master Builders Solutions]**
 - b. **<Insert manufacturer's name>**
- D. Urethane, Immersible, S, NS, 50, T, NT, I: Immersible, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 50, Uses T, NT, and I.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Tremco Incorporated]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Tremco Incorporated]**
 - b. **<Insert manufacturer's name>**
- E. Urethane, Immersible, S, NS, 35, T, NT, I: Immersible, single-component, nonsag, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 35, Uses T, NT, and I.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Master Builders Solutions]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Master Builders Solutions]**

- b. **<Insert manufacturer's name>**
- F. Urethane, Immersible, S, NS, 25, T, NT, I: Immersible, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T, NT, and I.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Master Builders Solutions]**
 - b. **[Pecora Corporation]**
 - c. **[Tremco Incorporated]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Master Builders Solutions]**
 - b. **[Pecora Corporation]**
 - c. **[Tremco Incorporated]**
 - d. **<Insert manufacturer's name>**
- G. Urethane, Immersible, S, P, 50, T, NT, I: Immersible, single-component, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 50, Uses T, NT, and I.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Tremco Incorporated]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Tremco Incorporated]**
 - b. **<Insert manufacturer's name>**
- H. Urethane, Immersible, S, P, 25, T, NT, I: Immersible, single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T, NT, and I.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Tremco Incorporated]**
 - b. **[W. R. Meadows, Inc]**
 - c. **<Insert manufacturer's name>**

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2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Tremco Incorporated]**
 - b. **[W. R. Meadows, Inc]**
 - c. **<Insert manufacturer's name>**
 - I. Polysulfide, Immersible, M, NS, 25, NT, I: Immersible, multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, polysulfide joint sealant; ASTM C920, Type M, Grade NS, Class 25, Uses NT and I.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Polymeric Systems, Inc.; PPG Industries, Inc.]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Polymeric Systems, Inc.; PPG Industries, Inc.]**
 - b. **<Insert manufacturer's name>**
 - J. Urethane, Immersible, M, NS, 50, T, NT, I: Immersible, multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Uses T, NT, and I.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[LymTal International, Inc.]**
 - b. **[Tremco Incorporated]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[LymTal International, Inc.]**
 - b. **[Tremco Incorporated]**
 - c. **<Insert manufacturer's name>**
 - K. Urethane, Immersible, M, NS, 25, T, NT, I: Immersible, multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Uses T, NT, and I.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the**

following]:

- a. **[Master Builders Solutions]**
 - b. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Master Builders Solutions]**
 - b. **<Insert manufacturer's name>**
- L. Polysulfide, Immersible, M, NS, 25, T, NT, I: Immersible, multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, polysulfide joint sealant; ASTM C920, Type M, Grade NS, Class 25, Uses T, NT, and I.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Pecora Corporation]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Pecora Corporation]**
 - b. **<Insert manufacturer's name>**
- M. Urethane, Immersible, M, P, 25, T, NT, I: Immersible, multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T, NT, and I.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[LymTal International, Inc.]**
 - b. **[Master Builders Solutions]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[LymTal International, Inc.]**
 - b. **[Master Builders Solutions]**
 - c. **<Insert manufacturer's name>**

2.7 SILANE-MODIFIED POLYMER JOINT SEALANTS

- A. Silane-Modified Polymer, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50

percent movement capability, nontraffic-use, [silyl-terminated polyether][silyl-terminated polyurethane][polyurea] joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Adfast]
 - b. [GE Construction Sealants; Momenive Performance Materials Inc.]
 - c. [Master Builders Solutions]
 - d. [Pecora Corporation]
 - e. [Premier Building Solutions]
 - f. [Sherwin-Williams Company (The)]
 - g. [Sika Corporation - Building Components]
 - h. [Soudal Accumetric]
 - i. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Adfast]
 - b. [GE Construction Sealants; Momenive Performance Materials Inc.]
 - c. [Master Builders Solutions]
 - d. [Pecora Corporation]
 - e. [Premier Building Solutions]
 - f. [Sherwin-Williams Company (The)]
 - g. [Sika Corporation - Building Components]
 - h. [Soudal Accumetric]
 - i. <Insert manufacturer's name>

B. Silane-Modified Polymer, S, NS, 35, NT: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability, nontraffic-use, [silyl-terminated polyether][silyl-terminated polyurethane][polyurea] joint sealant; ASTM C920, Type S, Grade NS, Class 35, Use NT.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Master Builders Solutions]
 - b. [Premier Building Solutions]
 - c. [Sika Corporation - Building Components]
 - d. [Tremco Incorporated]
 - e. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Master Builders Solutions]
 - b. [Premier Building Solutions]
 - c. [Sika Corporation - Building Components]
 - d. [Tremco Incorporated]

- e. <Insert manufacturer's name>
- C. Silane-Modified Polymer, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, **[silyl-terminated polyether][silyl-terminated polyurethane][polyurea]** joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Everkem Diversified Products, Inc.]**
 - b. **[Franklin International]**
 - c. **[Permathane; a Holcim brand]**
 - d. **[Polymeric Systems, Inc.; PPG Industries, Inc.]**
 - e. **[Sika Corporation - Building Components]**
 - f. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Everkem Diversified Products, Inc.]**
 - b. **[Franklin International]**
 - c. **[Permathane; a Holcim brand]**
 - d. **[Polymeric Systems, Inc.; PPG Industries, Inc.]**
 - e. **[Sika Corporation - Building Components]**
 - f. **<Insert manufacturer's name>**
- D. Silane-Modified Polymer, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, **[silyl-terminated polyether][silyl-terminated polyurethane][polyurea]** joint sealant; ASTM C920, Type S, Grade NS, Class 100, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Soudal Accumetric]**
 - b. **[Sto Corp.]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Soudal Accumetric]**
 - b. **[Sto Corp.]**
 - c. **<Insert manufacturer's name>**
- E. Silane-Modified Polymer, S, NS, 50, T, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, **[silyl-terminated polyether][silyl-terminated polyurethane][polyurea]** joint sealant; ASTM C920, Type S, Grade NS, Class 50, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the**

following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Franklin International]
- b. [Soudal Accumetric]
- c. <Insert manufacturer's name>

- 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Franklin International]
- b. [Soudal Accumetric]
- c. <Insert manufacturer's name>

- F. Silane-Modified Polymer, S, NS, 35, T, NT: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, [silyl-terminated polyether][silyl-terminated polyurethane][polyurea] joint sealant; ASTM C920, Type S, Grade NS, Class 35, Uses T and NT.

- 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Soudal Accumetric]
- b. <Insert manufacturer's name>

- 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Soudal Accumetric]
- b. <Insert manufacturer's name>

- G. Silane-Modified Polymer, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, [silyl-terminated polyether][silyl-terminated polyurethane][polyurea] joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T and NT.

- 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Soudal Accumetric]
- b. <Insert manufacturer's name>

- 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Soudal Accumetric]
- b. <Insert manufacturer's name>

- H. Silane-Modified Polymer, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25

percent movement capability, traffic- and nontraffic-use, **[silyl-terminated polyether][silyl-terminated polyurethane][polyurea]** joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Franklin International]**
 - b. **[Premier Building Solutions]**
 - c. **[Soudal Accumetric]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Franklin International]**
 - b. **[Premier Building Solutions]**
 - c. **[Soudal Accumetric]**
 - d. **<Insert manufacturer's name>**

2.8 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Adfast]**
 - b. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - c. **[Pecora Corporation]**
 - d. **[PPG Paints; PPG Industries, Inc.]**
 - e. **[Sika Corporation - Building Components]**
 - f. **[Soudal Accumetric]**
 - g. **[The Dow Chemical Company]**
 - h. **[Tremco Incorporated]**
 - i. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Adfast]**
 - b. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - c. **[Pecora Corporation]**
 - d. **[PPG Paints; PPG Industries, Inc.]**
 - e. **[Sika Corporation - Building Components]**

- f. **[Soudal Accumetric]**
- g. **[The Dow Chemical Company]**
- h. **[Tremco Incorporated]**
- i. **<Insert manufacturer's name>**

C. Silane-Modified Polymer, Mildew Resistant, S, NS, 50, NT: Mildew-resistant, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, **[silyl-terminated polyether][silyl-terminated polyurethane][polyurea]** joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. **[Master Builders Solutions]**
- b. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Master Builders Solutions]**
- b. **<Insert manufacturer's name>**

2.9 POLYSULFIDE JOINT SEALANTS

A. Polysulfide, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, polysulfide joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. **[W. R. Meadows, Inc]**
- b. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[W. R. Meadows, Inc]**
- b. **<Insert manufacturer's name>**

B. Polysulfide, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, polysulfide joint sealant; ASTM C920, Type M, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. [W. R. Meadows, Inc]
 - b. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [W. R. Meadows, Inc]
 - b. <Insert manufacturer's name>
- C. Polysulfide, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, polysulfide joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T and NT.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [W. R. Meadows, Inc]
 - b. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [W. R. Meadows, Inc]
 - b. <Insert manufacturer's name>

2.10 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Bostik; Arkema]
 - b. [Everkem Diversified Products, Inc.]
 - c. [GSSI Sealants]
 - d. [Pecora Corporation]
 - e. [Sika Corporation - Building Components]
 - f. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Bostik; Arkema]
 - b. [Everkem Diversified Products, Inc.]
 - c. [GSSI Sealants]
 - d. [Pecora Corporation]
 - e. [Sika Corporation - Building Components]
 - f. <Insert manufacturer's name>

2.11 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Adfast]**
 - b. **[Everkem Diversified Products, Inc.]**
 - c. **[Franklin International]**
 - d. **[Pecora Corporation]**
 - e. **[PPG Paints; PPG Industries, Inc.]**
 - f. **[Sherwin-Williams Company (The)]**
 - g. **[Tremco Incorporated]**
 - h. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Adfast]**
 - b. **[Everkem Diversified Products, Inc.]**
 - c. **[Franklin International]**
 - d. **[Pecora Corporation]**
 - e. **[PPG Paints; PPG Industries, Inc.]**
 - f. **[Sherwin-Williams Company (The)]**
 - g. **[Tremco Incorporated]**
 - h. **<Insert manufacturer's name>**

2.12 JOINT-SEALANT BACKING

- A. Sealant Backing Material: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Adfast]**
 - b. **[Alcot Plastics Ltd.]**
 - c. **[Construction Foam Products; a division of Nomaco, Inc.]**
 - d. **[Master Builders Solutions]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Adfast]**
 - b. **[Alcot Plastics Ltd.]**

- c. **[Construction Foam Products; a division of Nomaco, Inc.]**
- d. **[Master Builders Solutions]**
- e. **<Insert manufacturer's name>**
- B. Cylindrical Sealant Backings: ASTM C1330, **[Type C (closed-cell material with a surface skin)][Type O (open-cell material)][Type B (bicellular material with a surface skin)][or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated]**, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.13 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates

include the following:

- a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 - e. **<Insert other porous joint substrate>.**
3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
 - e. **<Insert other nonporous joint substrate>.**

- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants in accordance with requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.
 4. Provide flush joint profile at **[locations indicated on Drawings]<Insert locations>** in accordance with Figure 8B in ASTM C1193.
 5. Provide recessed joint configuration of recess depth and at **[locations indicated on Drawings]<Insert locations>** in accordance with Figure 8C in ASTM C1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - a. Extent of Testing: Test completed and cured sealant joints as follows:
 - 1) Perform **[10]<Insert number>** tests for the first **[1000 ft. (300 m)]<Insert dimension>** of joint length for each kind of sealant and joint substrate.
 - 2) Perform one test for each **[1000 ft. (300 m)]<Insert dimension>** of joint length thereafter or one test per each floor per elevation.
 - b. Test Method: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - c. Inspect tested joints and report on the following:
 - 1) Whether sealants filled joint cavities and are free of voids.
 - 2) Whether sealant dimensions and configurations comply with specified requirements.
 - 3) Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
 - d. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration,

- and sealant dimensions.
- e. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

- 2. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

- C. Prepare test and inspection reports.

3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 00 00



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 92 13 00	07 92 00 00	Joint Sealants



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SECTION 07 92 19 00 - ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Acoustical joint sealants.
- B. Related Requirements:
 - 1. Section 079200 "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for nonacoustical applications.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants, showing full range of available colors for each product exposed to view.
- C. Samples for Verification: For each type and color of acoustical joint sealant required.
 - 1. Size: **1/2-inch- (13-mm-)** wide sealant joints formed between two **6-inch- (150-mm-)** long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Acoustical Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.
- E. Sustainable Design Submittals:
 - 1. Product Data: For sealants, indicating VOC content.
 - 2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

1.3 INFORMATIONAL SUBMITTALS

- A. Test and Evaluation Reports:
 - 1. Product Test Reports: For each type of acoustical joint sealant, for tests performed by **[qualified testing agency][manufacturer and witnessed by a qualified testing agency]**.
- B. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

- A. Warranty Documentation:
 - 1. Manufacturers' special warranties.
 - 2. Installer's special warranties.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained between **40 and 95 deg F (4 and 35 deg C)**.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between **[35 and 100 deg F (2 and 38 deg C)][60 and 90 deg F (16 and 32 deg C)]**. **[Warm surfaces to be coated to 70 deg F (21 deg C) to enhance drying.]**

1.7 WARRANTY

- A. Installer's Special Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion.
- B. Manufacturer's Special Warranty: Manufacturer agrees to furnish acoustical joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: **<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACOUSTICAL JOINT SEALANTS

- A. Acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies in accordance with ASTM E90.
 - 1. Sealant shall have a VOC content of 250 g/L or less.
 - 2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 3. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical

- Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
4. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[DAP Products Inc.]**
 - b. **[Everkem Diversified Products, Inc.]**
 - c. **[Franklin International]**
 - d. **[Grabber Construction Products, Inc.]**
 - e. **[Hilti, Inc.]**
 - f. **[OSI Sealants; Henkel Corporation]**
 - g. **[Pecora Corporation]**
 - h. **[Specified Technologies Inc.]**
 - i. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[DAP Products Inc.]**
 - b. **[Everkem Diversified Products, Inc.]**
 - c. **[Franklin International]**
 - d. **[Grabber Construction Products, Inc.]**
 - e. **[Hilti, Inc.]**
 - f. **[OSI Sealants; Henkel Corporation]**
 - g. **[Pecora Corporation]**
 - h. **[Specified Technologies Inc.]**
 - i. **<Insert manufacturer's name>**
 3. Colors of Exposed Acoustical Joint Sealants: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range of colors]<Insert color>**.
- C. Acoustical Sealant for Concealed Joints: Manufacturer's standard nonsag, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber acoustical sealant.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[OSI Sealants; Henkel Corporation]**
 - b. **[Pecora Corporation]**
 - c. **[Tremco Incorporated]**
 - d. **[USG Corporation]**

- e. <Insert manufacturer's name>
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [OSI Sealants; Henkel Corporation]
 - b. [Pecora Corporation]
 - c. [Tremco Incorporated]
 - d. [USG Corporation]
 - e. <Insert manufacturer's name>

2.2 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by acoustical joint-sealant manufacturer where required for adhesion of sealant to joint substrates.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where recommended by acoustical joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
- B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C919, ASTM C1193, and manufacturer's written instructions for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
- C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 19 00



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07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 92 19 00	07 92 00 00	Joint Sealants



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SECTION 07 95 13 00 - PARKING DECK EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Parking deck expansion joint covers.

B. Related Requirements:

1. Section 079100 "Preformed Joint Seals" for preformed foam and extruded-silicone joint seals.

1.2 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.

1. Parking deck expansion joint covers.

B. Shop Drawings: For each expansion joint cover assembly.

1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples: For each expansion joint cover assembly and for each color and texture specified, full width by **6 inches (150 mm)** long in size.

D. Samples for Initial Selection: For each type of exposed finish.

1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.

E. Samples for Verification: For each type of expansion joint cover assembly, full width by **6 inches (150 mm)** long in size.

F. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:

1. Manufacturer and model number for each expansion joint cover assembly.
2. Expansion joint cover assembly location cross-referenced to Drawings.
3. Nominal, minimum, and maximum joint width.
4. Movement direction.
5. Materials, colors, and finishes.
6. Product options.
7. Fire-resistance ratings.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by **[manufacturer and witnessed by a qualified testing agency][a qualified testing agency]**.

1.4 QUALITY ASSURANCE

- A. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Build mockup of typical expansion joint cover assembly as shown on Drawings.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Furnish units in longest practicable lengths to minimize field splicing.
- B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Expansion joint cover assemblies shall withstand the effects of earthquake motions determined according to **[ASCE/SEI 7]<Insert requirement>**.
- B. Fire-Resistance Ratings: Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079 or ASTM E1966 by a qualified testing agency.
- C. Expansion Joint Design Criteria :
 - 1. Type of Movement: **[Thermal][Wind sway]**.
 - a. Nominal Joint Width: **[As indicated on Drawings]<Insert width>**.
 - b. Minimum Joint Width: **[As indicated on Drawings]<Insert width>**.
 - c. Maximum Joint Width: **[As indicated on Drawings]<Insert width>**.
 - 2. Seismic Movement: As indicated on Drawings.

2.3 PARKING DECK EXPANSION JOINT COVERS

- A. Metal-Plate Parking Deck Joint Cover : Assembly consisting of metal cover plate in continuous contact with metal frames fixed to sides of joint gap.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]
 - b. [Balco; a CSW Industrials Company]
 - c. [Construction Specialties, Inc.]
 - d. [inpro Corporation]
 - e. [LymTal International, Inc.]
 - f. [MM Systems Corporation]
 - g. [Nystrom, Inc.]
 - h. [Watson Bowman Acme Corp.]
 - i. [Willseal LLC, part of Tremco CPG]
 - j. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]
 - b. [Balco; a CSW Industrials Company]
 - c. [Construction Specialties, Inc.]
 - d. [inpro Corporation]
 - e. [LymTal International, Inc.]
 - f. [MM Systems Corporation]
 - g. [Nystrom, Inc.]
 - h. [Watson Bowman Acme Corp.]
 - i. [Willseal LLC, part of Tremco CPG]
 - j. <Insert manufacturer's name>
 3. Application: [Slab to slab][Slab to wall].
 4. Installation: [Surface mounted][Recessed][No bump].
 5. Load Capacity:
 - a. Uniform Load: [200 lb/sq. ft. (976 kg/sq. m)]<Insert load>.
 - b. Concentrated Load: [2000 lb (907 kg)]<Insert load>.
 - c. Maximum Deflection: [0.125 inch (3.2 mm)]<Insert deflection>.
 6. Fire-Resistance Rating: Not less than [that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>.
 7. Cover-Plate Design: [Plain][Serrated][Abrasive covered].
 8. Exposed Metal:
 - a. Aluminum: [Mill][Manufacturer's standard]<Insert finish>.
 - b. Stainless steel: [No. 2B][No. 4][Manufacturer's standard]<Insert finish>.
- B. T-Joint Parking Deck Joint Cover : Assembly consisting of factory-formed polyurethane block with tapered edges over steel plate. Provide manufacturer's standard, liquid-applied nosing sealant for preformed voids at tapered edges.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Balco; a CSW Industrials Company]
 - b. [Erie Metal Specialties, Inc.]
 - c. [LymTal International, Inc.]
 - d. [MM Systems Corporation]
 - e. [Watson Bowman Acme Corp.]
 - f. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Balco; a CSW Industrials Company]
 - b. [Erie Metal Specialties, Inc.]
 - c. [LymTal International, Inc.]
 - d. [MM Systems Corporation]
 - e. [Watson Bowman Acme Corp.]
 - f. <Insert manufacturer's name>
3. Application: [Slab to slab][Slab to wall].
4. Load Capacity:
 - a. Uniform Load: [200 lb/sq. ft. (976 kg/sq. m)]<Insert load>.
 - b. Concentrated Load: [2000 lb (907 kg)]<Insert load>.
 - c. Maximum Deflection: [0.125 inch (3.2 mm)]<Insert deflection>.
5. Fire-Resistance Rating: Not less than [that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>.
6. Exposed Metal:
 - a. Aluminum: [Mill][Manufacturer's standard]<Insert finish>.
 - b. Stainless steel: [No. 2B][No. 4][Manufacturer's standard]<Insert finish>.
7. Polyurethane Block:
 - a. Color: [Black][Gray][As selected by Architect from manufacturer's full range]<Insert color>.
- C. Compression-Seal Parking Deck Joint Cover : Complying with ASTM E1612/E1612M. Elastomeric seal designed to always stay in compression. Install using manufacturer's recommended lubricant adhesive.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]
 - b. [Balco; a CSW Industrials Company]
 - c. [Construction Specialties, Inc.]
 - d. [D.S. Brown; a Gibraltar Industries company]
 - e. [Erie Metal Specialties, Inc.]
 - f. [inpro Corporation]
 - g. [LymTal International, Inc.]
 - h. [MM Systems Corporation]
 - i. [Nystrom, Inc.]
 - j. [Watson Bowman Acme Corp.]

- k. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]
 - b. [Balco; a CSW Industrials Company]
 - c. [Construction Specialties, Inc.]
 - d. [D.S. Brown; a Gibraltar Industries company]
 - e. [Erie Metal Specialties, Inc.]
 - f. [inpro Corporation]
 - g. [LymTal International, Inc.]
 - h. [MM Systems Corporation]
 - i. [Nystrom, Inc.]
 - j. [Watson Bowman Acme Corp.]
 - k. <Insert manufacturer's name>
 3. Application: [Slab to slab][Slab to wall].
 4. Load Capacity:
 - a. Uniform Load: [200 lb/sq. ft. (976 kg/sq. m)]<Insert load>.
 - b. Concentrated Load: [2000 lb (907 kg)]<Insert load>.
 - c. Maximum Deflection: [0.125 inch (3.2 mm)]<Insert deflection>.
 5. Fire-Resistance Rating: Not less than [that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>.
 6. Seal: Preformed elastomeric extrusion.
 - a. Color: [Black][Gray][As selected by Architect from manufacturer's full range]<Insert color>.
- D. Precompressed Foam Parking Deck Expansion Joint Seals : Manufacturer's precompressed, self-expanding foam joint seal manufactured from urethane or EVA (ethylene vinyl acetate) foam, impregnated with a nondrying, water-repellent agent, and coated with traffic-grade silicone wearing surface. Factory produce in precompressed sizes in roll or stick form to fit joint widths based on design criteria indicated, with factory- or field-applied adhesive for bonding to substrates.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Balco; a CSW Industrials Company]
 - b. [EMSEAL; a Sika Company]
 - c. [Willseal LLC, part of Tremco CPG]
 - d. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Balco; a CSW Industrials Company]
 - b. [EMSEAL; a Sika Company]
 - c. [Willseal LLC, part of Tremco CPG]
 - d. <Insert manufacturer's name>

3. Design Criteria:

- a. Nominal Joint Width: **[As indicated on Drawings]<Insert dimension>**.
- b. Minimum Joint Width: **[As indicated on Drawings]<Insert dimension>**.
- c. Maximum Joint Width: **[As indicated on Drawings]<Insert dimension>**.
- d. Movement Capability: **[As indicated on Drawings][-50 percent/+50 percent]<Insert percentage>**.

4. Application: Slab to slab.

5. Fire-Resistance Rating: Not less than **[that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>**.

6. Joint Seal Color: **[Gray][As indicated by manufacturer's designations]<Insert color>**.

E. Epoxy-Bonded-Seal Parking Deck Joint Covers : Elastomeric seal, epoxy-bonded to sides of joint gap. Install using manufacturer's recommended epoxy adhesive.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
- b. **[Balco; a CSW Industrials Company]**
- c. **[Construction Specialties, Inc.]**
- d. **[D.S. Brown; a Gibraltar Industries company]**
- e. **[Erie Metal Specialties, Inc.]**
- f. **[LymTal International, Inc.]**
- g. **[MM Systems Corporation]**
- h. **[Watson Bowman Acme Corp.]**
- i. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
- b. **[Balco; a CSW Industrials Company]**
- c. **[Construction Specialties, Inc.]**
- d. **[D.S. Brown; a Gibraltar Industries company]**
- e. **[Erie Metal Specialties, Inc.]**
- f. **[LymTal International, Inc.]**
- g. **[MM Systems Corporation]**
- h. **[Watson Bowman Acme Corp.]**
- i. **<Insert manufacturer's name>**

3. Application: **[Slab to slab][Slab to wall]**.

4. Load Capacity:

- a. Uniform Load: **[200 lb/sq. ft. (976 kg/sq. m)]<Insert load>**.
- b. Concentrated Load: **[2000 lb (907 kg)]<Insert load>**.
- c. Maximum Deflection: **[0.125 inch (3.2 mm)]<Insert deflection>**.

5. Fire-Resistance Rating: Not less than **[that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>**.

6. Seal: Preformed elastomeric extrusion.

- a. Color: **[Black][Gray][As selected by Architect from manufacturer's full range]<Insert color>**.
- F. Strip-Seal Parking Deck Joint Covers : Complying with ASTM E1783/E1783M. Assembly consisting of elastomeric seal mechanically locked into a metal frame or edge rails cast into slab edges.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[D.S. Brown; a Gibraltar Industries company]**
 - b. **[Erie Metal Specialties, Inc.]**
 - c. **[inpro Corporation]**
 - d. **[LymTal International, Inc.]**
 - e. **[Watson Bowman Acme Corp.]**
 - f. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[D.S. Brown; a Gibraltar Industries company]**
 - b. **[Erie Metal Specialties, Inc.]**
 - c. **[inpro Corporation]**
 - d. **[LymTal International, Inc.]**
 - e. **[Watson Bowman Acme Corp.]**
 - f. **<Insert manufacturer's name>**
 - 3. Application: **[Slab to slab][Slab to wall]**.
 - 4. Load Capacity:
 - a. Uniform Load: **[200 lb/sq. ft. (976 kg/sq. m)]<Insert load>**.
 - b. Concentrated Load: **[2000 lb (907 kg)]<Insert load>**.
 - c. Maximum Deflection: **[0.125 inch (3.2 mm)]<Insert deflection>**.
 - 5. Fire-Resistance Rating: Not less than **[that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>**.
 - 6. Seal: Preformed elastomeric extrusion.
 - a. Color: **[Black][Gray][As selected by Architect from manufacturer's full range]<Insert color>**.
- G. Winged-Seal Parking Deck Joint Covers : Winged elastomeric seal grouted into block outs without mechanical attachment. Fully grout block out with manufacturer's elastomeric concrete.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[D.S. Brown; a Gibraltar Industries company]**
 - e. **[EMSEAL; a Sika Company]**

- f. **[Erie Metal Specialties, Inc.]**
 - g. **[inpro Corporation]**
 - h. **[LymTal International, Inc.]**
 - i. **[MM Systems Corporation]**
 - j. **[Watson Bowman Acme Corp.]**
 - k. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[D.S. Brown; a Gibraltar Industries company]**
 - e. **[EMSEAL; a Sika Company]**
 - f. **[Erie Metal Specialties, Inc.]**
 - g. **[inpro Corporation]**
 - h. **[LymTal International, Inc.]**
 - i. **[MM Systems Corporation]**
 - j. **[Watson Bowman Acme Corp.]**
 - k. **<Insert manufacturer's name>**
 3. Application: **[Slab to slab][Slab to wall]**.
 4. Load Capacity:
 - a. Uniform Load: **[200 lb/sq. ft. (976 kg/sq. m)]<Insert load>**.
 - b. Concentrated Load: **[2000 lb (907 kg)]<Insert load>**.
 - c. Maximum Deflection: **[0.125 inch (3.2 mm)]<Insert deflection>**.
 5. Fire-Resistance Rating: Not less than **[that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>**.
 6. Seal: Preformed elastomeric extrusion.
 - a. Color: **[Black][Gray][As selected by Architect from manufacturer's full range]<Insert color>**.
- H. Bolt-In Parking Deck Joint Cover : Assembly consisting of winged elastomeric seal locked into slab-edge block outs by metal frames bolted to slab. Fully grout block outs with elastomeric concrete.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[LymTal International, Inc.]**
 - d. **[MM Systems Corporation]**
 - e. **[Watson Bowman Acme Corp.]**
 - f. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[LymTal International, Inc.]**
 - d. **[MM Systems Corporation]**
 - e. **[Watson Bowman Acme Corp.]**
 - f. **<Insert manufacturer's name>**
3. Application: **[Slab to slab][Slab to wall]**.
4. Load Capacity:
 - a. Uniform Load: **[200 lb/sq. ft. (976 kg/sq. m)]<Insert load>**.
 - b. Concentrated Load: **[2000 lb (907 kg)]<Insert load>**.
 - c. Maximum Deflection: **[0.125 inch (3.2 mm)]<Insert deflection>**.
5. Fire-Resistance Rating: Not less than **[that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>**.
6. Seal: Preformed elastomeric extrusion.
 - a. Color: **[Black][Gray][As selected by Architect from manufacturer's full range]<Insert color>**.
- I. Split-Slab Membrane Parking Deck Joint Cover : Designed for use with slabs to receive toppings. Assembly consisting of elastomeric winged seals locked into metal edge rails, with flashing for hot-splicing into deck waterproofing. Provide stainless steel retaining caps for edge rails.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Balco; a CSW Industrials Company]**
 - b. **[Construction Specialties, Inc.]**
 - c. **[EMSEAL; a Sika Company]**
 - d. **[Erie Metal Specialties, Inc.]**
 - e. **[LymTal International, Inc.]**
 - f. **[MM Systems Corporation]**
 - g. **[Watson Bowman Acme Corp.]**
 - h. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Balco; a CSW Industrials Company]**
 - b. **[Construction Specialties, Inc.]**
 - c. **[EMSEAL; a Sika Company]**
 - d. **[Erie Metal Specialties, Inc.]**
 - e. **[LymTal International, Inc.]**
 - f. **[MM Systems Corporation]**
 - g. **[Watson Bowman Acme Corp.]**
 - h. **<Insert manufacturer's name>**
 3. Application: **[Slab to slab][Slab to wall]**.
 4. Load Capacity:
 - a. Uniform Load: **[200 lb/sq. ft. (976 kg/sq. m)]<Insert load>**.

- b. Concentrated Load: **[2000 lb (907 kg)]<Insert load>**.
- c. Maximum Deflection: **[0.125 inch (3.2 mm)]<Insert deflection>**.
- 5. Height: **[To match adjacent topping materials]<Insert height>**.
- 6. Fire-Resistance Rating: Not less than **[that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>**.
- 7. Exposed Metal:
 - a. Stainless steel: **[No. 2B][No. 4][Manufacturer's standard]<Insert finish>**.
- 8. Seal: Preformed elastomeric extrusion.
 - a. Color: **[Black][Gray][As selected by Architect from manufacturer's full range]<Insert color>**.

2.4 MATERIALS

- A. Aluminum: **ASTM B221 (ASTM B221M)**, Alloy 6063-T5 for extrusions; **ASTM B209 (ASTM B209M)**, Alloy 6061-T6 for sheet and plate.
 - 1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
- B. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304 for plates, sheet, and strips.
- C. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.
- D. Elastomeric Concrete: Modified epoxy or polyurethane extended into a prepackaged aggregate blend, specifically designed for bonding to concrete substrates.
- E. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.
- F. Moisture Barrier: Manufacturer's standard, flexible elastomeric material.
- G. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3. Directional Satin Finish: No. 4.



- C. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

2.6 ACCESSORIES

- A. Moisture Barriers: Manufacturer's standard continuous, waterproof membrane within joint and attached to substrate on sides of joint.
 - 1. Provide where indicated on Drawings.
- B. Manufacturer's stainless steel attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.
- B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.
- B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.
- C. Cast-In Frames: Coordinate and furnish frames to be cast into concrete.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.
- B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.
 - 1. Repair or grout block out as required for continuous frame support, using nonmetallic, shrinkage-resistant grout.
 - 2. Install frames in continuous contact with adjacent surfaces.
 - a. Shimming is not permitted.
 - 3. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.

4. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
 5. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
 6. Locate anchors at interval recommended by manufacturer, but not less than **3 inches (75 mm)** from each end and not more than **24 inches (600 mm)** o.c.
- C. Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
1. Provide in continuous lengths for straight sections.
 2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
 3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- D. Compression Seals: Apply adhesive or lubricant adhesive as recommended by manufacturer before installing compression seals.
- E. Precompressed Foam Parking Deck Expansion Joint Seals:
1. Install each length of seal immediately after removing protective wrapping.
 2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
 3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
 4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.
- F. Epoxy-Bonded Seals: Pressurize seal for time period and to pressure recommended by manufacturer. Do not overpressurize.
- G. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.
- H. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.
- I. Elastomeric Concrete: Install according to manufacturer's written application instructions.
- J. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work, so complete assemblies comply with performance requirements.
1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.
- K. Moisture Barrier Drainage: If indicated, provide drainage fittings and connect to drains.
- 3.4 PROTECTION
- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
- B. Protect the installation from damage by work of other Sections. Where necessary due to heavy



construction traffic, remove and properly store cover plates or seals, and install temporary protection over expansion joint cover assemblies. Reinstall cover plates or seals prior to Substantial Completion.

END OF SECTION 07 95 13 00



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SECTION 07 95 13 13 - INTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Floor expansion joint covers.
2. Wall expansion joint covers.
3. Ceiling expansion joint covers.

1.2 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.

1. Floor expansion joint covers.
2. Wall expansion joint covers.
3. Ceiling expansion joint covers.

B. Shop Drawings: For each expansion joint cover assembly.

1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples: For each expansion joint cover assembly and for each color and texture specified, full width by **6 inches (150 mm)** long in size.

D. Samples for Initial Selection: For each type of exposed finish.

1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric-seal material.

E. Samples for Verification: For each type of expansion joint cover assembly, full width by **6 inches (150 mm)** long in size.

F. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:

1. Manufacturer and model number for each expansion joint cover assembly.
2. Expansion joint cover assembly location cross-referenced to Drawings.
3. Nominal, minimum, and maximum joint width.
4. Movement direction.
5. Materials, colors, and finishes.
6. Product options.
7. Fire-resistance ratings.



1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by **[manufacturer and witnessed by a qualified testing agency][a qualified testing agency]**.

1.4 MOCKUPS

- A. Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Build mockup of typical expansion joint cover assembly as shown on Drawings.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Furnish units in longest practicable lengths to minimize field splicing.
- B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Expansion joint cover assemblies to withstand the effects of earthquake motions determined according to **[ASCE/SEI 7]<Insert requirement>**.
- B. Fire-Resistance Ratings: Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to **[UL 2079][or][ASTM E1966]** by a qualified testing agency.
 - 1. Hose Stream Test: Wall-to-wall and wall-to-ceiling assemblies to be subjected to hose stream testing.
- C. Expansion Joint Design Criteria :
 - 1. Type of Movement: **[Thermal][Wind sway]**.
 - a. Nominal Joint Width: **[As indicated on Drawings]<Insert width>**.
 - b. Minimum Joint Width: **[As indicated on Drawings]<Insert width>**.
 - c. Maximum Joint Width: **[As indicated on Drawings]<Insert width>**.
 - 2. Seismic Movement:
 - a. Joint Movement: As indicated on Drawings.

2.3 FLOOR EXPANSION JOINT COVERS

A. Metal-Plate Floor Joint Cover : Metal cover plate fixed on one side of joint gap and free to slide on other.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[Erie Metal Specialties, Inc.]**
 - e. **[inpro Corporation]**
 - f. **[MM Systems Corporation]**
 - g. **[Nystrom, Inc.]**
 - h. **[Watson Bowman Acme Corp.]**
 - i. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[Erie Metal Specialties, Inc.]**
 - e. **[inpro Corporation]**
 - f. **[MM Systems Corporation]**
 - g. **[Nystrom, Inc.]**
 - h. **[Watson Bowman Acme Corp.]**
 - i. **<Insert manufacturer's name>**
3. Application: **[Floor to floor][Floor to wall]**.
4. Installation: Surface mounted.
5. Load Capacity:
 - a. Uniform Load: **[50 lb/sq. ft. (244 kg/sq. m)]<Insert load>**.
 - b. Concentrated Load: **[300 lb (136 kg)]<Insert load>**.
 - c. Maximum Deflection: **[0.0625 inch (1.6 mm)]<Insert deflection>**.
6. Fire-Resistance Rating: Not less than **[that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>**.
7. Cover-Plate Design: **[Plain][Serrated][Abrasive covered]**.
8. Exposed Metal:
 - a. Aluminum: **[Mill][Clear anodic, Class I][Clear anodic, Class II][Color anodic, Class I][Color anodic, Class II][Manufacturer's standard]<Insert finish>**.
 - 1) Color: **[Light bronze][Dark bronze][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
 - b. Stainless Steel: **[No. 2B][No. 4][Manufacturer's standard]<Insert finish>**.
 - c. Bronze: **[Mill][Manufacturer's standard]<Insert finish>**.
 - d. Brass: **[Mill][Manufacturer's standard]<Insert finish>**.

- B. Center-Plate Floor Joint Cover : Assembly consisting of center plate that slides over metal frames fixed to sides of joint gaps.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[inpro Corporation]**
 - e. **[MM Systems Corporation]**
 - f. **[Nystrom, Inc.]**
 - g. **[Watson Bowman Acme Corp.]**
 - h. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[inpro Corporation]**
 - e. **[MM Systems Corporation]**
 - f. **[Nystrom, Inc.]**
 - g. **[Watson Bowman Acme Corp.]**
 - h. **<Insert manufacturer's name>**
 3. Application: **[Floor to floor][Floor to wall]**.
 4. Installation: **[Surface mounted][Recessed][No bump]**.
 5. Load Capacity:
 - a. Uniform Load: **[50 lb/sq. ft. (244 kg/sq. m)]<Insert load>**.
 - b. Concentrated Load: **[300 lb (136 kg)]<Insert load>**.
 - c. Maximum Deflection: **[0.0625 inch (1.6 mm)]<Insert deflection>**.
 6. Fire-Resistance Rating: Not less than **[that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>**.
 7. Cover-Plate Design: **[Plain][Serrated][Abrasive covered]**.
 8. Exposed Metal:
 - a. Aluminum: **[Mill][Clear anodic, Class I][Clear anodic, Class II][Color anodic, Class I][Color anodic, Class II][Manufacturer's standard]<Insert finish>**.
 - 1) Color: **[Light bronze][Dark bronze][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
 - b. Stainless Steel: **[No. 2B][No. 4][Manufacturer's standard]<Insert finish>**.
 - c. Bronze: **[Mill][Manufacturer's standard]<Insert finish>**.
 - d. Brass: **[Mill][Manufacturer's standard]<Insert finish>**.
- C. Glide-Plate Floor Joint Cover : Assembly consisting of center plate that slides in and out of slots in metal frames fixed to sides of joint gap.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[Erie Metal Specialties, Inc.]**
 - e. **[inpro Corporation]**
 - f. **[MM Systems Corporation]**
 - g. **[Nystrom, Inc.]**
 - h. **[Watson Bowman Acme Corp.]**
 - i. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[Erie Metal Specialties, Inc.]**
 - e. **[inpro Corporation]**
 - f. **[MM Systems Corporation]**
 - g. **[Nystrom, Inc.]**
 - h. **[Watson Bowman Acme Corp.]**
 - i. **<Insert manufacturer's name>**
 3. Application: **[Floor to floor][Floor to wall]**.
 4. Installation: Recessed.
 5. Load Capacity:
 - a. Uniform Load: **[50 lb/sq. ft. (244 kg/sq. m)]<Insert load>**.
 - b. Concentrated Load: **[300 lb (136 kg)]<Insert load>**.
 - c. Maximum Deflection: **[0.0625 inch (1.6 mm)]<Insert deflection>**.
 6. Fire-Resistance Rating: Not less than **[that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>**.
 7. Exposed Metal:
 - a. Aluminum: **[Mill][Clear anodic, Class I][Clear anodic, Class II][Color anodic, Class I][Color anodic, Class II][Manufacturer's standard]<Insert finish>**.
 - 1) Color: **[Light bronze][Dark bronze][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
 - b. Stainless Steel: **[No. 2B][No. 4][Manufacturer's standard]<Insert finish>**.
 - c. Bronze: **[Mill][Manufacturer's standard]<Insert finish>**.
 - d. Brass: **[Mill][Manufacturer's standard]<Insert finish>**.
- D. Hidden-Sightline Floor Joint Cover : Sliding leaf-spring and metal frame assembly designed to accept field-applied finish materials on visible surfaces for minimum frame exposure.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering**

products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Balco; a CSW Industrials Company]
- b. [Construction Specialties, Inc.]
- c. [inpro Corporation]
- d. [MM Systems Corporation]
- e. [Nystrom, Inc.]
- f. [Watson Bowman Acme Corp.]
- g. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Balco; a CSW Industrials Company]
- b. [Construction Specialties, Inc.]
- c. [inpro Corporation]
- d. [MM Systems Corporation]
- e. [Nystrom, Inc.]
- f. [Watson Bowman Acme Corp.]
- g. <Insert manufacturer's name>

3. Application: [Floor to floor][Floor to wall].

4. Installation: Recessed.

5. Load Capacity:

- a. Uniform Load: [50 lb/sq. ft. (244 kg/sq. m)]<Insert load>.
- b. Concentrated Load: [300 lb (136 kg)]<Insert load>.
- c. Maximum Deflection: [0.0625 inch (1.6 mm)]<Insert deflection>.

6. Fire-Resistance Rating: Not less than [that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>.

- E. Seismic-Pan Floor Joint Cover : Seismic pan assembly with sloped sides allowing extension of unit above floor plane during joint contraction, and equipped with springs to return unit back into alignment during joint expansion. Provide manufacturer's recommended sealant at pan edge.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]
- b. [Balco; a CSW Industrials Company]
- c. [Construction Specialties, Inc.]
- d. [inpro Corporation]
- e. [Nystrom, Inc.]
- f. [Watson Bowman Acme Corp.]
- g. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]
 - b. [Balco; a CSW Industrials Company]
 - c. [Construction Specialties, Inc.]
 - d. [inpro Corporation]
 - e. [Nystrom, Inc.]
 - f. [Watson Bowman Acme Corp.]
 - g. <Insert manufacturer's name>
3. Application: [Floor to floor][Floor to wall].
 4. Installation: Recessed.
 5. Load Capacity:
 - a. Uniform Load: [50 lb/sq. ft. (244 kg/sq. m)]<Insert load>.
 - b. Concentrated Load: [300 lb (136 kg)]<Insert load>.
 - c. Maximum Deflection: [0.0625 inch (1.6 mm)]<Insert deflection>.
 6. Fire-Resistance Rating: Not less than [that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>.
 7. Pan Recess Depth: [As required to accommodate adjacent flooring][1 inch (25 mm)][1-1/2 inch (38 mm)]<Insert depth>.
- F. Elastomeric-Seal Floor Joint Cover : Assembly consisting of elastomeric seal anchored to frames fixed to sides of joint gap.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]
 - b. [Balco; a CSW Industrials Company]
 - c. [Construction Specialties, Inc.]
 - d. [EMSEAL; a Sika Company]
 - e. [Erie Metal Specialties, Inc.]
 - f. [inpro Corporation]
 - g. [MM Systems Corporation]
 - h. [Nystrom, Inc.]
 - i. [Watson Bowman Acme Corp.]
 - j. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]
 - b. [Balco; a CSW Industrials Company]
 - c. [Construction Specialties, Inc.]
 - d. [EMSEAL; a Sika Company]
 - e. [Erie Metal Specialties, Inc.]
 - f. [inpro Corporation]
 - g. [MM Systems Corporation]
 - h. [Nystrom, Inc.]
 - i. [Watson Bowman Acme Corp.]
 - j. <Insert manufacturer's name>
 3. Application: [Floor to floor][Floor to wall].

4. Installation: **[Surface mounted][Recessed]**.
 5. Load Capacity:
 - a. Uniform Load: **[50 lb/sq. ft. (244 kg/sq. m)]<Insert load>**.
 - b. Concentrated Load: **[300 lb (136 kg)]<Insert load>**.
 - c. Maximum Deflection: **[0.0625 inch (1.6 mm)]<Insert deflection>**.
 6. Fire-Resistance Rating: Not less than **[that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>**.
 7. Exposed Metal:
 - a. Aluminum: **[Mill][Clear anodic, Class I][Clear anodic, Class II][Color anodic, Class I][Color anodic, Class II][Manufacturer's standard]<Insert finish>**.
 - 1) Color: **[Light bronze][Dark bronze][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
 - b. Stainless Steel: **[No. 2B][No. 4][Manufacturer's standard]<Insert finish>**.
 - c. Bronze: **[Mill][Manufacturer's standard]<Insert finish>**.
 - d. Brass: **[Mill][Manufacturer's standard]<Insert finish>**.
 8. Seal: Preformed elastomeric membrane or extrusion.
 - a. Color: **[Black][Gray][As selected by Architect from manufacturer's full range]<Insert color>**.
- G. Dual-Elastomeric-Seal Floor Joint Cover: Assembly consisting of dual-elastomeric seals and center plate anchored to frames fixed to sides of joint gap.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[inpro Corporation]**
 - e. **[MM Systems Corporation]**
 - f. **[Nystrom, Inc.]**
 - g. **[Watson Bowman Acme Corp.]**
 - h. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[inpro Corporation]**
 - e. **[MM Systems Corporation]**
 - f. **[Nystrom, Inc.]**
 - g. **[Watson Bowman Acme Corp.]**
 - h. **<Insert manufacturer's name>**

3. Application: **[Floor to floor][Floor to wall]**.
4. Installation: Recessed.
5. Load Capacity:
 - a. Uniform Load: **[50 lb/sq. ft. (244 kg/sq. m)]<Insert load>**.
 - b. Concentrated Load: **[300 lb (136 kg)]<Insert load>**.
 - c. Maximum Deflection: **[0.0625 inch (1.6 mm)]<Insert deflection>**.
6. Fire-Resistance Rating: Not less than **[that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>**.
7. Center-Plate Design: **[Plain][Serrated][Recessed to accept field-applied finish materials]**.
 - a. Center-Plate Recess Depth: **[As required to accommodate adjacent flooring][1/8 inch (3 mm)][3/8 inch (10 mm)]<Insert depth>**.
8. Exposed Metal:
 - a. Aluminum: **[Mill][Clear anodic, Class I][Clear anodic, Class II][Color anodic, Class I][Color anodic, Class II][Manufacturer's standard]<Insert finish>**.
 - 1) Color: **[Light bronze][Dark bronze][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
 - b. Stainless Steel: **[No. 2B][No. 4][Manufacturer's standard]<Insert finish>**.
 - c. Bronze: **[Mill][Manufacturer's standard]<Insert finish>**.
 - d. Brass: **[Mill][Manufacturer's standard]<Insert finish>**.
9. Seal: Preformed elastomeric membranes or extrusions.
 - a. Color: **[Black][Gray][As selected by Architect from manufacturer's full range]<Insert color>**.

2.4 WALL EXPANSION JOINT COVERS

- A. Metal-Plate Wall Joint Cover : Metal cover plate fixed on one side of joint gap and free to slide on other.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[Erie Metal Specialties, Inc.]**
 - e. **[inpro Corporation]**
 - f. **[MM Systems Corporation]**
 - g. **[Nystrom, Inc.]**
 - h. **[Watson Bowman Acme Corp.]**
 - i. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. [Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]
 - b. [Balco; a CSW Industrials Company]
 - c. [Construction Specialties, Inc.]
 - d. [Erie Metal Specialties, Inc.]
 - e. [inpro Corporation]
 - f. [MM Systems Corporation]
 - g. [Nystrom, Inc.]
 - h. [Watson Bowman Acme Corp.]
 - i. <Insert manufacturer's name>
3. Application: [Wall to wall][Wall to corner].
 4. Fire-Resistance Rating: Not less than [that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>.
 5. Exposed Metal:
 - a. Aluminum: [Mill][Clear anodic, Class I][Clear anodic, Class II][Color anodic, Class I][Color anodic, Class II][Manufacturer's standard]<Insert finish>.
 - 1) Color: [Light bronze][Dark bronze][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>.
 - b. Stainless Steel: [No. 2B][No. 4][Manufacturer's standard]<Insert finish>.
 - c. Bronze: [Mill][Manufacturer's standard]<Insert finish>.
 - d. Brass: [Mill][Manufacturer's standard]<Insert finish>.
- B. Center-Plate Wall Joint Cover : Assembly consisting of center plate that slides over gaskets in metal frames fixed to sides of joint gaps.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]
 - b. [Balco; a CSW Industrials Company]
 - c. [Construction Specialties, Inc.]
 - d. [inpro Corporation]
 - e. [MM Systems Corporation]
 - f. [Nystrom, Inc.]
 - g. [Watson Bowman Acme Corp.]
 - h. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]
 - b. [Balco; a CSW Industrials Company]
 - c. [Construction Specialties, Inc.]
 - d. [inpro Corporation]
 - e. [MM Systems Corporation]
 - f. [Nystrom, Inc.]
 - g. [Watson Bowman Acme Corp.]
 - h. <Insert manufacturer's name>

3. Application: **[Wall to wall][Wall to corner]**.
 4. Fire-Resistance Rating: Not less than **[that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>**.
 5. Exposed Metal:
 - a. Aluminum: **[Mill][Clear anodic, Class I][Clear anodic, Class II][Color anodic, Class I][Color anodic, Class II][Manufacturer's standard]<Insert finish>**.
 - 1) Color: **[Light bronze][Dark bronze][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
 - b. Stainless Steel: **[No. 2B][No. 4][Manufacturer's standard]<Insert finish>**.
 - c. Bronze: **[Mill][Manufacturer's standard]<Insert finish>**.
 - d. Brass: **[Mill][Manufacturer's standard]<Insert finish>**.
- C. Glide-Plate Wall Joint Cover : Assembly consisting of center plate that slides in and out of slots in metal frames fixed to sides of joint gap.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[Erie Metal Specialties, Inc.]**
 - e. **[inpro Corporation]**
 - f. **[MM Systems Corporation]**
 - g. **[Nystrom, Inc.]**
 - h. **[Watson Bowman Acme Corp.]**
 - i. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[Erie Metal Specialties, Inc.]**
 - e. **[inpro Corporation]**
 - f. **[MM Systems Corporation]**
 - g. **[Nystrom, Inc.]**
 - h. **[Watson Bowman Acme Corp.]**
 - i. **<Insert manufacturer's name>**
 3. Application: **[Wall to wall][Wall to corner]**.
 4. Fire-Resistance Rating: Not less than **[that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>**.
 5. Exposed Metal:
 - a. Aluminum: **[Mill][Clear anodic, Class I][Clear anodic, Class II][Color anodic, Class I][Color anodic, Class II][Manufacturer's standard]<Insert finish>**.
 - 1) Color: **[Light bronze][Dark bronze][Match Architect's sample][As selected by**

Architect from full range of industry colors and color densities]<Insert color>.

- b. Stainless Steel: **[No. 2B][No. 4][Manufacturer's standard]<Insert finish>.**
- c. Bronze: **[Mill][Manufacturer's standard]<Insert finish>.**
- d. Brass: **[Mill][Manufacturer's standard]<Insert finish>.**

D. Elastomeric-Seal Wall Joint Cover : Assembly consisting of elastomeric seal anchored to frames fixed to sides of joint gap.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[Erie Metal Specialties, Inc.]**
 - e. **[inpro Corporation]**
 - f. **[MM Systems Corporation]**
 - g. **[Nystrom, Inc.]**
 - h. **[Watson Bowman Acme Corp.]**
 - i. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[Erie Metal Specialties, Inc.]**
 - e. **[inpro Corporation]**
 - f. **[MM Systems Corporation]**
 - g. **[Nystrom, Inc.]**
 - h. **[Watson Bowman Acme Corp.]**
 - i. **<Insert manufacturer's name>**
3. Application: **[Wall to wall][Wall to corner].**
4. Fire-Resistance Rating: Not less than **[that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>.**
5. Exposed Metal:
 - a. Aluminum: **[Mill][Clear anodic, Class I][Clear anodic, Class II][Color anodic, Class I][Color anodic, Class II][Manufacturer's standard]<Insert finish>.**
 - 1) Color: **[Light bronze][Dark bronze][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>.**
 - b. Stainless Steel: **[No. 2B][No. 4][Manufacturer's standard]<Insert finish>.**
 - c. Bronze: **[Mill][Manufacturer's standard]<Insert finish>.**
 - d. Brass: **[Mill][Manufacturer's standard]<Insert finish>.**
6. Seal: Preformed elastomeric membranes or extrusions.

- a. Color: **[Black][Gray][As selected by Architect from manufacturer's full range]<Insert color>**.
- E. Dual-Elastomeric-Seal Wall Joint Cover: Assembly consisting of dual-elastomeric seals and center plate anchored to frames fixed to sides of joint gap.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[inpro Corporation]**
 - e. **[MM Systems Corporation]**
 - f. **[Nystrom, Inc.]**
 - g. **[Watson Bowman Acme Corp.]**
 - h. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[inpro Corporation]**
 - e. **[MM Systems Corporation]**
 - f. **[Nystrom, Inc.]**
 - g. **[Watson Bowman Acme Corp.]**
 - h. **<Insert manufacturer's name>**
 3. Application: **[Wall to wall][Wall to corner]**.
 4. Fire-Resistance Rating: Not less than **[that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>**.
 5. Center-Plate Design: **[Plain][Recessed to accept gypsum board][Recessed to accept wall tile]**.
 6. Exposed Metal:
 - a. Aluminum: **[Mill][Clear anodic, Class I][Clear anodic, Class II][Color anodic, Class I][Color anodic, Class II][Manufacturer's standard]<Insert finish>**.
 - 1) Color: **[Light bronze][Dark bronze][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
 - b. Stainless Steel: **[No. 2B][No. 4][Manufacturer's standard]<Insert finish>**.
 - c. Bronze: **[Mill][Manufacturer's standard]<Insert finish>**.
 - d. Brass: **[Mill][Manufacturer's standard]<Insert finish>**.
 7. Seal: Preformed elastomeric membranes or extrusions.
 - a. Color: **[Black][Gray][As selected by Architect from manufacturer's full range]<Insert color>**.

2.5 CEILING EXPANSION JOINT COVERS

- A. Metal-Plate Ceiling Joint Cover : Metal cover plate fixed on one side of joint gap and free to slide on other.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[inpro Corporation]**
 - e. **[MM Systems Corporation]**
 - f. **[Nystrom, Inc.]**
 - g. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[inpro Corporation]**
 - e. **[MM Systems Corporation]**
 - f. **[Nystrom, Inc.]**
 - g. **<Insert manufacturer's name>**
 3. Application: **[Ceiling to ceiling][Wall to ceiling]**.
 4. Fire-Resistance Rating: Not less than **[that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>**.
 5. Exposed Metal:
 - a. Aluminum: **[Mill][Clear anodic, Class I][Clear anodic, Class II][Color anodic, Class I][Color anodic, Class II][Manufacturer's standard]<Insert finish>**.
 - 1) Color: **[Light bronze][Dark bronze][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
 - b. Stainless Steel: **[No. 2B][No. 4][Manufacturer's standard]<Insert finish>**.
 - c. Bronze: **[Mill][Manufacturer's standard]<Insert finish>**.
 - d. Brass: **[Mill][Manufacturer's standard]<Insert finish>**.
- B. Center-Plate Ceiling Joint Cover : Assembly consisting of center plate that slides over gasket in metal frames fixed to sides of joint gaps.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**

- c. [Construction Specialties, Inc.]
 - d. [inpro Corporation]
 - e. [Nystrom, Inc.]
 - f. [Watson Bowman Acme Corp.]
 - g. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]
 - b. [Balco; a CSW Industrials Company]
 - c. [Construction Specialties, Inc.]
 - d. [inpro Corporation]
 - e. [Nystrom, Inc.]
 - f. [Watson Bowman Acme Corp.]
 - g. <Insert manufacturer's name>
3. Application: [Ceiling to ceiling][Wall to ceiling].
4. Fire-Resistance Rating: Not less than [that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>.
5. Exposed Metal:
- a. Aluminum: [Mill][Clear anodic, Class I][Clear anodic, Class II][Color anodic, Class I][Color anodic, Class II][Manufacturer's standard]<Insert finish>.
 - 1) Color: [Light bronze][Dark bronze][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>.
 - b. Stainless Steel: [No. 2B][No. 4][Manufacturer's standard]<Insert finish>.
 - c. Bronze: [Mill][Manufacturer's standard]<Insert finish>.
 - d. Brass: [Mill][Manufacturer's standard]<Insert finish>.
- C. Glide-Plate Ceiling Joint Cover : Assembly consisting of center plate that slides in and out of slots in metal frames fixed to sides of joint gap.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- a. [Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]
 - b. [Balco; a CSW Industrials Company]
 - c. [Construction Specialties, Inc.]
 - d. [inpro Corporation]
 - e. [MM Systems Corporation]
 - f. [Nystrom, Inc.]
 - g. [Watson Bowman Acme Corp.]
 - h. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]
 - b. [Balco; a CSW Industrials Company]

- c. **[Construction Specialties, Inc.]**
 - d. **[inpro Corporation]**
 - e. **[MM Systems Corporation]**
 - f. **[Nystrom, Inc.]**
 - g. **[Watson Bowman Acme Corp.]**
 - h. **<Insert manufacturer's name>**
 3. Application: **[Ceiling to ceiling][Wall to ceiling]**.
 4. Fire-Resistance Rating: Not less than **[that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>**.
 5. Exposed Metal:
 - a. Aluminum: **[Mill][Clear anodic, Class I][Clear anodic, Class II][Color anodic, Class I][Color anodic, Class II][Manufacturer's standard]<Insert finish>**.
 - 1) Color: **[Light bronze][Dark bronze][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
 - b. Stainless Steel: **[No. 2B][No. 4][Manufacturer's standard]<Insert finish>**.
 - c. Bronze: **[Mill][Manufacturer's standard]<Insert finish>**.
 - d. Brass: **[Mill][Manufacturer's standard]<Insert finish>**.
- D. Elastomeric-Seal Ceiling Joint Cover : Assembly consisting of elastomeric seal anchored to frames fixed to sides of joint gap.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[Erie Metal Specialties, Inc.]**
 - e. **[inpro Corporation]**
 - f. **[MM Systems Corporation]**
 - g. **[Nystrom, Inc.]**
 - h. **[Watson Bowman Acme Corp.]**
 - i. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[Erie Metal Specialties, Inc.]**
 - e. **[inpro Corporation]**
 - f. **[MM Systems Corporation]**
 - g. **[Nystrom, Inc.]**
 - h. **[Watson Bowman Acme Corp.]**
 - i. **<Insert manufacturer's name>**
 3. Application: **[Ceiling to ceiling][Wall to ceiling]**.

4. Fire-Resistance Rating: Not less than [that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>.
 - a. Aluminum: [Mill][Clear anodic, Class I][Clear anodic, Class II][Color anodic, Class I][Color anodic, Class II][Manufacturer's standard]<Insert finish>.
 - 1) Color: [Light bronze][Dark bronze][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>.
 - b. Stainless Steel: [No. 2B][No. 4][Manufacturer's standard]<Insert finish>.
 - c. Bronze: [Mill][Manufacturer's standard]<Insert finish>.
 - d. Brass: [Mill][Manufacturer's standard]<Insert finish>.
 5. Seal: Preformed elastomeric membranes or extrusions.
 - a. Color: [Black][Gray][As selected by Architect from manufacturer's full range]<Insert color>.
- E. Dual-Elastomeric-Seal Ceiling Joint Cover: Assembly consisting of dual-elastomeric seals and center plate anchored to frames fixed to sides of joint gap.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]
 - b. [Balco; a CSW Industrials Company]
 - c. [Construction Specialties, Inc.]
 - d. [inpro Corporation]
 - e. [MM Systems Corporation]
 - f. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]
 - b. [Balco; a CSW Industrials Company]
 - c. [Construction Specialties, Inc.]
 - d. [inpro Corporation]
 - e. [MM Systems Corporation]
 - f. <Insert manufacturer's name>
 3. Application: [Wall to wall][Wall to corner].
 4. Fire-Resistance Rating: Not less than [that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>.
 5. Center-Plate Design: [Plain][Recessed to accept gypsum board][Recessed to accept wall tile].
 6. Exposed Metal:
 - a. Aluminum: [Mill][Clear anodic, Class I][Clear anodic, Class II][Color anodic, Class I][Color anodic, Class II][Manufacturer's standard]<Insert finish>.
 - 1) Color: [Light bronze][Dark bronze][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>.

- b. Stainless Steel: **[No. 2B][No. 4][Manufacturer's standard]<Insert finish>**.
 - c. Bronze: **[Mill][Manufacturer's standard]<Insert finish>**.
 - d. Brass: **[Mill][Manufacturer's standard]<Insert finish>**.
 7. Seal: Preformed elastomeric membranes or extrusions.
 - a. Color: **[Black][Gray][As selected by Architect from manufacturer's full range]<Insert color>**.
- F. Elastomeric-Seal Acoustical Ceiling Joint Cover : Elastomeric-seal assembly designed for use in acoustical ceilings.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[Erie Metal Specialties, Inc.]**
 - e. **[inpro Corporation]**
 - f. **[Nystrom, Inc.]**
 - g. **[Watson Bowman Acme Corp.]**
 - h. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[Erie Metal Specialties, Inc.]**
 - e. **[inpro Corporation]**
 - f. **[Nystrom, Inc.]**
 - g. **[Watson Bowman Acme Corp.]**
 - h. **<Insert manufacturer's name>**
 3. Application: **[Ceiling to ceiling][Wall to ceiling]**.
 4. Fire-Resistance Rating: Not less than **[that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>**.
 5. Exposed Metal:
 - a. Aluminum: **[Mill][Clear anodic, Class I][Clear anodic, Class II][Color anodic, Class I][Color anodic, Class II][Manufacturer's standard]<Insert finish>**.
 - 1) Color: **[Light bronze][Dark bronze][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
 - b. Stainless Steel: **[No. 2B][No. 4][Manufacturer's standard]<Insert finish>**.
 - c. Bronze: **[Mill][Manufacturer's standard]<Insert finish>**.
 - d. Brass: **[Mill][Manufacturer's standard]<Insert finish>**.
 6. Seal: Preformed elastomeric membranes or extrusions.

- a. Color: **[Black][Gray][As selected by Architect from manufacturer's full range]<Insert color>**.

2.6 MATERIALS

- A. Aluminum: **ASTM B221 (ASTM B221M)**, Alloy 6063-T5 for extrusions; **ASTM B209 (ASTM B209M)**, Alloy 6061-T6 for sheet and plate.
1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
- B. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304 for plates, sheet, and strips.
- C. Brass: ASTM B36/B36M, UNS Alloy C26000 for half hard sheet and coil.
- D. Bronze: ASTM B455, Alloy C38500 for extrusions; Alloy C23000 red brass for plates.
- E. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.
- F. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.
- G. Moisture Barrier: Manufacturer's standard, flexible elastomeric material.
- H. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 ALUMINUM FINISHES

- A. Mill finish.
- B. Clear Anodic Finish: AAMA 611, **[AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm]** or thicker.
- C. Color Anodic Finish: AAMA 611, **[AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm]** or thicker.

2.8 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Directional Satin Finish: No. 4.
- C. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

2.9 COPPER-ALLOY FINISHES

- A. Buffed Finish: M21 (Mechanical Finish: buffed, smooth specular).
- B. Medium-Satin Finish: M32 (Mechanical Finish: directionally textured, medium satin).

2.10 ACCESSORIES

- A. Moisture Barriers: Manufacturer's standard continuous, waterproof membrane within joint and attached to substrate on sides of joint.
 - 1. Provide where indicated on Drawings.
- B. Manufacturer's **[standard][stainless steel]** attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.
- B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.
- B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.
- B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.
 - 1. Repair or grout block out as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
 - 2. Install frames in continuous contact with adjacent surfaces.
 - a. Shimming is not permitted.

3. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 4. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
 5. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
 6. Locate anchors at interval recommended by manufacturer, but not less than **3 inches (75 mm)** from each end and not more than **24 inches (600 mm)** o.c.
- C. Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
1. Provide in continuous lengths for straight sections.
 2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
 3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- D. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.
- E. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.
- F. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.
1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.
- G. Moisture Barrier Drainage: If indicated, provide drainage fittings and connect to drains.

3.4 PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
- B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion joint cover assemblies. Reinstall cover plates or seals prior to Substantial Completion.

END OF SECTION 07 95 13 13



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07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 95 13 13	07 95 13 00	Parking Deck Expansion Joint Cover Assemblies



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SECTION 07 95 13 16 - MANUFACTURED ROOF EXPANSION JOINTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flanged bellows-type roof expansion joints.
2. Extruded bellows roof expansion joints.
3. Aluminum roof expansion joints.
4. Preformed foam sealant-type roof expansion joints.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wooden curbs or cants for mounting roof expansion joints.
2. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-fabricated sheet metal expansion-joint systems, flashing, and other sheet metal items.
3. Section 077200 "Roof Accessories" for manufactured and prefabricated metal roof curbs.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference:** Conduct conference at **[Project site]<Insert location>**.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Flanged bellows-type roof expansion joints.
2. Extruded bellows roof expansion joints.
3. Aluminum roof expansion joints.
4. Preformed foam sealant-type roof expansion joints.

B. Shop Drawings: For roof expansion joints.

1. Include plans, elevations, sections, and attachment details.
2. Include details of splices, intersections, transitions, fittings, method of field assembly, and location and size of each field splice.
3. Provide isometric drawings of intersections, terminations, changes in joint direction or planes, and transition to other expansion joint systems depicting how components interconnect with each other and adjacent construction to allow movement and achieve waterproof continuity.

- C. Samples:** For each exposed product and for each color specified, **6 inches (150 mm)** in size.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data:** For Installer.

- B. Product Test Reports:** For each fire-barrier provided as part of a roof-expansion-joint assembly, for tests

performed by a qualified testing agency.

- C. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer of roofing membrane.

1.6 WARRANTY

- A. Special Warranty: Manufacturer and Installer agree to repair or replace roof expansion joints and components that leak, deteriorate beyond normal weathering, or otherwise fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion.
- B. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof expansion joints that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: **[10][20]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint seals, failure of connections, and other detrimental effects.
 - 1. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C)]<Insert temperature change>**, material surfaces.
- B. Fire-Resistance Rating: Comply with ASTM E1966 or UL 2079; testing by a qualified testing agency to resist the spread of fire and to accommodate building thermal[**and seismic**] movements without impairing its ability to resist the passage of fire and hot gases. Identify products with appropriate markings of applicable testing agency.
 - 1. Rating: Not less than **[1-hour][2-hour][fire-resistance rating of the roof assembly]<Insert rating>**.
 - 2. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 FLANGED BELLOWS-TYPE ROOF EXPANSION JOINTS

- A. Flanged Bellows-Type Roof Expansion Joint : Factory-fabricated, continuous, waterproof, joint cover consisting of exposed membrane bellows laminated to flexible, closed-cell support foam, and secured along each edge to **3- to 4-inch- (76- to 100-mm-)** wide metal flange.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[inpro Corporation]**
 - e. **[Johns Manville; a Berkshire Hathaway company]**
 - f. **[MM Systems Corporation]**
 - g. **[Nystrom, Inc.]**
 - h. **[Watson Bowman Acme Corp.]**
 - i. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[inpro Corporation]**
 - e. **[Johns Manville; a Berkshire Hathaway company]**
 - f. **[MM Systems Corporation]**
 - g. **[Nystrom, Inc.]**
 - h. **[Watson Bowman Acme Corp.]**
 - i. **<Insert manufacturer's name>**
 3. Source Limitations: Obtain flanged bellows-type roof expansion joints approved by roofing manufacturer and that are part of roofing membrane warranty.
 4. Joint Movement Capability: Plus and minus **[25 percent of joint size][50 percent of joint size][As indicated on Drawings]<Insert dimension or percentage>**.
 5. Bellows: **[EPDM][Neoprene][PVC]<Insert material>** flexible membrane, nominal **[60 mils (1.5 mm)]<Insert thickness>** thick.
 6. Flanges: **[Galvanized steel, 0.022 inch (0.56 mm) thick][Copper, 16 oz./sq. ft. (0.55 mm) thick][Stainless steel, 0.0188 inch (0.477 mm) thick][Aluminum, 0.032 inch (0.81 mm) thick]<Insert requirement>**.
 7. Configuration: **[Flat to fit cants][Angle formed to fit curbs]<Insert requirement>** as indicated on Drawings.
 8. Corner, Intersection, and Transition Units: Provide factory-fabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints.
 9. Cover Membrane: **[EPDM][Neoprene][PVC]<Insert material>** flexible membrane, factory laminated to bellows and covering entire joint assembly and curbs.
 - a. Color: **[Black][White]<Insert color>**.
 10. Accessories: Provide splicing units, adhesives, and other components as recommended by roof-expansion-joint manufacturer for complete installation.

11. Secondary Seal: Continuous, waterproof membrane within joint and attached to substrate on sides of joint below the primary bellows assembly.
 - a. Drain-Tube Assemblies: Equip secondary seal with drain tubes and seals to direct collected moisture **[to drain][to exterior-wall expansion joint cover][as indicated on Drawings]<Insert requirement>**.
 - b. Thermal Insulation: Fill space above secondary seal with **[mineral-fiber blanket][manufacturer's standard, factory-installed mineral-fiber]<Insert requirement>** insulation; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84.

12. Fire Barrier: Manufacturer's standard fire barrier for fire-resistance-rated expansion joint system.

B. Materials:

1. Galvanized-Steel Sheet: ASTM A653/A653M, hot-dip zinc-coating designation **G90 (Z275)**.
2. Copper Sheet: ASTM B370, cold-rolled copper sheet, H00 or H01 temper.
3. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
4. Aluminum Sheet: **ASTM B209 (ASTM B209M)**, mill finish, with temper to suit forming operations and performance required.
 - a. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious or preservative-treated wood materials.
5. EPDM Membrane: ASTM D4637/D4637M, type standard with manufacturer for application.
6. Neoprene Membrane: Neoprene sheet recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil; and as standard with roof-expansion-joint manufacturer for application.
7. PVC Membrane: ASTM D4434/D4434M, type standard with manufacturer for application.

2.3 EXTRUDED BELLOWS ROOF EXPANSION JOINTS

- A. Extruded Bellows Roof Expansion Joint: Manufactured, continuous, waterproof, joint cover assembly; consisting of primary and secondary, single-layered, elastomeric seals; secured along each edge with extruded-aluminum retainers for fastening to substrate.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Balco; a CSW Industrials Company]**
 - b. **[MM Systems Corporation]**
 - c. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Balco; a CSW Industrials Company]**
 - b. **[MM Systems Corporation]**
 - c. **<Insert manufacturer's name>**
3. Joint Movement Capability: Plus and minus **[25 percent of joint size][50 percent of joint**

- size**[As indicated on Drawings]<Insert dimension or percentage>.
4. Primary Seal: Silicone extrusion; color: **[Black][White][Bronze][Sandstone][Gray]**[As selected by Architect from manufacturer's full range]<Insert color>.
 5. Secondary Seal: EPDM, or manufacturer's standard elastomeric seal.
 6. Drain-Tube Assemblies: Equip secondary seal with drain tubes and seals to direct collected moisture **[to drain][to exterior-wall expansion joint cover]**[as indicated on Drawings]<Insert requirement>.
 7. Corner, Intersection, and Transition Units: Provide factory-fabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints.

B. Materials:

1. Aluminum: **ASTM B221 (ASTM B221M)** for extrusions; mill finish, with temper to suit forming operations and performance required.
 - a. Apply manufacturer's standard protective coating on aluminum surfaces in contact with cementitious or preservative-treated wood materials.
2. Silicone Extrusions: ASTM D2000, UV stabilized, and that does not propagate flame.
3. EPDM Membrane: ASTM D4637, type standard with manufacturer for application.

2.4 ALUMINUM ROOF EXPANSION JOINTS

- A. Aluminum Roof Expansion Joint: Factory-fabricated, continuous, waterproof, joint cover; consisting of a formed or extruded metal cover secured to extruded aluminum frames, with water-resistant gasketing between cover and frames, and with provision for securing assembly to substrate and sealing assembly to roofing membrane or flashing.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[inpro Corporation]**
 - e. **[MM Systems Corporation]**
 - f. **[Nystrom, Inc.]**
 - g. **[Watson Bowman Acme Corp.]**
 - h. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[inpro Corporation]**
 - e. **[MM Systems Corporation]**
 - f. **[Nystrom, Inc.]**
 - g. **[Watson Bowman Acme Corp.]**
 - h. **<Insert manufacturer's name>**

3. Joint Movement Capability: Plus and minus [25 percent of joint size][50 percent of joint size][As indicated on Drawings]<Insert dimension or percentage>.
4. Frame Members: Extruded aluminum configured [for curbs][for sloped cants][with integral aluminum curb]<Insert requirement> as indicated; with exposed finish [matching cover][as selected by Architect from manufacturer's full range]<Insert requirement>.
5. Cover: [Formed aluminum][Extruded aluminum][Formed or extruded aluminum][Stainless steel]<Insert material>; thickness [as recommended by manufacturer]<Insert thickness>.
6. Centering Devices: [Centering bars][Snap-on spring clips attached to the cover]<Insert item>.
7. Corner, Intersection, and Transition Units: Provide factory-fabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints.
8. Accessories: Provide splicing units, adhesives, and other components as recommended by roof-expansion-joint manufacturer for complete installation.
9. Secondary Seal: Continuous, waterproof membrane within joint and attached to substrate on sides of joint below the cover.
 - a. Drain-Tube Assemblies: Equip secondary seal with drain tubes and seals to direct collected moisture [to drain][to exterior-wall expansion joint cover][as indicated on Drawings]<Insert requirement>.
 - b. Thermal Insulation: Fill space above secondary seal with [mineral-fiber blanket]<Insert requirement> insulation; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84.
10. Fire Barrier: Manufacturer's standard fire barrier for fire-resistance-rated expansion joint system.

B. Materials:

1. Aluminum: **ASTM B209 (ASTM B209M)** for sheet and plate, **ASTM B221 (ASTM B221M)** for extrusions; alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
 - a. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious or preservative-treated wood materials.
 - b. Mill Finish: As manufactured.
 - c. Class II, Clear Anodic Finish: Architectural Class II, clear coating 0.010 mm or thicker, complying with AAMA 611.
 - d. Class I, Clear Anodic Finish: Architectural Class I, clear coating 0.018 mm or thicker, complying with AAMA 611.
 - e. Class I, Color Anodic Finish: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker, complying with AAMA 611.
 - f. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1) Two-Coat Fluoropolymer: System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
 - 2) Three-Coat Fluoropolymer: System consisting of primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent PVDF resin by weight.
 - g. Aluminum Finish Color: [Light bronze][Medium bronze][Dark bronze][As indicated by manufacturer's designations][As selected by Architect from manufacturer's full range]<Insert requirement>.
2. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304; finish ASTM A480/A480M

No. 2B.

2.5 PREFORMED FOAM SEALANT-TYPE ROOF EXPANSION JOINTS

- A. Preformed Sealant-Type Roof Expansion Joint : Factory-fabricated, continuous, waterproof, UV stable expansion joint consisting of exposed silicone cap laminated to each side of **[fire-retardant-impregnated]** polyurethane foam sealant.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Willseal LLC, part of Tremco CPG]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Willseal LLC, part of Tremco CPG]**
 - b. **<Insert manufacturer's name>**
 3. Source Limitations: Obtain preformed sealant-type roof expansion joints approved by roofing manufacturer and that are part of roofing membrane warranty.
 4. Joint Movement Capability: Plus and minus **[25 percent of joint size][50 percent of joint size][As indicated on Drawings]<Insert dimension or percentage>**.
 5. Corner, Intersection, and Transition Units: Provide factory-fabricated units for corner and joint intersections and horizontal and vertical transitions, including those to other building expansion joints.
 6. Facing: **[Uncoated][Coated on one side][Coated on both sides]**.
 - a. Color: **<Insert color>**.
 7. Accessories: Provide adhesives and other components as recommended by roof-expansion-joint manufacturer for complete installation.
 8. Edge and Splice Sealant: Manufacturer's standard silicone sealant for finishing edges and splice seams.
- B. Materials:
1. Foam: Polyurethane foam impregnated with fire-retardant acrylic polymers.
 2. Silicone Facings: ASTM C920, ultra-low-modulus, one-part, neutral-cure silicone sealant, UV stabilized, and that does not propagate flame.

2.6 MISCELLANEOUS MATERIALS

- A. Adhesives: As recommended by roof-expansion-joint manufacturer.
1. Adhesives shall have a VOC content of **[70]<Insert value>** g/L or less.
 2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 3. Adhesive shall comply with the testing and product requirements of the California Department of

Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

4. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 5. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 6. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.
1. Exposed Fasteners: Gasketed. Use screws with hex washer heads matching color of material being fastened.
- C. Mineral-Fiber Blanket: ASTM C665.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joint openings, substrates, and expansion-control joint systems that interface with roof expansion joints, for suitable conditions where roof expansion joints will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions for handling and installing roof expansion joints.
 1. Anchor roof expansion joints securely in place, with provisions for required movement. Use fasteners, protective coatings, sealants, and miscellaneous items as required to complete roof expansion joints.
 2. Install roof expansion joints true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 3. Provide for linear thermal expansion of roof-expansion-joint materials.
 4. Provide uniform profile of roof expansion joint throughout its length; do not stretch or squeeze membranes.
 5. Provide uniform, neat seams.
 6. Install roof expansion joints to fit substrates and to result in watertight performance.
- B. Directional Changes: Install factory-fabricated units at directional changes to provide continuous, uninterrupted, and watertight joints.

- C. Transitions to Other Expansion-Control Joint Assemblies: Coordinate installation of roof expansion joints with other exterior expansion-control joint assemblies specified in Section 079513.16 "Exterior Expansion Joint Cover Assemblies" to result in watertight performance. [**Install factory-fabricated units at transitions between roof expansion joints and exterior expansion-control joint systems.**]
- D. Splices: Splice roof expansion joints to provide continuous, uninterrupted, and waterproof joints.
 - 1. Install waterproof splices and prefabricated end dams to prevent leakage of secondary-seal membrane.
- E. Fire Barrier: Install fire barrier as required by manufacturer to provide continuous, uninterrupted fire resistance throughout length of roof expansion joint, including transitions and end joints.
- F. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

END OF SECTION 07 95 13 16



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SECTION 07 95 13 16A - EXTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior expansion joint covers.

B. Related Requirements:

1. Section 077129 "Manufactured Roof Expansion Joints" for factory-fabricated roof expansion joint cover assemblies.
2. Section 079100 "Preformed Joint Seals" for preformed foam and extruded-silicone joint seals.
3. Section 079513.19 "Parking Deck Expansion Joint Cover Assemblies" for expansion joint cover assemblies subject to vehicular traffic.

1.2 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.

1. Exterior expansion joint covers.

B. Shop Drawings: For each expansion joint cover assembly.

1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples: For each exposed expansion joint cover assembly and for each color and texture specified, full width by **6 inches (150 mm)** long in size.

D. Samples for Initial Selection: For each type of exposed finish.

1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.

E. Samples for Verification: For each type of expansion joint cover assembly, full width by **6 inches (150 mm)** long in size.

F. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:

1. Manufacturer and model number for each expansion joint cover assembly.
2. Expansion joint cover assembly location cross-referenced to Drawings.
3. Nominal, minimum, and maximum joint width.
4. Movement direction.
5. Materials, colors, and finishes.

6. Product options.
7. Fire-resistance ratings.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by **[manufacturer and witnessed by a qualified testing agency][a qualified testing agency]**.

1.4 MOCKUPS

- A. Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 1. Build mockup of typical expansion joint cover assembly as shown on Drawings.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Furnish units in longest practicable lengths to minimize field splicing.
- B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Expansion joint cover assemblies shall withstand the effects of earthquake motions determined according to **[ASCE/SEI 7]<Insert requirement>**.
- B. Fire-Resistance Ratings: Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to **[UL 2079][or][ASTM E1966]** by a qualified testing agency.
 1. Hose Stream Test: Wall-to-wall and wall-to-soffit assemblies shall be subjected to hose stream testing.
- C. Expansion Joint Design Criteria :
 1. Type of Movement: **[Thermal][Wind sway]**.
 - a. Nominal Joint Width: **[As indicated on Drawings]<Insert width>**.
 - b. Minimum Joint Width: **[As indicated on Drawings]<Insert width>**.
 - c. Maximum Joint Width: **[As indicated on Drawings]<Insert width>**.
 2. Seismic Movement:

- a. Joint Movement: As indicated on Drawings.

2.3 EXTERIOR EXPANSION JOINT COVERS

- A. Exterior Metal-Plate Joint Cover : Assembly consisting of sliding metal cover plate in continuous contact with gaskets mounted on metal frames fixed to sides of joint gap.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[inpro Corporation]**
 - e. **[MM Systems Corporation]**
 - f. **[Nystrom, Inc.]**
 - g. **[Watson Bowman Acme Corp.]**
 - h. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]**
 - b. **[Balco; a CSW Industrials Company]**
 - c. **[Construction Specialties, Inc.]**
 - d. **[inpro Corporation]**
 - e. **[MM Systems Corporation]**
 - f. **[Nystrom, Inc.]**
 - g. **[Watson Bowman Acme Corp.]**
 - h. **<Insert manufacturer's name>**
3. Application: **[Wall to wall][Wall to soffit][Soffit to soffit].**
4. Installation: Surface mounted.
5. Fire-Resistance Rating: Not less than **[that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>.**
6. Exposed Metal:
 - a. Aluminum: **[Mill][Clear anodic, Class I][Clear anodic, Class II][Color anodic, Class I][Color anodic, Class II][Manufacturer's standard]<Insert finish>.**
 - 1) Color: **[Light bronze][Dark bronze][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>.**
 - b. Stainless Steel: **[No. 2B][No. 4][Manufacturer's standard]<Insert finish>.**
 - c. Bronze: **[Mill][Manufacturer's standard]<Insert finish>.**
 - d. Brass: **[Mill][Manufacturer's standard]<Insert finish>.**

- B. Exterior Elastomeric-Seal Joint Cover : Assembly consisting of elastomeric seal anchored to surface-mounted frames fixed to sides of joint gap.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering**

products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]
- b. [Balco; a CSW Industrials Company]
- c. [Construction Specialties, Inc.]
- d. [inpro Corporation]
- e. [MM Systems Corporation]
- f. [Nystrom, Inc.]
- g. [Watson Bowman Acme Corp.]
- h. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC]
- b. [Balco; a CSW Industrials Company]
- c. [Construction Specialties, Inc.]
- d. [inpro Corporation]
- e. [MM Systems Corporation]
- f. [Nystrom, Inc.]
- g. [Watson Bowman Acme Corp.]
- h. <Insert manufacturer's name>

3. Application: [Wall to wall][Wall to soffit][Soffit to soffit].

4. Installation: [Surface-mounted][Recessed].

5. Fire-Resistance Rating: Not less than [that indicated on Drawings][that of adjacent construction][1 hour][2 hours]<Insert rating>.

6. Exposed Metal:

- a. Aluminum: [Mill][Clear anodic, Class I][Clear anodic, Class II][Color anodic, Class I][Color anodic, Class II][Manufacturer's standard]<Insert finish>.

- 1) Color: [Light bronze][Dark bronze][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>.

- b. Stainless Steel: [No. 2B][No. 4][Manufacturer's standard]<Insert finish>.

- c. Bronze: [Mill][Manufacturer's standard]<Insert finish>.

- d. Brass: [Mill][Manufacturer's standard]<Insert finish>.

7. Seal: Preformed elastomeric membrane or extrusion.

- a. Color: [Black][Gray][As selected by Architect from manufacturer's full range]<Insert color>.

- C. Preformed Foam Joint Seals: Manufacturer's standard joint seal manufactured from urethane or EVA (ethylene vinyl acetate) foam with minimum density of **10 lb/cu. ft. (160 kg/cu. m)** and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths based on design criteria indicated, with factory- or field-applied adhesive for bonding to substrates.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the

following]:

- a. [Balco; a CSW Industrials Company]
 - b. [EMSEAL; a Sika Company]
 - c. [LymTal International, Inc.]
 - d. [MM Systems Corporation]
 - e. [Nystrom, Inc.]
 - f. [Pecora Corporation]
 - g. [Schul International Company, LLC]
 - h. [Watson Bowman Acme Corp.]
 - i. [Willseal LLC, part of Tremco CPG]
 - j. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Balco; a CSW Industrials Company]
 - b. [EMSEAL; a Sika Company]
 - c. [LymTal International, Inc.]
 - d. [MM Systems Corporation]
 - e. [Nystrom, Inc.]
 - f. [Pecora Corporation]
 - g. [Schul International Company, LLC]
 - h. [Watson Bowman Acme Corp.]
 - i. [Willseal LLC, part of Tremco CPG]
 - j. <Insert manufacturer's name>
3. Design Criteria:
- a. Nominal Joint Width: [As indicated on Drawings]<Insert dimension>.
 - b. Minimum Joint Width: [As indicated on Drawings]<Insert dimension>.
 - c. Maximum Joint Width: [As indicated on Drawings]<Insert dimension>.
 - d. Movement Capability: [As indicated on Drawings] [-25 percent/+25 percent]<Insert percentage>.
4. Joint Seal Color: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from full range of industry colors]<Insert color>.

2.4 MATERIALS

- A. Aluminum: **ASTM B221 (ASTM B221M)**, Alloy 6063-T5 for extrusions; **ASTM B209 (ASTM B209M)**, Alloy 6061-T6 for sheet and plate.
 1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
- B. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304 for plates, sheet, and strips.
- C. Brass: ASTM B36/B36M, UNS Alloy C26000 for half hard sheet and coil.
- D. Bronze: ASTM B455, Alloy C38500 for extrusions; Alloy C23000 red brass for plates.
- E. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.

07 - Thermal And Moisture Protection

- F. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.
- G. Moisture Barrier: Manufacturer's standard, flexible elastomeric material.

2.5 ALUMINUM FINISHES

- A. Mill finish.
- B. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**][**AA-M12C22A31, Class II, 0.010 mm**] or thicker.
- C. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**][**AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.

2.6 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3. Directional Satin Finish: No. 4.
- C. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

2.7 COPPER-ALLOY FINISHES

- A. Buffed Finish: M21 (Mechanical Finish: buffed, smooth specular).
- B. Medium-Satin Finish: M32 (Mechanical Finish: directionally textured, medium satin).

2.8 ACCESSORIES

- A. Moisture Barriers: Manufacturer's standard continuous, waterproof membrane within joint and attached to substrate on sides of joint.
 - 1. Provide where indicated on Drawings.
- B. Manufacturer's [**standard**][**stainless steel**] attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.
- B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.
- B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.
- B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.
 - 1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 - 2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
 - 3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
 - 4. Install frames in continuous contact with adjacent surfaces.
 - a. Shimming is not permitted.
 - 5. Locate anchors at interval recommended by manufacturer, but not less than **3 inches (75 mm)** from each end and not more than **24 inches (600 mm)** o.c.
- C. Elastomeric Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
 - 1. Provide in continuous lengths for straight sections.
 - 2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
 - 3. Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- D. Preformed Foam Joint Seals: Install in compliance with manufacturer's written instructions. Install with minimum number of end joints.
 - 1. Install each length of seal immediately after removing protective wrapping.

2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
 3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
 4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.
- E. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.
- F. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.
- G. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.
1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.
- H. Moisture Barrier Drainage: If indicated, provide drainage fitting and connect to drains.

3.4 CONNECTIONS

- A. Transition to Roof Expansion Joint Covers: Coordinate installation of exterior wall and soffit expansion joint covers with roof expansion joint covers specified in Section 077129 "Manufactured Roof Expansion Joints." **[Install factory-fabricated units at transition between exterior walls and soffits and roof expansion joint cover assemblies.]**

3.5 PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
- B. Protect the installation from damage by work of other Sections.

END OF SECTION 07 95 13 16A



07 - Thermal And Moisture Protection

Task	Specification	Specification Description
07 95 13 16	07 95 13 13	Interior Expansion Joint Cover Assemblies
07 95 13 16	07 95 13 00	Parking Deck Expansion Joint Cover Assemblies



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SECTION 08 01 52 61 - WOOD WINDOW REPAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section includes wood window repairs as follows:

1. Repairing wood windows.
2. Repairing wood storm windows.
3. Repairing wood shutters.
4. Repairing wood insect screens.
5. Replacing wood windows with custom-fabricated replicas.
6. Replacing wood storm windows with custom-fabricated replicas.
7. Replacing wood shutters with custom-fabricated replicas.
8. Replacing wood insect screens with custom-fabricated replicas.
9. Replacing weather stripping.
10. Providing new storm windows where none existed previously.
11. Providing new shutters where they no longer exist.
12. Reglazing.
13. Repairing, refinishing, and replacing hardware.

B. Related Requirements:

1. Section 024119 "Selective Demolition" for specific requirements relating to selectively demolishing construction, including window and trim removal.
2. Section 085200 "Wood Windows" for new replacement wood windows or sash not custom fabricated to replicate the originals.

1.2 ALLOWANCES

A. See Section 012100 "Allowances" for description of allowances for wood window repairs.

1. Perform wood window repairs under quantity allowances and only as authorized. Authorized Work includes **[the Work required by Drawings and Specifications and][only]** the Work as directed in writing by Architect.
2. Notify Architect **[weekly]<Insert time interval>** of extent of the Work performed that is attributable to quantity allowances.
3. Perform the Work that exceeds quantity allowances only as authorized by Change Orders.

B. Provide preconstruction testing as part of testing and inspecting allowance.

C. Replace wood sash in Window No. 1 as part of **<Insert name of allowance>**.

D. Replace shutters at 10 windows as part of **<Insert name of allowance>**.

E. Repair **<Insert item description>** as part of **<Insert name of allowance>**.

1.3 UNIT PRICES

- A. See Section 012200 "Unit Prices" for description of unit prices affecting the Work of this Section.
 - 1. Unit prices apply to authorized Work covered by **[quantity allowances][estimated quantities]**.
 - 2. Unit prices apply to authorized additions to and deletions from the Work as authorized by Change Orders.

1.4 DEFINITIONS

- A. Design Reference Sample: A sample that represents the Architect's prebid selection of the Work to be matched; it may be existing Work or Work specially produced for the Project.
- B. Glazing: Includes glass, glazing points, glazing tapes, glazing sealants, and glazing compounds.
- C. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.
- D. Window: Includes window frame, sash, trim, and hardware unless otherwise indicated by context.
- E. Window Unit: Includes window and **[storm window,][exterior shutters,][interior shutters,][insect screens]** and associated hardware and accessories, unless otherwise indicated by context.
- F. Window Component Terminology: Wood window components for repair work include the following classifications:
 - 1. Frame Components: Head, jambs, and sill.
 - 2. Sash Components: Stiles and rails, parting bead, stop, and muntins.
 - 3. Exterior Trim: Exterior casing, brick mold, and cornice or drip cap.
 - 4. Interior Trim: Casing, stool, and apron.
 - 5. **<Insert item>**.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference **[Project site][by web conference]<Insert location>**.

1.6 SEQUENCING AND SCHEDULING

- A. Perform window repairs in the following sequence, which includes the Work specified in this and other Sections:
 - 1. Label each window frame with permanent opening-identification number in inconspicuous location.
 - 2. Tag existing window sash, trim, storm windows, shutters, and insect screens with opening-identification numbers and remove for on-site or off-site repair. Indicate on tags the locations on window of each component, such as "top sash," "bottom sash," "left shutter," and "right shutter."
 - 3. Remove window, dismantle hardware, and tag hardware with opening-identification numbers.
 - 4. Install temporary protection and security at window openings.
 - 5. In the shop, label each sash, trim, storm window, shutter, and insect screen with permanent opening-identification number in inconspicuous location and remove site-applied tags.
 - 6. Sort units by condition, separating those that need extensive repair.
 - 7. Clean surfaces.

8. General Wood-Repair Sequence:
 - a. Remove paint to bare wood.
 - b. Rack frames slightly to inject adhesive into mortise and tenon joints; square frames to proper fit before adhesive sets.
 - c. If thicker than original glass is required, rout existing muntins to required rebate size.
 - d. Repair wood by consolidation, member replacement, partial member replacement, and patching.
 - e. Sand, prime, fill, sand again, and prime surfaces again for refinishing.
9. Repair, refinish, and replace hardware if required. Reinstall operating hardware.
10. Install glazing.
11. Remove temporary protection and security at window openings.
12. Reinstall units.
13. Apply finish coats.
14. Install remaining hardware and weather stripping.

1.7 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include recommendations for product application and use.
 2. Include test data substantiating that products comply with requirements.
- B. Shop Drawings:
 1. Include plans, elevations, and sections showing locations and extent of repair and replacement work, with enlarged details of replacement parts indicating materials, profiles, joinery, reinforcing, method of splicing into or attaching to existing wood window unit, accessory items, and finishes.
 2. Include field-verified dimensions and provisions for **[sealant joints][flashing][and]<Insert item>** as required for location.
 3. **<Insert requirements>**.
- C. Samples for Initial Selection: For each type of exposed wood and finish.
 1. Identify wood species, cut, and other features.
 2. Include Samples of hardware and accessories involving color selection.
- D. Samples for Verification: Actual sample of finished product for the following products in manufacturer's standard sizes unless otherwise indicated:
 1. Replacement Wood Window Units: **12-inch- (300-mm-)** long, full-size sections with applied finish.
 2. Replacement Wood Window Unit Members: **12 inches (300 mm)** long for each wood replacement member.
 3. Repaired Wood Window Unit Members: Prepare Samples using existing wood window members removed from site, repaired, and prepared for refinishing.
 4. Refinished Wood Window Unit Members: Prepare Samples using existing wood window members removed from site, repaired, and refinished.
 5. Hardware: Full-size units with each factory-applied or restored finish.
 6. Weather Stripping: **12-inch- (300-mm-)** long sections.
 7. Glass: **[Full-size]<Insert dimensions>** units of each type and appearance.

1.8 INFORMATIONAL SUBMITTALS

- A. Preconstruction Test Reports: For wood window repairs.
- B. Qualification Statements: For **[wood-window-repair specialist][and][wood-repair-material manufacturer]**.

1.9 QUALITY ASSURANCE

- A. Wood-Window-Repair Specialist Qualifications: A qualified wood window specialist, experienced in repairing, refinishing, and replacing wood window units in whole and in part. Experience only in fabricating and installing new wood windows is insufficient experience for repairing wood windows.
 - 1. Title X Requirement: Each firm conducting activities that disturb painted surfaces is required to be a "Lead-Safe Certified Firm" in accordance with 40 CFR 745, Subpart E, and use only workers that are trained in lead-safe work practices.
- B. Wood-Repair-Material Manufacturer Qualifications: A firm regularly engaged in producing **[wood consolidant][and][wood-patching compound]** that have been used for similar wood-repair applications with successful results, and with factory-authorized service representatives who are available for consultation and Project-site inspection and on-site assistance.

1.10 MOCKUPS

- A. Prepare mockups of window repair to demonstrate aesthetic effects, to set quality standards for materials and execution, and to set quality standards for fabrication and installation. Prepare mockups so they are inconspicuous.
 - 1. Locate mockups **[on existing windows where directed by Architect][in locations that enable viewing under same conditions as the completed Work]**<Insert requirement>.
 - 2. Wood Window Repairs: Prepare one entire window to serve as mockup to demonstrate samples of each type of repair of wood window members including frame, sash, glazing, and hardware. Demonstrate operable windows will operate as intended after repair.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.11 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified wood-window-repair specialist to perform preconstruction testing on wood window units.
 - 1. Provide test specimens representative of proposed materials and existing construction.
 - 2. Test repair products and methods for effectiveness and compliance with specified requirements.

1.12 DELIVERY, STORAGE, AND HANDLING

- A. Pack, deliver, and store products in suitable packs, heavy-duty cartons, or wooden crates; surround with sufficient packing material to ensure that products are not deformed, broken, or otherwise damaged.

- B. Store products inside a well-ventilated area and protect from weather, moisture, soiling, abrasion, extreme temperatures, and humidity, and where environmental conditions comply with manufacturer's requirements.

1.13 FIELD CONDITIONS

- A. Weather Limitations: Proceed with wood window repairs only when existing and forecasted weather conditions are within the environmental limits set by each manufacturer's written instructions and specified requirements.

PART 2 - PRODUCTS

2.1 HISTORIC WOOD REPAIR QUALITY STANDARD

- A. Quality Standard: Comply with applicable requirements in Section 06, "Millwork," in AWMAC/WI's NAAWS for construction, finishes, grades of wood windows, and other requirements, unless otherwise indicated and with the exception of practices cited that delegate Contractor's repair work to specific trades.

2.2 REPLACEMENT WOOD WINDOWS

- A. Replacement Wood Windows: Custom-fabricated replicated wood window **[frames][and][sash][and][trim]**, with operating and latching hardware.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Adams Architectural Millwork Co.]**
 - b. **[Architectural Components, Inc.]**
 - c. **[Bear Wood Windows, Inc.]**
 - d. **[Cleary and Son, Inc.]**
 - e. **[H. Hirschmann LTD]**
 - f. **[Kingsland Architectural Millwork]**
 - g. **[Olek Lejbzon & Co.]**
 - h. **[Parrett Manufacturing, Inc.]**
 - i. **[Weston Millwork Company]**
 - j. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Adams Architectural Millwork Co.]**
 - b. **[Architectural Components, Inc.]**
 - c. **[Bear Wood Windows, Inc.]**
 - d. **[Cleary and Son, Inc.]**
 - e. **[H. Hirschmann LTD]**
 - f. **[Kingsland Architectural Millwork]**
 - g. **[Olek Lejbzon & Co.]**
 - h. **[Parrett Manufacturing, Inc.]**

- i. **[Weston Millwork Company]**
 - j. **<Insert manufacturer's name>**
3. Joint Construction: **[Joints matching existing][Mortise and tenon joints][Doweled joints]<Insert requirement>**.
 4. Wood, General: Clear fine-grained lumber; kiln dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than **1/32 inch (0.8 mm)** deep by **2 inches (51 mm)** wide.
 - a. Species: **[Ponderosa pine][Match species of each existing type of wood component or assembly]<Insert species>** unless otherwise indicated.
 5. Frame Heads and Jambs: **[Match existing species][Ponderosa pine][Ponderosa pine, eastern white pine, or Idaho white pine][Redwood][Douglas fir][African mahogany][Western red cedar]<Insert species>**.
 6. Exterior Trim: **[Match existing species][Match frame heads and jambs][All-heart vertical grain redwood][African mahogany]<Insert species>**.
 7. Sills: **[Match existing species][White oak][All-heart vertical grain redwood][African mahogany][Western red cedar]<Insert species>**.
 8. Sash Components: **[Match existing species][Ponderosa pine][Ponderosa pine, eastern white pine, or Idaho white pine][African mahogany][Douglas fir]<Insert species>**.
 9. Interior Trim: **[Match existing species][Ponderosa pine][Ponderosa pine, eastern white pine, or Idaho white pine][African mahogany]<Insert species>**.
 10. Wood Cut: **[Match cut of existing components][Plain sliced/plain sawn][Quarter cut/quarter sawn]<Insert requirement>**.
 11. Wood Window Members: Replicate existing window members.
 12. Glazing Stops: Provide replacement glazing stops coordinated with glazing system indicated.
 13. Integral Sash Inserts: Manufacturer's standard **[aluminum][wood]-framed [storm][and][screen]** sash inserts; Sash-insert frames recessed fully in rebates routed in window frame or sash as required; and secured with turn-button hardware.
 - a. Provide insect screen **[for each operable exterior sash or ventilator][where indicated on Drawings][where indicated in Wood-Window-Repair Schedule]<Insert requirement>**.
 14. Exposed Hardware: **[Reuse existing hardware unless otherwise indicated; repair and refinish as required][Provide replacement hardware][As indicated on Drawings][As indicated in Wood-Window-Repair Schedule]**.
 15. Weather Stripping: Full-perimeter **[and meeting rail]** weather stripping for each operable sash.

2.3 STORM WINDOWS

- A. Wood Storm Windows: **[New, custom-fabricated storm window][Replacement, custom-fabricated replicated storm window]**, tight fitting, with operating and latching hardware.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Adams Architectural Millwork Co.]**
 - b. **[Allied Window Inc.]**
 - c. **[Cleary and Son, Inc.]**
 - d. **[Kingsland Architectural Millwork]**

- e. **[Weston Millwork Company]**
 - f. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Adams Architectural Millwork Co.]**
 - b. **[Allied Window Inc.]**
 - c. **[Cleary and Son, Inc.]**
 - d. **[Kingsland Architectural Millwork]**
 - e. **[Weston Millwork Company]**
 - f. **<Insert manufacturer's name>**
 3. Fabricate storm windows for installation **[on inside of primary window][on outside of primary window][matching design reference sample][matching existing location][where indicated on Drawings][where indicated in Wood-Window-Repair Schedule]<Insert requirement>**.
 4. Fabricate storm window frame and sash so as not to be visible from the **[exterior][interior]**.
 5. Make storm windows removable for cleaning and storage.
 6. Joint Construction: **[Joints matching existing][Mortise and tenon joints][Doweled joints]<Insert requirement>**.
 7. Wood Species: **[Match wood species of existing storm windows][Match wood species of exterior trim and sash parts][Cedar]<Insert requirement>**.
 8. Wood Cut: **[Match cut of existing storm windows][Match cut of existing exterior wood window trim and sash parts][Plain sliced/plain sawn][Quarter cut/quarter sawn]<Insert requirement>**.
 9. Wood Storm-Window Members: **[Match design reference sample][Replicate existing wood storm window member][As indicated on Drawings]<Insert requirement>**.
 10. Hardware: **[Provide new hardware][Reuse existing hardware unless otherwise indicated; repair and refinish as required][Provide replacement hardware][As indicated on Drawings][As indicated in Wood-Window-Repair Schedule]**.
 11. Glazing Material: **[Uncoated clear float glass][Plastic glazing]<Insert requirement>**.
- B. Interior Aluminum Storm Windows: New storm windows fabricated from extruded aluminum to fit inside the wood window frame; finish as indicated; storm window frames concealed from exterior view.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Allied Window Inc.]**
 - b. **[edi Window Systems, Inc.]**
 - c. **[Mon-Ray, Inc.]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Allied Window Inc.]**
 - b. **[edi Window Systems, Inc.]**
 - c. **[Mon-Ray, Inc.]**
 - d. **<Insert manufacturer's name>**
 3. Aluminum Finish: Manufacturer's standard **[clear anodized][light bronze anodized][medium**

- bronze anodized][dark bronze anodized][anodized color matching design reference sample][anodized color matching Architect's sample][anodized color as selected by Architect from manufacturer's full range]<Insert color>.
4. Baked-Enamel or Powder-Coated Finish: [Color as indicated by manufacturer's designations][Color matching design reference sample][Color matching Architect's sample][Color as selected by Architect from manufacturer's full range]<Insert color>.
 5. Hardware: Provide new hardware.
 6. Glazing Material: [Uncoated clear float glass][Plastic glazing]<Insert requirement>.

2.4 SHUTTERS

- A. Exterior Wood Shutters: [New, custom fabricated stile and rail units][Replacement, custom fabricated replicated stile and rail units], tight fitting, with concealed fasteners and operating and latching hardware.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Adams Architectural Millwork Co.]
 - b. [Beech River Mill]
 - c. [Custom Shutter Company]
 - d. [Kestrel Shutters & Doors, Inc.]
 - e. [Kingsland Architectural Millwork]
 - f. [Shuttercraft, Inc.]
 - g. [Timberlane, Inc]
 - h. [Weston Millwork Company]
 - i. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Adams Architectural Millwork Co.]
 - b. [Beech River Mill]
 - c. [Custom Shutter Company]
 - d. [Kestrel Shutters & Doors, Inc.]
 - e. [Kingsland Architectural Millwork]
 - f. [Shuttercraft, Inc.]
 - g. [Timberlane, Inc]
 - h. [Weston Millwork Company]
 - i. <Insert manufacturer's name>
 3. Operation: [Fixed to wall][Swinging on vertical stile][Bahama or Bermuda style, out-swinging from top rail][Match design reference sample][Match existing]<Insert requirement>.
 4. Panel Configuration: [Louvered][Flat][Raised][Match design reference sample][Match existing][As indicated on Drawings]<Insert requirement>.
 5. Joint Construction: [Mortise and tenon joints][Doweled joints][Joints matching design reference sample][Joints matching existing]<Insert requirement>.
 6. Louver-Slat Construction: [Routed slats][Dadoed slats][Pivot pin movable slats with interior control rod][Match design reference sample][Match existing][As indicated on Drawings]<Insert requirement>.

7. Wood Species: **[Match wood species of existing shutters][Match wood species of exterior trim and sash parts][Cedar]<Insert requirement>**.
 8. Wood Cut: **[Match cut of existing shutters][Match cut of existing exterior wood window trim and sash parts][Plain sliced/plain sawn][Quarter cut/quarter sawn]<Insert requirement>**.
 9. Wood Shutter Members: **[Match wood profiles of design reference sample][Replicate existing wood shutter members][As indicated on Drawings]<Insert requirement>**.
 10. Wood Preservative: Apply borate preservative treatment to accessible surfaces of exterior wood shutters before finishing. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom.
 11. Hardware: **[Provide new hardware][Reuse existing hardware unless otherwise indicated; repair and refinish as required][Provide replacement hardware][As indicated on Drawings][As indicated in Wood-Window-Repair Schedule]**.
 12. Drip Cap: **[Aluminum][Copper]<Insert requirement>** drip cap fitted to window head; finished **[to match window trim][white]<Insert requirement>**.
- B. Interior Wood Shutters: [New, custom fabricated stile and rail units][Replacement, custom fabricated replicated stile and rail units]**, tight fitting and removable, and with concealed fasteners and operating and latching hardware.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Beech River Mill]**
 - b. **[Custom Shutter Company]**
 - c. **[Kestrel Shutters & Doors, Inc.]**
 - d. **[Shuttercraft, Inc.]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Beech River Mill]**
 - b. **[Custom Shutter Company]**
 - c. **[Kestrel Shutters & Doors, Inc.]**
 - d. **[Shuttercraft, Inc.]**
 - e. **<Insert manufacturer's name>**
 3. Operation: **[Swinging on vertical stile][Bifolding leaves, swinging on vertical stile][Match design reference sample][Match existing]<Insert requirement>**.
 4. Panel Configuration: **[Louvered][Flat][Raised][Match design reference sample][Match existing][As indicated on Drawings]<Insert requirement>**.
 - a. Height: **[Full-height, single units][Full-height, double-stacked units][Half-height units][Match design reference sample][Match existing][As indicated on Drawings]<Insert requirement>**.
 5. Joint Construction: **[Mortise and tenon joints][Doweled joints][Match design reference sample][Match existing]<Insert requirement>**.
 6. Louver-Slat Construction: **[Routed slats][Dadoed slats][Pivot pin movable slats with interior control rod][Match design reference sample][Match existing][As indicated on Drawings]<Insert requirement>**.
 7. Wood Species: **[Match wood species of existing interior shutters][Match wood species of interior trim and sash parts][White oak]<Insert requirement>**.

8. Wood Cut: **[Match cut of existing interior shutters][Match cut of existing exterior wood window trim and sash parts][Plain sliced/plain sawn][Quarter cut/quarter sawn]<Insert requirement>.**
9. Wood Shutter Members: **[Match wood profiles of design reference sample][Replicate existing wood shutter members][As indicated on Drawings]<Insert requirement>.**
10. Hardware: **[Provide new hardware][Reuse existing hardware unless otherwise indicated; repair and refinish as required][Provide replacement hardware][As indicated on Drawings][As indicated in Wood-Window-Repair Schedule].**

2.5 REPLACEMENT INSECT SCREENS

- A. Replacement Wood Insect-Screen Frames: Custom-fabricated, replicated wood insect-screen frame; tight fitting and removable, with a minimum of exposed fasteners and latches.
 1. Joint Construction: **[Joints matching existing][Mortise and tenon joints][Doweled joints]<Insert requirement>.**
 2. Wood Species: **[Match wood species of existing insect screen][Match wood species of window][Cedar]<Insert requirement>.**
 3. Wood Cut: **[Match cut of existing insect screen][Match cut of window wood][Plain sliced/plain sawn][Quarter cut/quarter sawn]<Insert requirement>.**
 4. Insect-Screen Members: **[Replicate existing insect screen members][As indicated on Drawings]<Insert requirement>.**
- B. Replacement Aluminum Insect-Screen Frames: Extruded aluminum custom fabricated to fit inside interior wood window frame; tight fitting and removable, with a minimum of exposed fasteners and latches; finish as indicated; concealed from exterior view.
 1. Mounting: Manufacturer's standard **[magnetic mounting consisting of extruded-aluminum guide at head with magnetic tape at jambs and weather seal at sill][mounting consisting of extruded-aluminum guide at sill with screw attachment at head and jambs]<Insert description>.**
 2. Aluminum Finish: Manufacturer's standard **[clear anodized][light bronze anodized][medium bronze anodized][dark bronze anodized][anodized color matching design reference sample][anodized color matching Architect's sample][anodized color as selected by Architect from manufacturer's full range]<Insert color>.**
 3. Baked-Enamel or Powder-Coated Finish: **[Color as indicated by manufacturer's designations][Color matching design reference sample][Color matching Architect's sample][Color as selected by Architect from manufacturer's full range]<Insert color>.**
- C. Wickets: Provide **[sliding][or][hinged]** wickets matching insect-screen frame material and finish; framed and trimmed for a tight fit and durability during use.
- D. Copper Wire Fabric: **16-by-16 count per sq. in. (1.3-by-1.3-mm)** mesh of **0.011-inch- (0.28-mm-)** diameter copper wire.
- E. Bronze Wire Fabric: **18-by-14 count per sq. in. (1.1-by-1.5-mm)** mesh of **[0.009-inch- (0.23-mm-)][0.011-inch- (0.28-mm-)]** diameter bronze wire with a clear varnish finish.
- F. Aluminum Wire Fabric: **18-by-16 count per sq. in. (1.1-by-1.3-mm)** mesh of **0.011-inch- (0.28-mm-)** diameter, coated aluminum wire; **[natural bright][charcoal gray][black]** finish.

2.6 WOOD-REPAIR MATERIALS

- A. Source Limitations: Obtain wood consolidant and wood-patching compound from single source from single manufacturer.
- B. Wood Consolidant: Ready-to-use product designed to penetrate, consolidate, and strengthen soft fibers of wood materials that have deteriorated due to weathering and decay and designed specifically to enhance the bond of wood-patching compound to existing wood.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Abatron, Inc]**
 - b. **[ConServ Epoxy LLC]**
 - c. **[Gougeon Brothers, Inc.]**
 - d. **[Protective Coating Company]**
 - e. **[System Three Resins, Inc.]**
 - f. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Abatron, Inc]**
 - b. **[ConServ Epoxy LLC]**
 - c. **[Gougeon Brothers, Inc.]**
 - d. **[Protective Coating Company]**
 - e. **[System Three Resins, Inc.]**
 - f. **<Insert manufacturer's name>**
- C. Wood-Patching Compound: Two-part epoxy-resin wood-patching compound; knife-grade formulation as recommended in writing by manufacturer for type of wood repair indicated, tooling time required for the detail of work, and site conditions. Compound designed for filling voids in damaged wood materials that have deteriorated due to weathering and decay. Compound capable of filling deep holes and spreading to feather edge.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Abatron, Inc]**
 - b. **[Advanced Repair Technology, Inc.]**
 - c. **[ConServ Epoxy LLC]**
 - d. **[Gougeon Brothers, Inc.]**
 - e. **[Polymeric Systems, Inc.; PPG Industries, Inc.]**
 - f. **[Protective Coating Company]**
 - g. **[System Three Resins, Inc.]**
 - h. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. [Abatron, Inc]
- b. [Advanced Repair Technology, Inc.]
- c. [ConServ Epoxy LLC]
- d. [Gougeon Brothers, Inc.]
- e. [Polymeric Systems, Inc.; PPG Industries, Inc.]
- f. [Protective Coating Company]
- g. [System Three Resins, Inc.]
- h. <Insert manufacturer's name>

2.7 GLAZING MATERIALS

A. Glass:

- 1. See Section 088000 "Glazing."
- 2. [Uncoated clear float-glass][Clear insulating-glass][Low-E clear insulating-glass][Glass Type GL-xx]<Insert description> units according to Section 088000 "Glazing."
- 3. <Insert requirements>.

B. Plastic Glazing: [Uncoated monolithic acrylic][Coated monolithic acrylic][Uncoated monolithic polycarbonate][Abrasion- and UV-resistant monolithic polycarbonate][UV-resistant monolithic polycarbonate]<Insert description> sheet according to Section 088400 "Plastic Glazing."

C. Glazing Systems:

- 1. Traditional Glazing Products: Glazing points and oil-based glazing putty or latex glazing compound. Tint to required color in accordance with manufacturer's written instructions.
 - a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - 1) DAP Products Inc.
 - 2) Sarco Putty Company, Inc.
 - 3) <Insert manufacturer's name>.
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- 2. Polyurethane Glazing Products: Glazing points and single-component polyurethane glazing compound; ASTM C920, Type S, Grade NS, Class 25, Use G; struck uniformly to match taper of existing glazing system (removed); colored as required to match painted sash.
- 3. Silicone Glazing Products: Glazing securement and silicone glazing sealant according to Section 088000 "Glazing"; struck uniformly to match taper of existing glazing system (removed); colored as required to match painted sash.
- 4. Primers and Cleaners for Glazing: As recommended in writing by glazing material manufacturer.

2.8 HARDWARE

A. General:

- 1. Window Hardware: Provide complete sets of window hardware consisting of sash balances,

- hinges, pulls, latches, and accessories indicated for each window or required for proper operation. Sets to include replacement hardware to complement repaired and refinished, existing hardware, where required, unless otherwise indicated. Window hardware to smoothly operate, tightly close, and securely lock wood windows and be sized to accommodate sash or ventilator weight and dimensions.
2. Other Hardware: Provide complete sets of hardware for each type of **[storm window][shutter][and][insect screen]** consisting of hinges, pulls, latches, and accessories indicated or required for proper operation. Sets to include replacement hardware to complement repaired and refinished, existing hardware, where required, unless otherwise indicated. Hardware to smoothly operate, tightly close, and secure units appropriately for unit weight and dimensions.
- B. New Hardware: Provide hardware for **[storm windows][and][shutters]** as follows:
1. Wood Storm Windows: **[Match design reference sample][As indicated on Drawings][As indicated in Wood-Window-Repair Schedule][As required to secure storm window to window frames]<Insert requirement>**
 2. Interior Aluminum Storm Windows: **[As indicated on Drawings][As indicated in Wood-Window-Repair Schedule][As required to secure storm window to window frames][Magnetic mounting][Extruded-aluminum track slides at head and sill]<Insert requirement>**.
 3. Exterior Wood Shutters: **[Match design reference sample][As indicated on Drawings][As indicated in Wood-Window-Repair Schedule][As required to secure shutter to window frames and latch tightly][As required to secure shutter to window frames, with pintle hinges to allow removability, and to latch tightly][As required to secure shutter to wall]<Insert requirement>**.
 4. Interior Wood Shutters: **[Match design reference sample][As indicated on Drawings][As indicated in Wood-Window-Repair Schedule][As required to secure shutter to window frames and latch tightly]<Insert requirement>**.
- C. Replacement Hardware: Replace existing damaged or missing hardware with new **[custom hardware to replicate existing hardware][hardware matching type and appearance of existing hardware]** manufactured by one of the following:
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Architectural Resource Center (The)]**
 - b. **[Ball and Ball, LLC]**
 - c. **[Blaine Window Hardware Inc.]**
 - d. **[Bronze Craft Corporation (The)]**
 - e. **[Phelps Company]**
 - f. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Architectural Resource Center (The)]**
 - b. **[Ball and Ball, LLC]**
 - c. **[Blaine Window Hardware Inc.]**
 - d. **[Bronze Craft Corporation (The)]**
 - e. **[Phelps Company]**
 - f. **<Insert manufacturer's name>**

3. Replacement Hardware Types: Duplicate existing exposed hardware of the following types:
 - a. Projected window hinge.
 - b. Window lock.
 - c. Window latch.
 - d. Handle.
 - e. Pole ring.
 - f. Shutter hinges.
 - g. Shutter dogs (tiebacks).
 - h. Shutter pull rings.
 - i. Shutter slide bolts.
 - j. Shutter catches.
 - k. **<Insert hardware type>**.
 4. Weight and Pulley Sash-Balance: Concealed weight and pulley balance system including steel or cast iron weights, cast-bronze pulleys, **[synthetic sash cord][bronze sash chain][or][stainless-steel sash chain]<Insert requirement>**; size and capacity to hold sash stationary at any open position.
 5. Spring Sash-Balance: Concealed **[tape-spring][spiral-tube][spring-loaded, block-and-tackle]<Insert description>** type; size and capacity to hold sash stationary at any open position.
- D. Hardware Materials: **[Solid bronze of alloy indicated][Cast or wrought aluminum][Nonmagnetic stainless steel]<Insert material>** unless otherwise indicated.
- E. Hardware Finishes: Comply with ANSI/BHMA A156.18 for base material and finish requirements indicated by the following:
1. ANSI/BHMA 605: Bright brass, clear-coated; brass base metal.
 2. ANSI/BHMA 606: Satin brass, clear-coated; brass base metal.
 3. ANSI/BHMA 611: Bright bronze, clear-coated; bronze base metal.
 4. ANSI/BHMA 612: Satin bronze, clear-coated; bronze base metal.
 5. ANSI/BHMA 613: Dark-oxidized satin bronze, oil-rubbed; bronze base metal.
 6. ANSI/BHMA 624: Dark-oxidized statuary bronze, clear-coated; bronze base metal.
 7. ANSI/BHMA 628: Satin aluminum, clear-anodized; aluminum base metal.
 8. ANSI/BHMA 630: Satin stainless steel; stainless-steel base metal.
 9. ANSI/BHMA 689: Aluminum painted; over any base metal.
 10. **<Insert finish or special custom finish>**.

2.9 REPLACEMENT WEATHER STRIPPING

- A. Replacement Compression-Type Weather Stripping: Compressible weather stripping designed for permanently resilient sealing under bumper or wiper action; completely concealed when window is closed.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[National Guard Products, Inc]**
 - b. **[Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - c. **[Reese Enterprises, Inc]**
 - d. **[Zero International; Allegion plc]**

- e. <Insert manufacturer's name>
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [National Guard Products, Inc]
 - b. [Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - c. [Reese Enterprises, Inc]
 - d. [Zero International; Allegion plc]
 - e. <Insert manufacturer's name>
- 3. Weather-Stripping Material: Match existing materials and profiles as much as possible unless otherwise indicated.
 - a. Cellular Elastomeric Gaskets: Preformed; complying with ASTM C509.
 - b. Dense Elastomeric Gaskets: Preformed; complying with ASTM C864.
- B. Replacement Sliding-Type Weather Stripping: Woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [National Guard Products, Inc]
 - b. [Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - c. [Reese Enterprises, Inc]
 - d. [Zero International; Allegion plc]
 - e. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [National Guard Products, Inc]
 - b. [Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - c. [Reese Enterprises, Inc]
 - d. [Zero International; Allegion plc]
 - e. <Insert manufacturer's name>
 - 3. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material.
- C. Replacement Metal Weather Stripping: [Bronze][Zinc]<Insert metal> weather stripping; designed either as one piece to seal by sliding into a groove in the sash or as two pieces that interlock; and completely concealed when window is closed.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. **[Reese Enterprises, Inc]**
 - b. **[Zero International; Allegion plc]**
 - c. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Reese Enterprises, Inc]**
 - b. **[Zero International; Allegion plc]**
 - c. **<Insert manufacturer's name>**

2.10 MISCELLANEOUS MATERIALS

- A. Borate Preservative Treatment: Inorganic, borate-based solution, with disodium octaborate tetrahydrate as the primary ingredient; manufactured for preserving weathered and decayed wood from further damage by decay fungi and wood-boring insects; containing no boric acid.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Nisus Corporation]**
 - b. **[System Three Resins, Inc.]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Nisus Corporation]**
 - b. **[System Three Resins, Inc.]**
 - c. **<Insert manufacturer's name>**
- B. Cleaning Materials:
 1. Detergent Solution: Solution prepared by mixing **2 cups (0.5 L)** of tetrasodium pyrophosphate (TSPP), **1/2 cup (125 mL)** of laundry detergent that contains no ammonia, **5 quarts (5 L)** of 5 percent sodium hypochlorite bleach, and **15 quarts (15 L)** of warm water for each **5 gal. (20 L)** of solution required.
 2. Mildewcide: Commercial, proprietary mildewcide or a solution prepared by mixing **1/3 cup (80 mL)** of household detergent that contains no ammonia, **1 quart (1 L)** of 5 percent sodium hypochlorite bleach, and **3 quarts (3 L)** of warm water.
- C. Adhesives: Wood adhesives with minimum 15- to 45-minute cure at **70 deg F (21 deg C)**, in gunnable and liquid formulations as recommended in writing by adhesive manufacturer for each type of repair and exposure condition.
- D. Fasteners: Use fastener metals that are noncorrosive and compatible with each material joined.
 1. Match existing fasteners in material and type of fastener unless otherwise indicated.
 2. Use concealed fasteners for interconnecting wood components.
 3. Use concealed fasteners for attaching items to other work unless exposed fasteners are

- [unavoidable][or][the existing fastening method].
- 4. For fastening metals, use fasteners of same basic metal as fastened metal unless otherwise indicated.
- 5. For exposed fasteners, use Phillips-type machine screws of head profile flush with metal surface unless otherwise indicated.
- 6. Finish exposed fasteners to match finish of metal fastened unless otherwise indicated.
- E. Anchors, Clips, and Accessories: Fabricate anchors, clips, and window accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel complying with requirements in ASTM B633 for SC 3 (Severe) service condition.

2.11 WOOD WINDOW UNIT FINISHES

- A. Unfinished Replacement Units: Provide exposed [exterior][and][interior] wood surfaces of replacement units unfinished; smooth, filled, and suitably prepared for on-site priming and finishing.
- B. Factory-Primed Replacement Units: [Manufacturer's standard]<Insert requirement> factory-prime coat on exposed [exterior][and][interior] wood surfaces; compatible with indicated finish coating.
- C. Factory-Finished Units: [Alkyd][Latex]<Insert system type> finish system consisting of [primer and two finish coats]<Insert requirement> on exposed [exterior][and][interior] wood surfaces.
 - 1. Finish Coats: [Manufacturer's standard.][Match intermediate coat and topcoat products used for adjacent, repaired wood windows.]<Insert requirement.>
 - 2. Color and Gloss: Match [Munsell Color 10 G 8/2][Plochere Color System #8da399][colors indicated on Drawings]<Insert color(s) or requirement>.

PART 3 - EXECUTION

3.1 WOOD-WINDOW-REPAIR SPECIALIST

- A. Wood-Window-Repair Specialist Firms: Subject to compliance with requirements, [provide wood window repairs by one of the following][firms that may provide wood window repairs include, but are not limited to, the following]:
 - 1. <Insert, in separate subparagraphs, names of wood-window-repair specialist firms>.

3.2 WOOD WINDOW UNIT REPAIRS, GENERAL

- A. Appearance Standard: Completed work is to have a uniform appearance as viewed by Architect from the window interior at [5 ft. (1.5 m)][10 ft. (3 m)]<Insert distance> away and from the window exterior at [20 ft. (6 m)][50 ft. (15 m)]<Insert distance> away.
- B. General: In repairing wood window units, disturb them as minimally as possible and as follows:
 - 1. Stabilize and repair wood window units to reestablish structural integrity and weather resistance while maintaining the existing form of each item.
 - 2. Repair items in place where possible.
 - 3. Refinish wood window units in accordance with Section 090190.52 "Maintenance Repainting" unless otherwise indicated.
 - 4. Mechanical Abrasion: Where mechanical abrasion is needed for the work, use gentle mechanical

methods, such as scraping and natural-fiber bristle brushing, that will not abrade wood substrate, reducing clarity of detail.

- C. Identify removed window units with numbering system corresponding to window locations to ensure reinstallation in same location. Key window units to Drawings indicating location of each removed unit. Permanently label units in a location that will be concealed after reinstallation.

3.3 EXAMINATION

- A. Examine areas, and conditions, with wood-window-repair specialist present, for compliance with requirements for environmental conditions, and other conditions affecting performance of the Work.
 - 1. If existing wood window units cannot be prepared to an acceptable condition for repair, notify Architect in writing.
 - 2. Notify Architect of undocumented detrimental conditions, including rotted wood and other deteriorated items.
- B. Begin wood window unit repair work only after unsatisfactory conditions have been corrected.

3.4 PREPARATION

- A. Protect adjacent materials from damage by performing wood window unit repairs.
- B. Install temporary protective measures to protect wood window unit work that is indicated to be completed later.
- C. Clean wood window units of mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. After cleaning, rinse thoroughly with fresh water. Allow to dry before repairing or painting.
- D. Condition replacement wood members and replacement units to prevailing conditions at installation areas before installing.
- E. Remove coatings and apply borate preservative treatment before repair. Remove coatings in accordance with Section 090190.52 "Maintenance Repainting" unless otherwise indicated.
- F. Protection of Openings: Where sash or windows are indicated for removal, cover resultant openings with temporary enclosures so that openings are weathertight during repair period.

3.5 WOOD WINDOW UNIT REPAIR

- A. Repair and Refinish Existing Hardware: Dismantle window hardware; strip paint, repair, and refinish it to match finish samples; and lubricate moving parts just enough to function smoothly.
- B. Repair Wood Window Units: Replicate existing.
 - 1. Repair wood window units by consolidating, patching, splicing, or otherwise reinforcing wood with new wood matching existing wood or with salvaged, sound, original wood.
 - 2. Sash Balance: Repair sash balances to function according to type as specified in "Hardware" Article" above. Provide missing sash balances.

3.6 WOOD WINDOW UNIT PATCH-TYPE REPAIR

- A. General: Patch wood members that exhibit depressions, holes, or similar voids and that have limited amounts of rotted or decayed wood.
 - 1. Remove **[sash][storm windows][and][screens]** from windows before performing patch-type repairs at meeting or sliding surfaces unless otherwise indicated. Reglaze units before reinstallation.
 - 2. Verify that surfaces are sufficiently clean and free of paint residue before patching.
 - 3. Remove rotted or decayed wood down to sound wood.
- B. Apply borate preservative treatment to accessible surfaces after removing rotted or decayed wood and before applying wood consolidant or patching compound. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom. Allow treatment to dry.
- C. Apply wood-patching compound to fill depressions, nicks, cracks, and other voids created by removed or missing wood.
 - 1. Prime patch area with application of wood consolidant or manufacturer's recommended primer.
 - 2. Mix only as much patching compound as can be applied in accordance with manufacturer's written instructions.
 - 3. Apply patching compound in layers as recommended in writing by manufacturer until the void is completely filled.
 - 4. Sand patch surface smooth and flush with adjacent wood, without voids in patch material, and matching contour of wood member.
 - 5. Clean spilled compound from adjacent materials immediately.

3.7 WOOD WINDOW UNIT, MEMBER-REPLACEMENT REPAIR

- A. General: Replace parts of or entire wood window unit members at locations **[indicated on Drawings][indicated in the Wood-Window-Repair Schedule][and][where damage is too extensive to patch]<Insert requirement>**.
 - 1. Remove **[sash][storm windows][and][shutters]** from windows before performing member-replacement repairs unless otherwise indicated.
 - 2. Verify that surfaces are sufficiently clean and free of paint residue before repair.
 - 3. Remove broken, rotted, and decayed wood down to sound wood.
 - 4. Custom fabricate new wood part or member to replace missing wood part or member; either replace entire wood member or splice new wood part into existing member.
 - 5. Secure new wood part or member using finger joints, multiple dowels, or splines with adhesive and nailing to ensure maximum structural integrity at each splice. Use only concealed fasteners. Fill nail holes and patch surface to match surrounding sound wood.
- B. Apply borate preservative treatment to accessible surfaces after replacements are made. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom.
- C. Repair remaining depressions, holes, or similar voids with patch-type repairs.
- D. Clean spilled materials from adjacent surfaces immediately.
- E. Glazing: Reglaze units before reinstallation.
 - 1. Mill new and rout existing glazed members to accommodate new glass thickness.
 - 2. Provide replacement glazing stops coordinated with glazing system indicated.
 - 3. Provide glazing stops to match contour of sash frames.

- F. Reinstall units removed for repair into original openings.
- G. Weather Stripping: Replace nonfunctioning and install missing weather stripping to ensure full-perimeter **[and meeting rail]** weather stripping for each operable sash.

3.8 WOOD WINDOW UNIT REPLACEMENT

- A. General: Replace existing wood **[window frame][sash][exterior trim][interior trim][storm window][exterior shutter][interior shutter][and][insect screen]** units with custom-fabricated, replicated units at locations **[indicated on Drawings][indicated in the Wood-Window-Repair Schedule][and][where damage is too extensive to repair]<Insert requirement>**.
- B. Use surviving prototypes to create patterns for duplicate replacements.
- C. Apply borate preservative treatment to accessible surfaces before finishing. Apply treatment liberally by brush to joints, edges, and ends; top, sides, and bottom.
- D. Mill glazed members to accommodate glass thickness. Glaze units before installation.

3.9 REGLAZING

- A. Comply with combined written instructions of manufacturers of glass, glazing systems, and glazing materials, unless more stringent requirements are indicated.
- B. Remove cracked and damaged glass and glazing materials from openings and prepare surfaces for reglazing.
- C. Remove existing glass and glazing where indicated **[on Drawings][in the Wood-Window-Repair Schedule]**, and prepare surfaces for reglazing.
- D. Remove glass and glazing from openings and prepare surfaces for reglazing.
- E. Size glass as required by Project conditions to provide necessary bite on glass, minimum edge and face clearances, with reasonable tolerances.
- F. Apply primers to joint surfaces where required for adhesion of glazing system, as determined by preconstruction testing.
- G. Install setting bead, side beads, and back bead against stop in glazing rabbets before setting glass, in accordance with glazing-system manufacturer's instructions.
- H. Install glass with proper orientation so that coatings, if any, face exterior or interior as required.
- I. Install glazing system. **[Install silicone glazing products as specified in Section 088000 "Glazing."]**
- J. Disposal of Removed Glass: **[Remove from Owner's property and legally dispose of it][Protect unbroken lites and deliver as salvage to Owner for storage where directed]<Insert requirement>** unless otherwise indicated.

3.10 INSTALLATION OF REPLACEMENT WOOD WINDOWS

- A. Install units, hardware, weather stripping, accessories, and other components[**as indicated on Drawings**].
- B. Install units level, plumb, square, true to line, without distortion or impeding movement; anchored securely in place to structural support; and in proper relation to wall flashing, trim, and other adjacent construction.
- C. Set sill members in bed of sealant for weathertight construction unless otherwise indicated.
- D. Install window units with new anchors into existing openings.
- E. Weather Stripping: Install full-perimeter[**and meeting rail**] weather stripping for each operable sash.
- F. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- G. Disposal of Removed Units: **[Remove from Owner's property and legally dispose of them][Deliver as salvage to Owner for storage where directed]<Insert requirement>**.

3.11 INSTALLATION OF STORM WINDOWS

- A. Install wood storm windows at each window jamb[**indicated**].
- B. Install interior aluminum storm windows at each window[**indicated**].
- C. Install units by mounting to window frames[**as indicated on Drawings and**] in accordance with manufacturer's written instructions.
- D. Disposal of Removed Units: **[Remove from Owner's property and legally dispose of them][Deliver as salvage to Owner for storage where directed]<Insert requirement>**.

3.12 INSTALLATION OF SHUTTERS

- A. Install wood shutters at each window jamb[**indicated**].
- B. Install units by mounting[**as indicated on Drawings and**] in accordance with manufacturer's written instructions.
- C. Disposal of Removed Units: **[Remove from Owner's property and legally dispose of them][Deliver as salvage to Owner for storage where directed]<Insert requirement>**.

3.13 INSTALLATION OF REPLACEMENT INSECT SCREENS

- A. Install [wood][aluminum] insect-screen frames [for each operable exterior sash or ventilator][where indicated]<Insert requirement>.
 - 1. Locate insect-screen frames on [inside][outside] of window unless otherwise indicated.
 - 2. Install insect-screen frames by mounting to window or sash frame[**as indicated on Drawings and**] in accordance with manufacturer's written instructions.

- B. Install insect screening to be smooth, flat, and uniformly taut.
- C. Disposal of Removed Units: **[Remove from Owner's property and legally dispose of them][Deliver as salvage to Owner for storage where directed]<Insert requirement>**.

3.14 INSTALLATION OF REPLACEMENT WEATHER STRIPPING

- A. Install weather stripping for tight seal of joints as determined by preconstruction testing and demonstrated in mockup.

3.15 ADJUSTING

- A. Adjust existing and replacement operating sash, screens, hardware, weather stripping, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.16 CLEANING AND PROTECTION

- A. Protect window surfaces from contact with contaminating substances resulting from construction operations. Monitor window surfaces adjacent to and below exterior concrete and masonry during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances contact window surfaces, remove contaminants immediately.
- B. Clean exposed surfaces immediately after repairing wood windows. Avoid damage to coatings and finishes. Remove excess sealants, glazing and patching materials, dirt, and other substances.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction.

3.17 WOOD-WINDOW-REPAIR SCHEDULE

- A. Wood Window Repair: **[WW-#]<Insert drawing designation>**
 1. Description: **[Single-hung][Double-hung][Triple-hung][Casement][Fixed]<Insert window description>** window.
 2. General: Repair existing wood windows using indicated treatments. Repair sash, storm windows, and shutters **[on-site][or][off-site]<Insert requirement>**.
 3. Removal of Existing Paint and Refinishing: See Section 090190.52 "Maintenance Repainting" for paint removal, surface preparation for refinishing, and refinishing wood windows.
 4. Window Frame Repair: **[Wood consolidant][patch-type repairs][whole or partial member-replacement repairs][and][re-anchor frame as indicated on Drawings]<Insert repair description>**.
 5. Window Frame Member Repair: Repair **[head][jamb][sill]** with **[wood consolidant][patch-type repairs][and][whole or partial member-replacement repairs]**. **[Re-anchor][and][realign]** the **[head][jamb][sill]**. **<Insert repair description>**.
 6. Window Sash Repair: **[Wood consolidant][patch-type repairs with sash removed from opening][patch-type repairs in place][and][whole or partial member-replacement repairs]<Insert repair description>**.
 7. Window Sash Member Repair: Repair **[stile][rails][parting bead][stop][and][muntins]<Insert component>** with **[wood consolidant][patch-type repairs][and][whole or partial member-**

- replacement repairs]. Realign [stiles][rails][parting bead][and][stops]<Insert component>.
 8. Window Sash Replacement: Remove existing units for replacement with custom-fabricated, replicated units.
 9. Hardware: [Sash balance][Projected window hinge][Window lock][Window latch][Handle][Pole ring]<Insert hardware type>.
 10. <Insert requirements>.
- B. Wood Window Replacement: [WW-#]<Insert drawing designation>
1. Description: [Single-hung][Double-hung][Triple-hung][Casement][Fixed]<Insert window description> window.
 2. General: Remove wood window completely, including window frame and sash, and replace with custom-fabricated, replicated wood windows.
 3. Wood Exterior Shutters: Custom-fabricated, [new][replicated] units specified in this Section.
 4. Wood Interior Shutters: Custom-fabricated, [new][replicated] units specified in this Section.
 5. Hardware: [Sash balance][Projected window hinge][Window lock][Window latch][Handle][Pole ring]<Insert hardware type>.
 6. <Insert requirements>.

END OF SECTION 08 01 52 61



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Task	Specification	Specification Description
08 01 52 61	08 52 00 00	Wood Windows
08 01 81 10	08 80 00 00	Glazing



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SECTION 08 05 13 00 - STAINLESS-STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stainless steel doors and frames.
2. Stainless steel panels.

B. Related Requirements:

1. **[Section 087100 "Door Hardware"]****[Section 087111 "Door Hardware (Descriptive Specification)"]** for door hardware for stainless steel doors.

1.2 COORDINATION

- A. Coordinate anchorage installation for stainless steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]**<Insert location>.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Stainless steel doors and frames.
2. Stainless steel panels.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, core descriptions, **[fire-resistance ratings]**,**[temperature-rise ratings]**, and finishes.

C. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Environmental Product Declaration: For each product.
3. Health Product Declaration: For each product.
4. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
5. Environmental Product Declaration: For each product.

6. Environmental Product Declaration: For each product.
7. Environmental Product Declaration: For each product.
8. Third-Party Certifications: For each product.
9. Third-Party Certified Life Cycle Assessment: For each product.

D. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

E. Samples:

1. Finishes: For each type of exposed finish required, prepared on Samples of not less than **3 by 5 inches (75 by 125 mm)**.
2. Doors: Show vertical-edge, top, and bottom construction; core construction; **[glazing;]**and hinge and other applied hardware reinforcement.
3. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.

F. Product Schedule: For stainless steel doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
3. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Product Test Reports: For each type of **[fire-rated stainless steel door and frame assembly][fire-rated borrowed-lite assembly][and][windborne-debris impact resistance door]** for tests performed by a qualified testing agency indicating compliance with performance requirements.

C. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.7 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies must meet the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
 - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.
- B. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies must meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
 - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver stainless steel doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store stainless steel doors and frames under cover at Project site with head up. Place units on minimum **4-inch- (100-mm-)** high wood blocking.
- D. Provide minimum **1/4-inch (6-mm)** space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, acceptable to authorities having jurisdiction for fire-protection ratings[**and temperature-rise limits**] indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - 2. Temperature-Rise Limit: [**Where indicated on Drawings**][**At vertical exit enclosures and exit passageways**], provide doors that have a maximum transmitted temperature end point of not more than **450 deg F (250 deg C)** above ambient after 30 minutes of standard fire-test exposure.
- B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.
- C. Fire-Rated, Borrowed-Lite Frame Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing in accordance with NFPA 257 or UL 9.
- D. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone [1][2][3][4] for [**basic**][**enhanced**] protection.

1. Large-Missile Test: For glazed openings located within [30 feet (9.1 m)]<Insert dimension> of grade.

2.2 STAINLESS STEEL DOORS AND FRAMES

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. [AMBICO Limited]
2. [Ceco Door; AADG, Inc.; ASSA ABLOY]
3. [Curries, AADG, Inc.; ASSA ABLOY Group]
4. [Custom Metal Products]
5. [DCI Hollow Metal on Demand]
6. [DE LA FONTAINE]
7. [Fleming Door Products Ltd.; ASSA ABLOY Group]
8. [Hollow Metal Xpress]
9. [MegaMet Industries]
10. [Mesker Door; Mesker Openings Group]
11. [Next Door Company]
12. [Security Metal Products; a brand of ASSA ABLOY]
13. [Stainless Doors, Inc.]
14. [Steelcraft; Allegion plc]
15. [Titan Metal Products]
16. <Insert manufacturer's name>

- B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [AMBICO Limited]
2. [Ceco Door; AADG, Inc.; ASSA ABLOY]
3. [Curries, AADG, Inc.; ASSA ABLOY Group]
4. [Custom Metal Products]
5. [DCI Hollow Metal on Demand]
6. [DE LA FONTAINE]
7. [Fleming Door Products Ltd.; ASSA ABLOY Group]
8. [Hollow Metal Xpress]
9. [MegaMet Industries]
10. [Mesker Door; Mesker Openings Group]
11. [Next Door Company]
12. [Security Metal Products; a brand of ASSA ABLOY]
13. [Stainless Doors, Inc.]
14. [Steelcraft; Allegion plc]
15. [Titan Metal Products]
16. <Insert manufacturer's name>

- C. Construct stainless steel door and frame assemblies to comply with NAAMM-HMMA 866 for the application indicated, including materials, fabrication methods, hardware reinforcement, tolerances, and clearances, and as specified. Comply with SDI ANSI/A250.4, for Physical Performance Level A.

- D. Doors and Frames for Highly Corrosive Environments: [At locations indicated in the Door and Frame Schedule on Drawings]<Insert locations>.

1. Stainless Steel Doors:

- a. Type: As indicated in the Door and Frame Schedule on Drawings.
 - b. Thickness: **1-3/4 inches (44.5 mm)**.
 - c. Face Sheets: Type 316 stainless steel sheet, minimum thickness **[0.050 inch (1.27 mm)][0.062 inch (1.59 mm)][0.078 inch (1.98 mm)]**.
 - d. Edge Construction: Continuously welded with no visible seam.
 - e. Top and Bottom Edges: Closed with continuous stainless steel channels with minimum thickness of **0.062 inch (1.27 mm)**, **[welded][adhesive laminated]** to face sheets.
 - 1) Provide flush top and bottom closures for exterior doors, with weep holes at bottom edge.
 - f. Core Construction: **[Welded steel-stiffened core][Polyisocyanurate, polystyrene, or polyurethane laminated to face sheets][Steel-stiffener core laminated to face sheets]**.
 - g. Fire-Rated Core: Manufacturer's standard **[vertical steel stiffener][laminated mineral board]** core for fire-rated **[and temperature-rise-rated]** doors.
2. Stainless Steel Frames:
- a. Materials: Type 316 stainless steel sheet.
 - b. Door Frames for Openings 48 Inches (1219 mm) Wide or Less: Fabricate from stainless steel sheet, minimum thickness **[0.062 inch (1.59 mm)][0.078 inch (1.98 mm)][0.109 inch (2.78 mm)]**.
 - c. Door Frames for Openings More Than 48 Inches (1219 mm) Wide: Fabricate from stainless steel sheet, minimum thickness **[0.078 inch (1.98 mm)][0.109 inch (2.78 mm)]**.
 - d. Construction: **[Face welded][Full profile welded][Knocked down][Slip on]**.
3. Hardware Reinforcement: Stainless steel sheet.
4. Finish: ASTM A480/A480M **[No. 4, Directional Satin][No. 6, Dull Satin][No. 8, Mirrorlike Reflective, Nondirectional Polish][No. 2B, Bright, Cold-Rolled, Unpolished]**.
- E. Doors and Frames for Moderately Corrosive Environments: **[At locations indicated in the Door and Frame Schedule on Drawings]<Insert locations>**.
1. Stainless Steel Doors:
- a. Type: As indicated in the Door and Frame Schedule on Drawings.
 - b. Thickness: **1-3/4 inches (44.5 mm)**.
 - c. Face Sheets: Type 304 stainless steel sheet, minimum thickness **[0.050 inch (1.27 mm)][0.062 inch (1.59 mm)][0.078 inch (1.98 mm)]**.
 - d. Edge Construction: **[Continuously welded with no visible seam][Interlocking or lock tab visible seam][Intermittently welded visible seam]**.
 - e. Top and Bottom Edges: Closed with continuous stainless steel channels with minimum thickness of **0.062 inch (1.27 mm)**, **[welded][adhesive laminated]** to face sheets.
 - 1) Provide flush top and bottom closures for exterior doors, with weep holes at bottom edge.
 - f. Core Construction: **[Welded steel-stiffened core][Polyisocyanurate, polystyrene, or polyurethane laminated to face sheets][Steel-stiffener core laminated to face sheets]**.
 - g. Fire-Rated Core: Manufacturer's standard **[vertical steel stiffener][laminated mineral board]** core for fire-rated **[and temperature-rise-rated]** doors.
2. Stainless Steel Frames:
- a. Materials: Type 304 stainless steel sheet.
 - b. Door Frames for Openings 48 Inches (1219 mm) Wide or Less: Fabricate from stainless

- steel sheet, minimum thickness [0.062 inch (1.59 mm)][0.078 inch (1.98 mm)][0.109 inch (2.78 mm)].
- c. Door Frames for Openings More Than 48 Inches (1219 mm) Wide: Fabricate from stainless steel sheet, minimum thickness [0.078 inch (1.98 mm)][0.109 inch (2.78 mm)].
 - d. Construction: [Face welded][Full profile welded][Knocked down][Slip on].
3. Hardware Reinforcement: Stainless steel sheet.
 4. Finish: ASTM A480/A480M [No. 4, Directional Satin][No. 6, Dull Satin][No. 8, Mirrorlike Reflective, Nondirectional Polish][No. 2B, Bright, Cold-Rolled, Unpolished].
- F. Doors and Frames for Clean Room Environments: [At locations indicated in the Door and Frame Schedule on Drawings]<Insert locations>.
1. Stainless Steel Doors:
 - a. Type: As indicated in the Door and Frame Schedule on Drawings.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - c. Face Sheets: [Type 304][Type 316] stainless steel sheet, minimum thickness [0.050 inch (1.27 mm)][0.062 inch (1.59 mm)][0.078 inch (1.98 mm)].
 - d. Edge Construction: Continuously welded with no visible seam.
 - e. Top and Bottom Edges: Closed with continuous stainless steel channels with minimum thickness of 0.062 inch (1.59 mm), [intermittently welded][intermittently welded and sealed][continuously welded][adhesive-laminated and sealed] to face sheets.
 - f. Core Construction: [Welded steel-stiffened core, without insulation][Polyisocyanurate, polystyrene, or polyurethane laminated to face sheets][Steel-stiffener core laminated to face sheets].
 - g. Fire-Rated Core: Manufacturer's standard [vertical steel stiffener][laminated mineral board] core for fire-rated [and temperature-rise-rated] doors.
 2. Stainless Steel Frames:
 - a. Materials: [Type 304][Type 316] stainless steel sheet.
 - b. Door Frames for Openings 48 Inches (1219 mm) Wide or Less: Fabricate from stainless steel sheet, minimum thickness [0.062 inch (1.59 mm)][0.078 inch (1.98 mm)][0.109 inch (2.78 mm)].
 - c. Door Frames for Openings More Than 48 Inches (1219 mm) Wide: Fabricate from stainless steel sheet, minimum thickness [0.078 inch (1.98 mm)][0.109 inch (2.78 mm)].
 - d. Construction: Full profile welded.
 3. Hardware Reinforcement: [Stainless steel][Uncoated steel][Metallic-coated steel] sheet.
 4. Finish: ASTM A480/A480M [No. 4, Directional Satin][No. 6, Dull Satin][No. 8, Mirrorlike Reflective, Nondirectional Polish][No. 2B, Bright, Cold-Rolled, Unpolished].
- G. Doors and Frames for Aesthetic Environments: [At locations indicated in the Door and Frame Schedule on Drawings]<Insert locations>.
1. Stainless Steel Doors:
 - a. Type: As indicated in the Door and Frame Schedule on Drawings.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - c. Face Sheets: Type 304 stainless steel sheet, minimum thickness [0.050 inch (1.27 mm)][0.062 inch (1.59 mm)][0.078 inch (1.98 mm)].
 - d. Edge Construction: Continuously welded with no visible seam.
 - e. Top and Bottom Edges: Closed with continuous [0.062-inch- (1.59-mm-) thick stainless steel][0.053-inch- (1.34-mm-) thick metallic-coated steel] channels, [welded][adhesive

laminated] to face sheets.

- 1) Provide flush top and bottom closures for exterior doors, with weep holes at bottom edge.
- f. Core Construction: **[Honeycomb kraft paper][Polyisocyanurate, polystyrene, or polyurethane][Steel-stiffener core]** laminated to face sheets.
- g. Fire-Rated Core: Manufacturer's standard **[vertical steel stiffener][laminated mineral board]** core for fire-rated **[and temperature-rise-rated]** doors.
2. Stainless Steel Frames:
 - a. Materials: Type 304 stainless steel sheet.
 - b. Door Frames for Openings 48 Inches (1219 mm) Wide or Less: Fabricate from stainless steel sheet, minimum thickness **[0.062 inch (1.59 mm)][0.078 inch (1.98 mm)][0.109 inch (2.78 mm)]**.
 - c. Door Frames for Openings More Than 48 Inches (1219 mm) Wide: Fabricate from stainless steel sheet, minimum thickness **[0.078 inch (1.98 mm)][0.109 inch (2.78 mm)]**.
 - d. Construction: **[Face welded][Full profile welded][Knocked down][Slip on]**.
3. Hardware Reinforcement: **[Uncoated steel][Metallic-coated steel]** sheet.
4. Finish: ASTM A480/A480M **[No. 4, Directional Satin][No. 6, Dull Satin][No. 8, Mirrorlike Reflective, Nondirectional Polish]**.

2.3 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- B. Stainless Steel Sheet: ASTM A240/A240M, austenitic stainless steel, **[Type 304][Type 316][Type 304 or 316 as indicated]<Insert type>**.
- C. Steel Sheet: ASTM A1008/A1008M or ASTM A1011/A1011M, commercial steel, Type B.
- D. Metallic-Coated Steel Sheet: ASTM A653/A653M, commercial steel, Type B; with minimum **G60 (Z180)** or **A60 (ZF180)** metallic coating.
- E. Foam-Plastic Insulation: Manufacturer's standard **[polystyrene][urethane]** board insulation with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, in accordance with ASTM E84. Enclose insulation completely within door.
- F. Mineral-Fiber Insulation: Insulation made of rock-wool fibers, slag-wool fibers, or glass fibers.
- G. Inserts, Bolts, and Anchor Fasteners:
 1. Stainless steel components complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 for bolts and nuts.
 2. Hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.

2.4 STAINLESS STEEL PANELS

- A. Stainless Steel Panels: Same construction, materials, and finish as specified for adjoining stainless steel doors.

2.5 FRAME ANCHORS

- A. Provide anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
- B. Postinstalled Expansion Anchor: Minimum **3/8-inch- (9.5-mm-)** diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- C. Number and Spacing:
 - 1. Masonry Type: Locate anchors not more than **18 inches (457 mm)** from top and bottom of frame. Space anchors not more than **32 inches (813 mm)** o.c.
 - 2. Stud-Wall Type: Locate anchors not more than **18 inches (457 mm)** from top and bottom of frame. Space anchors not more than **32 inches (813 mm)** o.c. Two anchors per head for frames more than **42 inches (1066 mm)** wide and mounted in metal-stud partitions.
 - 3. Compression Type: Not less than two anchors in each jamb.
 - 4. Postinstalled Expansion Type: Locate anchors not more than **6 inches (152 mm)** from top and bottom of frame. Space anchors not more than **26 inches (660 mm)** o.c.
- D. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
 - 1. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than **2-inch (51-mm)** height adjustment. Terminate bottom of frames at top of underlayment.
- E. Material:
 - 1. Stainless steel sheet. Same type as door face.
 - 2. Steel sheet, hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.6 FABRICATION

- A. Stainless Steel Door Fabrication: Provide doors rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.
 - 1. Tolerances: Fabricate doors to tolerances indicated in NAAMM-HMMA 866.
 - 2. Stops and Moldings: Factory cut openings in doors. Provide minimum **0.038-inch- (0.95-mm-)** thick, stainless steel stops and moldings around glazed lites. Form corners of stops and moldings with butted or mitered hairline joints.
 - a. Glazed Lites: Provide fixed stops and moldings welded on secure side of door.
 - b. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.
- B. Stainless Steel Frame Fabrication: Provide stainless steel frames rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.
 - 1. Tolerances: Fabricate frames to tolerances indicated in NAAMM-HMMA 866.
 - 2. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
 - 3. Borrowed-Lite Frames: Fabricate from **[0.062-inch- (1.59-mm-)] [0.078-inch- (1.98-mm-)] [0.109-inch- (2.78-mm-)]** thick, stainless steel sheet.

4. Sidelite and Transom Frames: Fabricate from stainless steel sheet of same thickness as adjacent door frame.
 5. Mullions, Rails, and Transom Bars: Provide closed tubular members with no visible face seams or joints. Fasten members at crossings and to jambs by butt welding according to joint designs in NAAMM-HMMA 820.
 6. Provide countersunk, flat-, or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 7. Door Silencers: Except on weather-stripped and gasketed frames, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
 8. Stops and Moldings: Provide stops and moldings formed integrally with stainless steel frames around **[glazed lites][and][solid panels]**, minimum **5/8 inch (16 mm)** high unless otherwise indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 - a. Loose Stops for Glazed Lites and Panels: **0.038-inch- (0.95-mm-)** thick, stainless steel.
 - b. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of door or frame.
 - c. Multiple Glazed Lites: Provide fixed and removable stops and moldings such that each lite is capable of being removed independently.
 - d. Coordinate rabbet width between fixed and removable stops with type of glazing **[or panel]** and type of installation.
 - e. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than **9 inches (230 mm)** o.c. and not more than **2 inches (51 mm)** o.c. from each corner.
 9. Terminated Stops: Where indicated on Drawings for interior door frames, terminate stops **6 inches (152 mm)** above finish floor with a **[45][90]-degree** angle cut, and close open end of stop with stainless steel sheet closure. Cover opening in extension of frame with welded-stainless steel filler plate, with welds ground smooth and flush with frame.
 10. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than **9 inches (230 mm)** o.c. and not more than **2 inches (51 mm)** o.c. from each corner.
 11. Grouted Frames:
 - a. Plaster Guards: Weld guards to frame at back of hardware mortises and mounting holes in frames to be grouted.
 - b. Head Reinforcement: For frames more than **48 inches (1219 mm)** wide, provide continuous head reinforcement for full width of opening, welded to back of frame at head.
- C. Hardware Preparation: Factory prepare stainless steel doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping, in accordance with the Door Hardware Schedule on Drawings, and templates.
1. Reinforce doors to receive nontemplated mortised and surface-mounted door hardware.
 2. Comply with ANSI/BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

2.7 FINISHES

- A. Stainless Steel Finishes: Remove tool and die marks and stretch lines, or blend into finish. Grind and polish surfaces to produce uniform finish, free of cross scratches. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

- B. Grain Direction: For finishes exhibiting grain, run grain vertically on door faces and frame jambs.

2.8 ACCESSORIES

- A. Glazing: Comply with requirements in Section 088000 "Glazing."
- B. Grout: Comply with ASTM C476, with a slump of not more than **4 inches (102 mm)** as measured in accordance with ASTM C143/C143M.
- C. Mineral-Fiber Insulation: Insulation made of rock-wool fibers, slag-wool fibers, or glass fibers.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation and with installation spreaders in place, adjust and securely brace stainless steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - 1. Squareness: Plus or minus **1/16 inch (1.6 mm)**, measured at door rabbet on a line 90 degrees from jamb, and perpendicular to frame head.
 - 2. Alignment: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus **1/16 inch (1.6 mm)**, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.2 INSTALLATION

- A. Install stainless steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Stainless Steel Frames:
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - b. Install frames with removable glazing stops located on secure side of opening.
 - 2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
 - 3. Floor Anchors: Secure with postinstalled expansion anchors.

- a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
4. Solidly pack mineral-fiber insulation inside frames.
5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors.
6. Installation Tolerances: Adjust stainless steel frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus **1/16 inch (1.6 mm)**, measured at door rabbet on a line 90 degrees from jamb, and perpendicular to frame head.
 - b. Alignment: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus **1/16 inch (1.6 mm)**, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs at floor.
- C. Stainless Steel Doors: Fit and adjust stainless steel doors accurately in frames within clearances specified below:
 1. Non-Fire-Rated Doors: Comply with NAAMM-HMMA 841 and NAAMM-HMMA 866.
 2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.
 3. Smoke-Control Doors: Install doors in accordance with NFPA 105.
- D. Glazing: Install glazing in sidelites, transoms, and borrowed lites to comply with installation requirements in Section 088000 "Glazing."

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: **[Owner will engage][Engage]** a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
 2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in **[NFPA 80][and][NFPA 101]**.

3.4 ADJUSTING AND CLEANING

- A. Clean grout and other bonding material off stainless steel doors and frames immediately after installation.



08 - Openings

- B. Stainless Steel Touchup: Immediately after erection, smooth any scratched or damaged areas of stainless steel; polish to match undamaged finish.

END OF SECTION 08 05 13 00



Task	Specification	Specification Description
08 05 13 00	01 11 19 00	No Specification Required
08 05 13 00	08 14 16 00	Flush Wood Doors



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SECTION 08 11 13 00 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.
3. Interior custom hollow-metal doors and frames.
4. Exterior custom hollow-metal doors and frames.

B. Related Requirements:

1. Section 081119 "Stainless-Steel Doors and Frames" for hollow-metal doors and frames manufactured from stainless steel.
2. Section 083473.13 "Metal Sound Control Door Assemblies" for packaged, acoustically rated hollow-metal door and frame assemblies.
3. **[Section 087100 "Door Hardware"]****[Section 087111 "Door Hardware (Descriptive Specification)"]** for door hardware for hollow-metal doors.
4. Section 119812 "Detention Doors and Frames" for hollow-metal doors and frames for detention facilities.
5. Section 134900 "Radiation Protection" for lead-lined, hollow-metal doors and frames.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]**<Insert location>.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Interior standard steel doors and frames.

2. Exterior standard steel doors and frames.
 3. Interior custom hollow-metal doors and frames.
 4. Exterior custom hollow-metal doors and frames.
- B. Product Data Submittals: For each product.
1. Include construction details, material descriptions, core descriptions, **[fire-resistance ratings,][temperature-rise ratings,]** and finishes.
- C. Sustainable Design Submittals:
1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 2. Environmental Product Declaration: For each product.
 3. Health Product Declaration: For each product.
 4. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
 5. Environmental Product Declaration: For each product.
 6. Environmental Product Declaration: For each product.
 7. Environmental Product Declaration: For each product.
 8. Third-Party Certifications: For each product.
 9. Third-Party Certified Life Cycle Assessment: For each product.
- D. Shop Drawings: Include the following:
1. Elevations of each door type.
 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of each different wall opening condition.
 6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 7. Details of anchorages, joints, field splices, and connections.
 8. Details of accessories.
 9. Details of moldings, removable stops, and glazing.
- E. Samples for Initial Selection: For hollow-metal doors and frames with factory-applied color finishes.
- F. Samples for Verification:
1. Finishes: For each type of exposed finish required, prepared on Samples of not less than **3 by 5 inches (75 by 127 mm)**.
 2. Fabrication: Prepare Samples approximately **[12 by 12 inches (305 by 305 mm)][8 by 10 inches (203 by 254 mm)]<Insert dimension>** to demonstrate compliance with requirements for quality of materials and construction:
 - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.
- G. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For door inspector.
 - 1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
 - 2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
 - 3. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.
- B. Product Test Reports: For each type of **[fire-rated hollow-metal door and frame assembly][fire-rated borrowed-lite assembly][windborne-debris impact resistance door][and][thermally rated door assemblies]** for tests performed by a qualified testing agency indicating compliance with performance requirements.
- C. Oversize Construction Certification: For assemblies required to be fire-rated and exceeding limitations of labeled assemblies.
- D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.8 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies is to meet the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
 - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.
- B. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies is to meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
 - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum **4-inch- (102-mm-)** high wood blocking. Provide minimum **1/4-inch (6-mm)** space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 HOLLOW METAL DOORS AND FRAMES

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

1. **[Airtec Corporation]**
2. **[Apex Industries, Inc]**
3. **[BARON Metal Industries, Inc.; ASSA ABLOY of Canada, Ltd.; ASSA ABLOY]**
4. **[Ceco Door; AADG, Inc.; ASSA ABLOY]**
5. **[Concept Frames, AADG, Inc.; ASSA ABLOY Group]**
6. **[Curries, AADG, Inc.; ASSA ABLOY Group]**
7. **[Custom Metal Products]**
8. **[Daybar Industries, Ltd]**
9. **[DCI Hollow Metal on Demand]**
10. **[DE LA FONTAINE]**
11. **[Deansteel Manufacturing Company, Inc.]**
12. **[Deronde Products]**
13. **[DKS Steel Door & Frame Systems, Inc.]**
14. **[Fleming Door Products Ltd.; ASSA ABLOY Group]**
15. **[Gensteel Doors]**
16. **[HMF Express]**
17. **[Hollow Metal Xpress]**
18. **[JR Metal Frames, Inc.]**
19. **[Karpen Steel Custom Doors & Frames]**
20. **[L.I.F. Industries, Inc]**
21. **[LaForce, LLC]**
22. **[MegaMet Industries]**
23. **[Mesker Door; Mesker Openings Group]**
24. **[Metropolitan Door Industries Corp.]**
25. **[Michbi Doors Inc]**
26. **[MPI Group, LLC (The)]**
27. **[National Custom Hollow Metal Doors & Frames]**
28. **[North American Door Corp]**
29. **[Philipp Manufacturing Co (The)]**
30. **[Pioneer Industries; AADG, Inc.; ASSA ABLOY]**
31. **[Premier Products, Inc]**
32. **[Republic Doors and Frames; a Allegion brand]**
33. **[Rocky Mountain Metals, Inc]**
34. **[Security Metal Products; a brand of ASSA ABLOY]**
35. **[Steelcraft; Allegion plc]**
36. **[Steward Steel, Door & Frame Division]**
37. **[Stiles Custom Metal, Inc]**
38. **[Titan Metal Products]**
39. **[Trillium Steel Doors Limited]**
40. **[West Central Manufacturing, Inc.]**
41. **<Insert manufacturer's name>**

- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

1. **[Airtec Corporation]**

2. [Apex Industries, Inc]
3. [BARON Metal Industries, Inc.; ASSA ABLOY of Canada, Ltd.; ASSA ABLOY]
4. [Ceco Door; AADG, Inc.; ASSA ABLOY]
5. [Concept Frames, AADG, Inc.; ASSA ABLOY Group]
6. [Curries, AADG, Inc.; ASSA ABLOY Group]
7. [Custom Metal Products]
8. [Daybar Industries, Ltd]
9. [DCI Hollow Metal on Demand]
10. [DE LA FONTAINE]
11. [Deansteel Manufacturing Company, Inc.]
12. [Deronde Products]
13. [DKS Steel Door & Frame Systems, Inc.]
14. [Fleming Door Products Ltd.; ASSA ABLOY Group]
15. [Gensteel Doors]
16. [HMF Express]
17. [Hollow Metal Xpress]
18. [JR Metal Frames, Inc.]
19. [Karpen Steel Custom Doors & Frames]
20. [L.I.F. Industries, Inc]
21. [LaForce, LLC]
22. [MegaMet Industries]
23. [Mesker Door; Mesker Openings Group]
24. [Metropolitan Door Industries Corp.]
25. [Michbi Doors Inc]
26. [MPI Group, LLC (The)]
27. [National Custom Hollow Metal Doors & Frames]
28. [North American Door Corp]
29. [Philipp Manufacturing Co (The)]
30. [Pioneer Industries; AADG, Inc.; ASSA ABLOY]
31. [Premier Products, Inc]
32. [Republic Doors and Frames; a Allegion brand]
33. [Rocky Mountain Metals, Inc]
34. [Security Metal Products; a brand of ASSA ABLOY]
35. [Steelcraft; Allegion plc]
36. [Steward Steel, Door & Frame Division]
37. [Stiles Custom Metal, Inc]
38. [Titan Metal Products]
39. [Trillium Steel Doors Limited]
40. [West Central Manufacturing, Inc.]
41. <Insert manufacturer's name>

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings[**and temperature-rise limits**] indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
 1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.
 2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 3. Temperature-Rise Limit: [Where indicated on Drawings][At vertical exit enclosures and exit

passageways], provide doors that have a maximum transmitted temperature end point of not more than **450 deg F (250 deg C)** above ambient after 30 minutes of standard fire-test exposure.

- B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing in accordance with NFPA 257 or UL 9.
- C. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone **[1][2][3][4]** for **[basic][enhanced]** protection.
 - 1. Large-Missile Test: For glazed openings located within **[30 feet (9.1 m)]<Insert dimension>** of grade.
- D. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than **[0.50 deg Btu/F x h x sq. ft. (2.84 W/K x sq. m)][0.40 deg Btu/F x h x sq. ft. (2.27 W/K x sq. m)][0.38 deg Btu/F x h x sq. ft. (2.16 W/K x sq. m)]<Insert U-factor>** when tested in accordance with ASTM C1363 or ASTM E1423.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Standard-Duty Doors and Frames: ANSI/SDI A250.8, Level 1; ANSI/SDI A250.4, Level C. **[At locations indicated in the Door and Frame Schedule on Drawings]<Insert locations>**.
 - 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule on Drawings.
 - b. Thickness: **[1-3/4 inches (44.5 mm)][1-3/8 inches (34.9 mm)]**.
 - c. Face: **[Uncoated][Metallic-coated]** steel sheet, minimum thickness of **0.032 inch (0.8 mm)**.
 - d. Edge Construction: **[Model 1, Full Flush][Model 2, Seamless]**.
 - e. Edge Bevel: **[Bevel lock and hinge edges 1/8 inch in 2 inches (3.2 mm in 51 mm)][Bevel lock edge 1/8 inch in 2 inches (3.2 mm in 51 mm)][Provide manufacturer's standard beveled or square edges]**.
 - f. Core: **[Manufacturer's standard][Kraft-paper honeycomb][Polystyrene][Polyurethane][Polyisocyanurate][Vertical steel stiffener]**.
 - g. Fire-Rated Core: Manufacturer's standard **[vertical steel stiffener][laminated mineral board]** core for fire-rated **[and temperature-rise-rated]** doors.
 - 2. Frames:
 - a. Materials: **[Uncoated][Metallic-coated]** steel sheet, minimum thickness of **0.042 inch (1.0 mm)**.
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: **[Knocked down][Slip-on drywall][Face welded][Full profile welded]**.
 - 3. Exposed Finish: **[Prime][Factory]**.
- C. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. **[At locations indicated in the Door and Frame Schedule on Drawings]<Insert locations>**.

1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule on Drawings.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - c. Face: [Uncoated][Metallic-coated] steel sheet, minimum thickness of 0.042 inch (1.0 mm).
 - d. Edge Construction: [Model 1, Full Flush][Model 2, Seamless].
 - e. Edge Bevel: [Bevel lock and hinge edges 1/8 inch in 2 inches (3.2 mm in 51 mm)][Bevel lock edge 1/8 inch in 2 inches (3.2 mm in 51 mm)][Provide manufacturer's standard beveled or square edges].
 - f. Core: [Manufacturer's standard][Kraft-paper honeycomb][Polystyrene][Polyurethane][Polyisocyanurate][Vertical steel stiffener].
 - g. Fire-Rated Core: Manufacturer's standard [vertical steel stiffener][laminated mineral board] core for fire-rated [and temperature-rise-rated]doors.
 2. Frames:
 - a. Materials: [Uncoated][Metallic-coated] steel sheet, minimum thickness of 0.053 inch (1.3 mm).
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: [Knocked down][Slip-on drywall][Face welded][Full profile welded].
 3. Exposed Finish: [Prime][Factory].
- D. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A. [At locations indicated in the Door and Frame Schedule on Drawings]<Insert locations>.
1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule on Drawings.
 - b. Thickness: 1-3/4 inches (44.5 mm).
 - c. Face: [Uncoated][Metallic-coated] steel sheet, minimum thickness of 0.053 inch (1.3 mm).
 - d. Edge Construction: [Model 1, Full Flush][Model 2, Seamless][Model 3, Stile and Rail].
 - e. Edge Bevel: [Bevel lock and hinge edges 1/8 inch in 2 inches (3.2 mm in 51 mm)][Bevel lock edge 1/8 inch in 2 inches (3.2 mm in 51 mm)][Provide manufacturer's standard beveled or square edges].
 - f. Core: [Manufacturer's standard][Kraft-paper honeycomb][Polystyrene][Polyurethane][Polyisocyanurate][Vertical steel stiffener].
 - g. Fire-Rated Core: Manufacturer's standard [vertical steel stiffener][laminated mineral board] core for fire-rated [and temperature-rise-rated]doors.
 2. Frames:
 - a. Materials: [Uncoated][Metallic-coated] steel sheet, minimum thickness of 0.053 inch (1.3 mm).
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: [Knocked down][Slip-on drywall][Face welded][Full profile welded].
 3. Exposed Finish: [Prime][Factory].
- E. Maximum-Duty Doors and Frames: ANSI/SDI A250.8, Level 4; ANSI/SDI A250.4, Level A. [At locations indicated in the Door and Frame Schedule on Drawings]<Insert locations>.

1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule on Drawings.
 - b. Thickness: **1-3/4 inches (44.5 mm)**.
 - c. Face: **[Uncoated][Metallic-coated]** steel sheet, minimum thickness of **0.067 inch (1.7 mm)**.
 - d. Edge Construction: **[Model 1, Full Flush][Model 2, Seamless]**.
 - e. Edge Bevel: **[Bevel lock and hinge edges 1/8 inch in 2 inches (3.2 mm in 51 mm)][Bevel lock edge 1/8 inch in 2 inches (3.2 mm in 51 mm)][Provide manufacturer's standard beveled or square edges]**.
 - f. Core: **[Manufacturer's standard][Kraft-paper honeycomb][Polystyrene][Polyurethane][Polyisocyanurate][Vertical steel stiffener]**.
 - g. Fire-Rated Core: Manufacturer's standard **[vertical steel stiffener][laminated mineral board]** core for fire-rated **[and temperature-rise-rated]** doors.
2. Frames:
 - a. Materials: **[Uncoated][Metallic-coated]** steel sheet, minimum thickness of **0.067 inch (1.7 mm)**.
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: **[Knocked down][Slip-on drywall][Face welded][Full profile welded]**.
3. Exposed Finish: **[Prime][Factory]**.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. **[At locations indicated in the Door and Frame Schedule on Drawings]<Insert locations>**.

1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule on Drawings.
 - b. Thickness: **1-3/4 inches (44.5 mm)**.
 - c. Face: Metallic-coated steel sheet, minimum thickness of **0.042 inch (1.0 mm)**, with minimum **[A40 (ZF120)][A60 (ZF180)]** coating.
 - d. Edge Construction: **[Model 1, Full Flush][Model 2, Seamless]**.
 - e. Edge Bevel: **[Bevel lock and hinge edges 1/8 inch in 2 inches (3.2 mm in 51 mm)][Bevel lock edge 1/8 inch in 2 inches (3.2 mm in 51 mm)][Provide manufacturer's standard beveled or square edges]**.
 - f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
 - g. Bottom Edges: Close bottom edges of doors **[where required for attachment of weather stripping]** with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
 - h. Core: **[Manufacturer's standard][Polystyrene][Polyurethane][Polyisocyanurate][Vertical steel stiffener]**.
 - i. Fire-Rated Core: Manufacturer's standard **[vertical steel stiffener with insulation][laminated mineral board]** core for fire-rated doors.
2. Frames:

- a. Materials: Metallic-coated steel sheet, minimum thickness of **0.053 inch (1.3 mm)**, with minimum **[A40 (ZF120)][A60 (ZF180)]** coating.
 - b. Construction: **[Knocked down][Face welded][Full profile welded]**.
 3. Exposed Finish: **[Prime][Factory]**.
- C. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A. **[At locations indicated in the Door and Frame Schedule on Drawings]<Insert locations>**.
 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule on Drawings.
 - b. Thickness: **1-3/4 inches (44.5 mm)**.
 - c. Face: Metallic-coated steel sheet, minimum thickness of **0.053 inch (1.3 mm)**, with minimum **[A40 (ZF120)][A60 (ZF180)]** coating.
 - d. Edge Construction: **[Model 1, Full Flush][Model 2, Seamless][Model 3, Stile and Rail]**.
 - e. Edge Bevel: **[Bevel lock and hinge edges 1/8 inch in 2 inches (3.2 mm in 51 mm)][Bevel lock edge 1/8 inch in 2 inches (3.2 mm in 51 mm)][Provide manufacturer's standard beveled or square edges]**.
 - f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
 - g. Bottom Edges: Close bottom edges of doors **[where required for attachment of weather stripping]** with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
 - h. Core: **[Manufacturer's standard][Polystyrene][Polyurethane][Polyisocyanurate][Vertical steel stiffener]**.
 - i. Fire-Rated Core: Manufacturer's standard **[vertical steel stiffener with insulation][laminated mineral board]** core for fire-rated doors.
 2. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of **0.053 inch (1.3 mm)**, with minimum **[A40 (ZF120)][A60 (ZF180)]** coating.
 - b. Construction: **[Knocked down][Face welded][Full profile welded]**.
 3. Exposed Finish: **[Prime][Factory]**.
- D. Maximum-Duty Doors and Frames: ANSI/SDI A250.8, Level 4; ANSI/SDI A250.4, Level A. **[At locations indicated in the Door and Frame Schedule on Drawings]<Insert locations>**.
 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule on Drawings.
 - b. Thickness: **1-3/4 inches (44.5 mm)**.
 - c. Face: Metallic-coated steel sheet, minimum thickness of **0.067 inch (1.7 mm)**, with minimum **[A40 (ZF120)][A60 (ZF180)]** coating.
 - d. Edge Construction: **[Model 1, Full Flush][Model 2, Seamless]**.
 - e. Edge Bevel: **[Bevel lock and hinge edges 1/8 inch in 2 inches (3.2 mm in 51 mm)][Bevel lock edge 1/8 inch in 2 inches (3.2 mm in 51 mm)][Provide manufacturer's standard beveled or square edges]**.
 - f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
 - g. Bottom Edges: Close bottom edges of doors **[where required for attachment of weather stripping]** with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
 - h. Core: **[Manufacturer's**

- i. **standard** **[Polystyrene]** **[Polyurethane]** **[Polyisocyanurate]** **[Vertical steel stiffener]**.
Fire-Rated Core: Manufacturer's standard **[vertical steel stiffener with insulation]** **[laminated mineral board]** core for fire-rated doors.

2. Frames:

- a. Materials: Metallic-coated steel sheet, minimum thickness of **0.067 inch (1.7 mm)**, with minimum **[A40 (ZF120)]** **[A60 (ZF180)]** coating.
- b. Construction: **[Knocked down]** **[Face welded]** **[Full profile welded]**.

3. Exposed Finish: **[Prime]** **[Factory]**.

2.5 INTERIOR CUSTOM HOLLOW-METAL DOORS AND FRAMES

- A. Hollow-Metal Doors and Frames: NAAMM-HMMA 860; ANSI/SDI A250.4, Physical Performance Level A. **[At locations indicated in the Door and Frame Schedule on Drawings]** **<Insert locations>**.

1. Doors:

- a. Type: As indicated in the Door and Frame Schedule on Drawings.
- b. Thickness: **1-3/4 inches (44.5 mm)**.
- c. Face: **[Uncoated]** **[Metallic-coated]** steel sheet, minimum thickness of **[0.032 inch (0.8 mm)]** **[0.042 inch (1.0 mm)]** **[0.053 inch (1.3 mm)]**.
- d. Edge Construction: **[Continuously welded with no]** **[Projection or tack welded with no]** **[Interlocking with]** **[Projection or tack welded with]** visible seam.
- e. Core: Steel stiffened.
- f. Fire-Rated Core: Manufacturer's standard **[vertical steel stiffener]** **[laminated mineral board]** core for fire-rated **[and temperature-rise-rated]** doors.

2. Frames:

- a. Materials: **[Uncoated]** **[Metallic-coated]** steel sheet, minimum thickness of **0.053 inch (1.3 mm)**.
- b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
- c. Construction: **[Knocked down]** **[Slip-on drywall]** **[Face welded]** **[Full profile welded]**.

3. Exposed Finish: Prime.

- B. Commercial Doors and Frames: NAAMM-HMMA 861; ANSI/SDI A250.4, Physical Performance Level A. **[At locations indicated in the Door and Frame Schedule on Drawings]** **<Insert locations>**.

1. Doors:

- a. Type: As indicated in the Door and Frame Schedule on Drawings.
- b. Thickness: **1-3/4 inches (44.5 mm)**.
- c. Face: **[Uncoated]** **[Metallic-coated]** steel sheet, minimum thickness of **0.042 inch (1.0 mm)**.
- d. Edge Construction: Continuously welded with no visible seam.
- e. Core: Steel stiffened.
- f. Fire-Rated Core: Manufacturer's standard **[vertical steel stiffener]** **[laminated mineral board]** core for fire-rated **[and temperature-rise-rated]** doors.

2. Frames:

- a. Materials: **[Uncoated][Metallic-coated]** steel sheet, minimum thickness of **0.053 inch (1.3 mm)**, except **0.067 inch (1.7 mm)** for openings exceeding **4 feet (1219 mm)** wide.
 - b. Sidelite and Transom Frames: Fabricated from same material as adjacent door frame.
 - c. Construction: **[Face][Full profile]** welded.
 3. Exposed Finish: Prime.
- C. Commercial Laminated Doors and Frames: NAAMM-HMMA 867; ANSI/SDI A250.4, Physical Performance Level A. **[At locations indicated in the Door and Frame Schedule on Drawings]<Insert locations>**.
 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule on Drawings.
 - b. Thickness: **1-3/4 inches (44.5 mm)**.
 - c. Face: **[Uncoated][Metallic-coated]** steel sheet, minimum thickness of **[0.032 inch (0.8 mm)][0.042 inch (1.0 mm)][0.053 inch (1.3 mm)]**.
 - d. Edge Construction: **[Continuously welded with no visible seam][Interlocking with visible seam][Interlocking with no visible seam][Projection, spot, or tack welded with or without visible seams]**.
 - e. Edge Bevel: **[Bevel lock and hinge edges 1/8 inch in 2 inches (3.2 mm in 51 mm)][Bevel lock edge 1/8 inch in 2 inches (3.2 mm in 51 mm)]**.
 - f. Core: **[Kraft-paper honeycomb][Polyisocyanurate][Polystyrene][Polyurethane][Vertical steel stiffener]**.
 - g. Fire-Rated Core: Manufacturer's standard **[vertical steel stiffener][laminated mineral board]** core for fire-rated **[and temperature-rise-rated]** doors.
 2. Frames:
 - a. Materials: **[Uncoated][Metallic-coated]** steel sheet, minimum thickness of **0.053 inch (1.3 mm)**.
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: **[Knocked down][Slip-on drywall][Face welded][Full profile welded]**.
 3. Exposed Finish: **[Prime][Unprimed]**.

2.6 EXTERIOR CUSTOM HOLLOW-METAL DOORS AND FRAMES

- A. Commercial Doors and Frames: NAAMM-HMMA 861; ANSI/SDI A250.4, Physical Performance Level A. **[At locations indicated in the Door and Frame Schedule on Drawings]<Insert locations>**.
 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule on Drawings.
 - b. Thickness: **1-3/4 inches (44.5 mm)**.
 - c. Face: Metallic-coated steel sheet, minimum thickness of **0.053 inch (1.30 mm)**, with minimum **G60 or A60 (ZF180)** coating.
 - d. Edge Construction: Continuously welded with no visible seam.
 - e. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
 - f. Bottom Edges: Close bottom edges of doors **[where required for attachment of weather stripping]** with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
 - g. Core: Steel stiffened.

2. Frames:

- a. Materials: Metallic-coated steel sheet, minimum thickness of **0.053 inch (1.3 mm)**, except **0.067 inch (1.7 mm)** for openings exceeding **4 feet (1219 mm)** wide; with minimum **G60 or A60 (ZF180)** coating.
- b. Construction: **[Face][Full profile]** welded.

3. Exposed Finish: Prime.

B. Commercial Laminated Doors and Frames: NAAMM-HMMA 867; ANSI/SDI A250.4, Physical Performance Level A. **[At locations indicated in the Door and Frame Schedule on Drawings]<Insert locations>**.

1. Doors:

- a. Type: As indicated in the Door and Frame Schedule on Drawings.
- b. Thickness: **1-3/4 inches (44.5 mm)**.
- c. Face: Metallic-coated steel sheet, minimum thickness of **[0.053 inch (1.3 mm)][0.042 inch (1.0 mm)]**, with minimum **G60 or A60 (ZF180)** coating.
- d. Edge Construction: **[Continuously welded with no visible seam][Interlocking with visible seam][Interlocking with no visible seam][Projection, spot, or tack welded with or without visible seams]**.
- e. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
- f. Bottom Edges: Close bottom edges of doors **[where required for attachment of weather stripping]** with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
- g. Core: **[Kraft-paper honeycomb][Polyisocyanurate][Polystyrene][Polyurethane][Vertical steel stiffener]**.

2. Frames:

- a. Materials: Metallic-coated steel sheet, minimum thickness of **0.053 inch (1.3 mm)**, with minimum **G60 or A60 (ZF180)** coating.
- b. Construction: **[Knocked down][Face welded][Full profile welded]**.

3. Exposed Finish: **[Prime][Unprimed]**.

2.7 BORROWED LITES

- A. Fabricate of **[uncoated][metallic-coated]** steel sheet, minimum thickness of **[0.053 inch (1.3 mm)][0.042 inch (1.0 mm)]**.
- B. Construction: **[Knocked down][Face welded][Full profile welded]**.
- C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.
- D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.8 HOLLOW-METAL PANELS

- A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.9 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each **24 inches (610 mm)** of frame height above **7 feet (2.1 m)**.
 - 3. Postinstalled Expansion Anchor: Minimum **3/8-inch- (9.5-mm-)** diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than **2-inch (51-mm)** height adjustment. Terminate bottom of frames at top of underlayment.
- D. Material: ASTM A879/A879M, Commercial Steel (CS), **04Z (12G)** coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.10 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- B. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- D. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- G. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
- H. Glazing: Comply with requirements in Section 088000 "Glazing."

2.11 FABRICATION

- A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum **3/4 inch (19 mm)** beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
 - 1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding[, **or by rigid mechanical anchors**].
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
 - 4. Terminated Stops (Hospital Stops): Terminate stops **[6 inches (152 mm)]<Insert dimension>** above finish floor with a **[45][90]**-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
- D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with **[butted][or][mitered]** hairline joints.
 - 1. Provide stops and moldings flush with face of door, and with **[beveled][square]** stops unless otherwise indicated.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
 - 4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
 - 5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than **9 inches (230 mm)** o.c. and not more than **2 inches (51 mm)** o.c. from each corner.

2.12 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying

with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

- B. Factory Finish: Clean, pretreat, and apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, complying with ANSI/SDI A250.3.
 - 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

2.13 LOUVERS

- A. Provide louvers for interior doors, where indicated, which comply with SDI 111, with blades or baffles formed of **0.020-inch- (0.5-mm-)** thick, cold-rolled steel sheet set into **0.032-inch- (0.8-mm-)** thick steel frame.
 - 1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
 - 2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other.
 - 3. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.
- B. Form corners of moldings with hairline joints. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

- A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with **[ANSI/SDI A250.11][NAAMM-HMMA 840]**.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
 3. Floor Anchors: Secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 4. Solidly pack mineral-fiber insulation inside frames.
 5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. **[Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.]**
 7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus or minus **1/16 inch (1.6 mm)**, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus **1/16 inch (1.6 mm)**, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
1. Non-Fire-Rated Steel Doors: Comply with **[ANSI/SDI A250.8][NAAMM-HMMA 841 and NAAMM-HMMA guide specification indicated]**.
 2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.
 3. Smoke-Control Doors: Install doors in accordance with NFPA 105.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: **[Owner will engage][Engage]** a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
 2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance

with each item listed in [NFPA 80][and][NFPA 101].

3.4 REPAIR

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint in accordance with manufacturer's written instructions.
- C. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish in accordance with manufacturer's written instructions.
- D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

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SECTION 08 11 73 00 - INTERIOR ALUMINUM DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior aluminum doors and frames.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, **[fire rating,]**and finishes.
 - b. **<Insert requirements>**.

B. Shop Drawings:

1. Elevations, sections, and installation details for each wall-opening condition.
2. Details of construction of each component, including dimensioned profiles and metal thicknesses.
3. Locations of reinforcements and preparations for hardware.
4. Details of anchorages, joints, splices, connections, and accessories.
5. Details of trim, removable stops, and glazing.

- C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

- D. Samples for Verification: Actual sample of finished products for each type of the following products:

1. Framing Member and Finish: **12 inches (300 mm)** long. Include trim.
2. Window Corner Fabrication and Finish: **12-by-12-inch- (300-by-300-mm-)** long, full-size corner, including full-size sections of extrusions with removable stops.
3. Door Finish: Manufacturer's standard-size unit, but not less than **[3 inches (75 mm) square]<Insert dimensions>**.

- E. Product Schedule: Use same designations indicated on Drawings. Coordinate with door hardware schedule and glazing.

F. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.

1.4 INFORMATIONAL SUBMITTALS

- A. Oversize Fire-Rated Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.
- B. Field Quality-Control Reports: For **[fire-rated][smoke- and draft-control][and][egress]** door assemblies.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For interior aluminum doors and frames.

1.6 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Documented as complying with requirements in NFPA 80 **[and having Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification]<Insert requirements>**.
- B. Egress Door Inspector Qualifications: Documented as complying with requirements in NFPA 101 **[and having Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification]<Insert requirements>**.

1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockup **[as indicated on Drawings]<Insert mockup requirements>**.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Complying with requirements in NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated **[on Drawings][in schedules]**, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
- B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control based on testing in accordance with UL 1784 by a qualified testing agency acceptable to authorities having jurisdiction.

2.2 INTERIOR ALUMINUM DOORS AND FRAMES

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[Alpha Aluminum Architectural Products]**
 2. **[Avalon International Aluminum LLC]**
 3. **[DIRTT Environmental Solutions]**
 4. **[Frameworks]**
 5. **[Modulex Products, Inc]**
 6. **[RACO Interiors]**
 7. **[Special-Lite]**
 8. **[Speed View USA]**
 9. **[Tubelite Inc.]**
 10. **[Western Integrated Materials, Inc.]**
 11. **[Wilson Partitions; a division of Arcadia Inc.]**
 12. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Alpha Aluminum Architectural Products]**
 2. **[Avalon International Aluminum LLC]**
 3. **[DIRTT Environmental Solutions]**
 4. **[Frameworks]**
 5. **[Modulex Products, Inc]**
 6. **[RACO Interiors]**
 7. **[Special-Lite]**
 8. **[Speed View USA]**
 9. **[Tubelite Inc.]**
 10. **[Western Integrated Materials, Inc.]**
 11. **[Wilson Partitions; a division of Arcadia Inc.]**
 12. **<Insert manufacturer's name>**
- C. Source Limitations: Obtain interior aluminum doors and frames from single source from single manufacturer.
- D. Aluminum Framing: **ASTM B221 (ASTM B221M)**, with alloy and temper required to suit structural and finish requirements, and not less than **0.062 inch (1.6 mm)** thick.
- E. Door Frames: Extruded aluminum, reinforced for hinges, strikes, and closers.
- F. Glazing Frames: Extruded aluminum, for glass thickness **[indicated on Drawings][indicated in schedules]<Insert requirements>**.
- G. Sliding-Door Head Tracks: Extruded aluminum where exposed; provide complete with door-hanging roller assemblies and floor guides.
- H. Pocket-Door Frame Assemblies: Extruded aluminum where exposed, complete with sliding-door head tracks, wall-pocket frames, door-hanging roller assemblies, and floor guides.
- I. Trim: Extruded aluminum, not less than **0.062 inch (1.6 mm)** thick; removable, snap-in **[casing trim][glazing stops][and][door stops]**, without exposed fasteners.
1. Trim Style: **[As indicated on Drawings]<Insert requirements>**.

- J. Aluminum-Framed Glass Doors: Manufacturer's standard, factory-assembled, 1-3/4-inch- (45-mm-) thick doors.
1. Stile Width: **[As indicated on Drawings][Narrow][Medium][Wide][3-3/4 inches (95 mm)]<Insert requirements>**.
 2. Top-Rail Height: **[As indicated on Drawings][3-3/4 inches (95 mm)][6 inches (152 mm)]<Insert dimension>**.
 3. Bottom-Rail Height: **[As indicated on Drawings][6 inches (152 mm)][Provides smooth surface within 10 inches (254 mm) of finished floor measured vertically]<Insert dimension>**.

2.3 ACCESSORIES

- A. Fire-Rated Door Assemblies: Comply with requirements of tested assembly.
- B. Smoke- and Draft-Control Door Assemblies: Comply with requirements of tested assembly.
- C. Wood Doors: As specified in **[Section 081416 "Flush Wood Doors."]<Insert requirements.>**
- D. Fasteners: Aluminum, nonmagnetic, stainless steel, zinc-plated steel or other noncorrosive metal fasteners compatible with frames, stops, panels, reinforcement plates, hardware, anchors, and other items being fastened.
- E. Corner Reinforcements and Alignment Clips: Manufacturer's standard concealed units to provide accurately fitted hairline joints at butted and mitered connections.
- F. Door Silencers: Manufacturer's standard continuous mohair, wool pile, or vinyl seals, **[in manufacturer's standard color][black]<Insert requirements>**.
- G. Glazing Gaskets: Manufacturer's standard extruded or molded rubber or plastic, to accommodate glazing thickness indicated; **[in manufacturer's standard color][black][gray]<Insert color>**.
- H. Glazing Stops: Removable to allow glazing replacement without framing disassembly.
- I. Glass: As specified in **[Section 088000 "Glazing."][Section 088813 "Fire-Rated Glazing."]<Insert glazing requirements.>**
- J. Door Hardware: **[As selected by Architect from manufacturer's full range.][As specified in Section 087100 "Door Hardware."][As specified in Section 087111 "Door Hardware (Descriptive Specification)."]<Insert requirements.>**

2.4 FABRICATION

- A. Hardware Preparation: Factory prepare components to receive templated mortised hardware; include cutouts, reinforcements, mortising, drilling, and tapping.
1. Reinforce doors and frames to receive nontemplated mortised and surface-mounted hardware.
 2. Locate hardware as indicated **[on Drawings]<Insert requirements>**.
- B. Glazing Stops: Locate removable stops on inside of spaces accessed by locking doors.
- C. Fabricate components to allow secure installation without exposed fasteners and to provide accurately fitted hairline joints at butted and mitered connections.

- D. Fabricate frame components [96 inches (2440 mm)][108 inches (2745 mm)]<Insert dimension> long or shorter as one piece. Where splices are required, no individual piece may be less than [48 inches (1220 mm)]<Insert dimension> long.
- E. Fabricate door assemblies for sliding operation to conceal door-hanging roller assemblies from view.

2.5 ALUMINUM FINISHES

- A. Comply with NAAMM/NOMMA AMP 500 for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Clear Anodic Finish: AAMA 611, [AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm] or thicker.
- E. Color Anodic Finish: AAMA 611, [AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A34, Class II, 0.010 mm] or thicker.
 - 1. Color: [Light bronze][Medium bronze][Dark bronze][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>.
- F. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry-film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and curing finish.
 - 1. Color and Gloss: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ALUMINUM DOORS AND FRAMES

- A. Install aluminum frames plumb, rigid, properly aligned, and securely fastened in place in accordance with manufacturer's written instructions.
 - 1. Fire-Rated Door Assemblies: Install in accordance with NFPA 80.
 - 2. Smoke- and Draft-Control Door Assemblies: Install in accordance with NFPA 105.
 - 3. Fasten to suspended ceiling grid on maximum [48-inch (1220-mm)]<Insert dimension> centers, using sheet metal screws or other fasteners approved by frame manufacturer.

4. Use concealed installation clips to produce tightly fitted and aligned splices and connections.
5. Secure clips to extruded main-frame components and not to snap-in or trim members.
6. Do not leave screws or other fasteners exposed to view when installation is complete.

B. Glass: Install glass in accordance with **[Section 088000 "Glazing"]****[Section 088113 "Decorative Glass Glazing"]****[Section 088400 "Plastic Glazing"]****[Section 088813 "Fire-Rated Glazing"]** and aluminum-frame manufacturer's written instructions.

C. Doors: Install doors aligned with frames and fitted with required hardware.

1. Wood Doors: Install in accordance with **[Section 081416 "Wood Doors" and]** aluminum-frame manufacturer's written instructions.
2. Hardware: Install in accordance with **[Section 087100 "Door Hardware" and]****[Section 087111 "Door Hardware (Descriptive Specification)" and]** aluminum-frame manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage]****[Engage]** a qualified testing agency to perform tests and inspections.
- B. Fire-Rated Door Assembly Acceptance Testing: Test and inspect fire-rated door assemblies in accordance with NFPA 80.
- C. Smoke- and Draft-Control Door Assembly Acceptance Testing: Test and inspect smoke- and draft-control door assemblies in accordance with NFPA 105.
- D. Egress Door Assembly Acceptance Testing: Test and inspect egress doors in accordance with NFPA 101.
- E. Repair or remove and replace installations where testing and inspections indicate that they do not comply with specified requirements.
- F. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- G. Prepare test and inspection reports.

3.4 ADJUSTING AND CLEANING

- A. Inspect installation, correct misalignments, and tighten loose connections.
- B. Doors: Adjust doors to operate smoothly and easily, without binding or warping. Adjust hardware to function smoothly in accordance with manufacturer's written instructions.
- C. Clean exposed frame surfaces promptly after installation, using cleaning methods recommended in writing by frame manufacturer and in accordance with AAMA 609 & 610.
- D. Touch Up: Immediately after installation, repair damaged areas of aluminum finishes and touchup in accordance with manufacturer's written instructions.



END OF SECTION 08 11 73 00

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SECTION 08 11 73 00A - SLIDING METAL FIRE DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sliding metal fire doors.

B. Related Requirements:

1. Section 099113 "Exterior Painting" for on-site finish painting of factory prime-coated sliding metal fire doors.
2. Section 099123 "Interior Painting" for on-site finish painting of factory prime-coated sliding metal fire doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
3. Include description of automatic closing device and testing and resetting instructions.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Show locations of controls, locking devices, detectors or replaceable fusible links, and other accessories.
5. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For [Installer][and][testing and inspecting agency].

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
3. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Product Certificates: For each type of sliding metal fire door.

C. Oversized Special-Purpose Fire Door Assembly Certification: For door assemblies required to be fire rated and that exceed size limitations of labeled assemblies, signed by authorized representative of

testing agency.

- D. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sliding metal fire doors to include in emergency, operation, and maintenance manuals.
- B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies shall comply with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
 - 1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.
- C. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies shall comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
 - 1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

1.6 FIELD CONDITIONS

- A. Field Measurements: Indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.
 - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - 2. Fire-Rated Swinging Pass Door Assemblies: Based on testing as a component of sliding metal fire door assembly.
 - 3. Temperature-Rise Limit: Where indicated on Drawings, provide doors that have a maximum transmitted temperature end point of not more than indicated temperature above ambient after 30 minutes of standard fire-test exposure.

- B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
1. Design Wind Load: **[As indicated on Drawings][Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward]<Insert loads>.**
 2. Testing: According to **[ASTM E330]<Insert requirement>.**
 3. Operability under Wind Load: Design overhead coiling doors to remain operable under **[design][uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa)]<Insert load>** wind load, acting inward and outward.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SLIDING METAL FIRE DOORS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
1. **[AST Doors, Inc.]**
 2. **[Chase Doors; a Senneca Company]**
 3. **[Door Engineering and Manufacturing, LLC]**
 4. **[Shure Star]**
 5. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[AST Doors, Inc.]**
 2. **[Chase Doors; a Senneca Company]**
 3. **[Door Engineering and Manufacturing, LLC]**
 4. **[Shure Star]**
 5. **<Insert manufacturer's name>**
- C. Source Limitations: Obtain sliding metal fire doors from single source from single manufacturer.
- D. Fire-Protection Rating: **[4 hours][3 hours][1-1/2 hours][3/4 hour][As indicated]<Insert requirement>.**
1. Temperature-Rise Limit: **[250 deg F (139 deg C)][450 deg F (250 deg C)][650 deg F (361 deg C)].**
- E. Door Type: **[Overhead supported from wall-mounted track][Bottom supported on floor track with top guide]**, with hidden reinforcements for mounting- and hardware-attachment locations, and with attached armor edges and astragals.
1. Configuration: **[Single-leaf][Biparting][Multiple-leaf (telescoping)].**
 2. Door Construction: Manufacturer's standard for opening size and required performance.
 3. Hollow-Metal Construction: Facing material bonded to both sides of core and with perimeter steel channels as reinforcing and to enclose the core material. Splice panel sections of wide leaves with a manufacturer's continuous, steel H column splice kit with surface-applied splice plate or otherwise reinforce panels at connecting joints to provide a solid one-piece door. Weld and fill joints and grind exposed welds smooth and flush. **[Splice plate shall have no visible fasteners.]**
 4. Tubular-Frame Construction: Facing material welded to both sides of steel-tube perimeter frame and internal stiffeners, with mitered corner joints in frame and welded frame and stiffener joints; joints in face sheets located over stiffeners. Splice panel sections of wide leaves with a

manufacturer's continuous, surface-applied, through-bolt splice plate or otherwise reinforce panels at connecting joints to provide a solid one-piece door. Weld and fill joints and grind exposed welds smooth and flush.

- F. Operating System: **[Counterbalanced][Power operated]**.
- G. Facing Material:
1. Steel Sheet: **[0.033-inch (0.8-mm)][0.043-inch (1.1-mm)][0.053-inch (1.35-mm)][0.067-inch (1.7-mm)]** minimum thickness.
 2. Metallic-Coated Steel Sheet: **[0.040-inch (1.0-mm)][0.052-inch (1.3-mm)][0.064-inch (1.6-mm)][0.079-inch (2.0-mm)]** nominal thickness.
 3. Stainless Steel Sheet: **[0.038-inch (0.96-mm)][0.050-inch (1.3-mm)][0.062-inch (1.57-mm)][0.078-inch (1.98-mm)]** nominal thickness.
- H. Core Material: Provide **[manufacturer's standard][resin-impregnated honeycomb][mineral-fiber board][mineral wool][urethane][fiberglass][calcium silicate][or][inorganic mineral]<Insert requirement>** core material according to fire-protection-rating **[and temperature-rise]** requirements.
- I. Operating Hardware: Manufacturer's standard, labeled, automatic-closing-type, sliding fire door hardware complete with track, roller assemblies, adjustable roller guides, binders, floor stops, cables, counterbalance or motorized operator system as required, and fusible links. Furnish necessary hangers, fittings, and fasteners required for attaching hardware to door and for door sliding operation, including latch or handle for manual operation.
- J. Counterweight System: Cable-and-pulley system powered by weights that move within a formed-metal safety enclosure.
1. Safety Enclosure: Continuous, **0.064-inch- (1.6-mm-)** thick, metallic-coated steel sheet; size as required for counterweights and clearance.
- K. Crush Plates: Continuous **3/16-inch-thick by 6-inch-wide (4.8-mm-thick by 150-mm-wide)** steel-bearing plates on hollow concrete masonry walls to bridge wall cavities and prevent through-wall bolts from crushing the masonry units.
- L. Track Hood: Formed, **[metallic-coated steel][stainless steel]** sheet; shape and size as required for door clearance and to protect tracks; finished to match door.
- M. Weather Stripping: Manufacturer's standard **[neoprene][vinyl][or][nylon filament brush-style]** weather stripping around full door perimeter, with concealed attachments for mounting at head, jamb, and bottom edges of door, and acceptable to authorities having jurisdiction.
- N. Motorized Operator: Adjustable speed operator listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction; with reversing motor of sufficient size to operate door at no more than 75 percent of rated motor capacity, high-starting-torque, and thermal-overload protection. Include fusible-link release to disengage operator and to allow door to close automatically.
1. Design operator for current characteristics of electrical service supplied.
 2. Electrical Characteristics:
 - a. Horsepower: **[1/4][1/2]<Insert value>** hp.
 - b. Single-Phase Voltage: **[115-V ac][208-V ac]**, 60 Hz.
 - c. Three-Phase Voltage: **[208-V ac][230-V ac][460-V ac]**, 60 Hz.
 3. Equip door for completely automatic operation with clutch, speed reducer, brake, limit switches,

sensing edge, brackets, bolts, and release for manual operation. Control equipment includes **[two pull cords][two three-button control stations with push buttons labeled "OPEN," "CLOSE," and "STOP"]****[two motion detectors][two loop detectors][two photoelectric obstruction detectors][time delay for closing][and][electric interlock for pass door]****<Insert requirement>**.

- O. Interconnecting Device: Device that connects fusible links for doors on both sides of wall.
- P. Door-Release Device: Electromagnetic release device compatible with **[smoke detectors][and][building's fire-alarm system]**.
- Q. Smoke Detectors: Early warning, photoelectric smoke detectors or ionization detectors coupled to electromagnetic door-release device **[and building's fire-alarm system]**.
- R. Door Sill: Noncombustible door sill according to **[Section 087100 "Door Hardware"]****[Section 087111 "Door Hardware (Descriptive Specification)"]** unless otherwise indicated.
- S. Pass Door: Swing door and frame assembly, listed for use in sliding metal fire door.
 - 1. Pass-Door Hardware: Factory installed in the sliding metal fire door and including one and one-half pairs of mortise **[spring hinges][butt hinges and closer]** and **[mortise latchset][mortise lock][fire-exit device]****<Insert item>**.
- T. Vision Panels: Factory fabricated in door with removable glass stops. Provide glazing product listed and labeled as a component for fire-protection-rated sliding fire door assembly by a qualified testing agency acceptable to authorities having jurisdiction; do not exceed area allowed for door's fire-protection rating.

2.3 MATERIALS

- A. Steel Plate, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Sheets: **[ASTM A1008/A1008M, cold rolled][or][ASTM A1011/A1011M, hot rolled]** Commercial Steel (CS) or Drawing Steel (DS).
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), with **[G60 (Z180)][G90 (Z275)]** zinc coating **[or A60 (ZF180) zinc-iron-alloy (galvannealed) coating]**; restricted flatness.
- D. Stainless Steel Sheet: ASTM A240/A240M, **[Type 304][Type 316]**; stretcher-leveled standard of flatness; ASTM A480/A480M, No. **[4][6]** finish.
- E. Hardware and Fastener Finish: **[Manufacturer's standard][Hot-dip galvanize according to ASTM A153/A153M where units are used on galvanized-steel exterior doors][Stainless steel]****<Insert requirement>**.

2.4 FABRICATION

- A. Fabricate sliding metal fire door assemblies to be rigid and free of defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Factory prepare sliding metal fire door assemblies and frames to receive hardware and accessories including cutouts, reinforcements, mortising, drilling, and tapping.

2.5 METALLIC-COATED STEEL SHEET FINISHES

- A. Surface Preparation: Clean surfaces of oil and other contaminants. Use cleaning methods that do not leave residue. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A780/A780M.
- B. Factory Prime Finish: After cleaning and pretreating, apply an air-dried primer compatible with the organic coating to be applied over it.
- C. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of **2 mils (0.05 mm)**.
 - 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

2.6 STEEL FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with **[SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning"]**[or]**[SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning"]**<Insert surface preparation method>.**[After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.]**
- B. Factory Prime Finish: After surface preparation and pretreatment, apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer.
- C. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of **2 mils (0.05 mm)**.
 - 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

2.7 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3. Directional Satin Finish: ASTM A480/A480M No. 4.
 - 4. Dull Satin Finish: ASTM A480/A480M No. 6.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Examine floor under door to confirm that floor is level for the full travel of door.
 - 2. Examine wall where track assembly mounts and area behind door to confirm that wall is smooth and in same plane for the full travel of door.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sliding metal fire doors according to NFPA 80 and manufacturer's written instructions for type of door operation indicated and fire-protection rating required.
 - 1. Connect fire-detection devices with building's fire-alarm system.
- B. Concrete Masonry: Install continuous crush plates between concrete masonry walls and tracks and operating mechanisms mounted to the walls.
- C. Drill necessary holes for anchors in concrete and masonry cleanly, with no broken areas or spalls. Remove and replace or repair damaged concrete and masonry as directed.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections and to furnish reports to Architect.
- B. Perform the following tests and inspections[**with the assistance of a factory-authorized service representative**]:
 - 1. Perform acceptance testing according to NFPA 80.
 - a. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
 - 2. Test door release, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed door[**and pass door**]. Reset door-closing mechanism after successful test.
 - 3. Operational Test: After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 5. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements according to NFPA 101, Section 7.2.1.15.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with

specified requirements.

- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in **[NFPA 80][and][NFPA 101]**.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly, and lubricate as recommended by manufacturer.

3.5 DEMONSTRATION

- A. **[Engage a factory-authorized service representative to train][Train]** Owner's maintenance personnel to adjust, operate, and maintain sliding metal fire doors.

END OF SECTION 08 11 73 00A

SECTION 08 12 13 00 - HOLLOW METAL FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standard steel frames.
2. Exterior standard steel frames.
3. Interior custom hollow-metal frames.
4. Exterior custom hollow-metal frames.
5. Borrowed lites.

B. Related Requirements:

1. Section 081113 "Hollow Metal Doors and Frames" for hollow-metal doors and frames.
2. Section 081119 "Stainless Steel Doors and Frames" for hollow-metal doors and frames manufactured from stainless steel.
3. **[Section 087100 "Door Hardware"]****[Section 087111 "Door Hardware (Descriptive Specification)"]** for door hardware for hollow-metal doors.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]**<Insert location>.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Interior standard steel frames.
2. Exterior standard steel frames.
3. Interior custom hollow-metal frames.
4. Exterior custom hollow-metal frames.

-
- 5. Borrowed lites.
 - B. Product Data Submittals: For each product.
 - 1. Include construction details, material descriptions, **[fire-resistance ratings,]** and finishes.
 - C. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Environmental Product Declaration: For each product.
 - 3. Health Product Declaration: For each product.
 - 4. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
 - 5. Environmental Product Declaration: For each product.
 - 6. Environmental Product Declaration: For each product.
 - 7. Environmental Product Declaration: For each product.
 - 8. Third-Party Certifications: For each product.
 - 9. Third-Party Certified Life Cycle Assessment: For each product.
 - D. Shop Drawings: Include the following:
 - 1. Elevations of each frame type.
 - 2. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 3. Locations of reinforcement and preparations for hardware.
 - 4. Details of each different wall opening condition.
 - 5. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
 - E. Samples for Initial Selection: For hollow-metal frames with factory-applied color finishes.
 - F. Samples for Verification:
 - 1. Finishes: For each type of exposed finish required, prepared on Samples of not less than **3 by 5 inches (75 by 127 mm)**.
 - 2. Fabrication: Prepare Samples approximately **[12 by 12 inches (305 by 305 mm)][8 by 10 inches (203 by 254 mm)]<Insert dimension>** to demonstrate compliance with requirements for quality of materials and construction. Show profile, corner joint, floor and wall anchors, and silencers.
 - G. Product Schedule: For hollow-metal frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.
- 1.6 INFORMATIONAL SUBMITTALS
- A. Product Test Reports: For each type of **[fire-rated hollow-metal frame assembly][and][fire-rated borrowed-lite assembly]** for tests performed by a qualified testing agency indicating compliance with performance requirements.
 - B. Oversize Construction Certification: For assemblies required to be fire-rated and exceeding limitations of labeled assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal frames vertically under cover at Project site with head up. Place on minimum **4-inch-(102-mm-)** high wood blocking. Provide minimum **1/4-inch (6-mm)** space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 HOLLOW METAL FRAMES

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - 1. **[Airtec Corporation]**
 - 2. **[Apex Industries, Inc]**
 - 3. **[BARON Metal Industries, Inc.; ASSA ABLOY of Canada, Ltd.; ASSA ABLOY]**
 - 4. **[Ceco Door; AADG, Inc.; ASSA ABLOY]**
 - 5. **[Concept Frames, AADG, Inc.; ASSA ABLOY Group]**
 - 6. **[Curries, AADG, Inc.; ASSA ABLOY Group]**
 - 7. **[Custom Metal Products]**
 - 8. **[Daybar Industries, Ltd]**
 - 9. **[DCI Hollow Metal on Demand]**
 - 10. **[DE LA FONTAINE]**
 - 11. **[Deansteel Manufacturing Company, Inc.]**
 - 12. **[Deronde Products]**
 - 13. **[DKS Steel Door & Frame Systems, Inc.]**
 - 14. **[Fleming Door Products Ltd.; ASSA ABLOY Group]**
 - 15. **[Gensteel Doors]**
 - 16. **[HMF Express]**
 - 17. **[Hollow Metal Xpress]**
 - 18. **[JR Metal Frames, Inc.]**
 - 19. **[Karpen Steel Custom Doors & Frames]**
 - 20. **[L.I.F. Industries, Inc]**
 - 21. **[LaForce, LLC]**
 - 22. **[MegaMet Industries]**
 - 23. **[Mesker Door; Mesker Openings Group]**
 - 24. **[Metropolitan Door Industries Corp.]**
 - 25. **[Michbi Doors Inc]**
 - 26. **[MPI Group, LLC (The)]**
 - 27. **[National Custom Hollow Metal Doors & Frames]**
 - 28. **[North American Door Corp]**
 - 29. **[Philipp Manufacturing Co (The)]**
 - 30. **[Pioneer Industries; AADG, Inc.; ASSA ABLOY]**
 - 31. **[Premier Products, Inc]**
 - 32. **[Republic Doors and Frames; a Allegion brand]**

33. [Rocky Mountain Metals, Inc]
34. [Security Metal Products; a brand of ASSA ABLOY]
35. [Steelcraft; Allegion plc]
36. [Steward Steel, Door & Frame Division]
37. [Stiles Custom Metal, Inc]
38. [Titan Metal Products]
39. [Trillium Steel Doors Limited]
40. [West Central Manufacturing, Inc.]
41. <Insert manufacturer's name>

B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [Airtec Corporation]
2. [Apex Industries, Inc]
3. [BARON Metal Industries, Inc.; ASSA ABLOY of Canada, Ltd.; ASSA ABLOY]
4. [Ceco Door; AADG, Inc.; ASSA ABLOY]
5. [Concept Frames, AADG, Inc.; ASSA ABLOY Group]
6. [Curries, AADG, Inc.; ASSA ABLOY Group]
7. [Custom Metal Products]
8. [Daybar Industries, Ltd]
9. [DCI Hollow Metal on Demand]
10. [DE LA FONTAINE]
11. [Deansteel Manufacturing Company, Inc.]
12. [Deronde Products]
13. [DKS Steel Door & Frame Systems, Inc.]
14. [Fleming Door Products Ltd.; ASSA ABLOY Group]
15. [Gensteel Doors]
16. [HMF Express]
17. [Hollow Metal Xpress]
18. [JR Metal Frames, Inc.]
19. [Karpen Steel Custom Doors & Frames]
20. [L.I.F. Industries, Inc]
21. [LaForce, LLC]
22. [MegaMet Industries]
23. [Mesker Door; Mesker Openings Group]
24. [Metropolitan Door Industries Corp.]
25. [Michbi Doors Inc]
26. [MPI Group, LLC (The)]
27. [National Custom Hollow Metal Doors & Frames]
28. [North American Door Corp]
29. [Philipp Manufacturing Co (The)]
30. [Pioneer Industries; AADG, Inc.; ASSA ABLOY]
31. [Premier Products, Inc]
32. [Republic Doors and Frames; a Allegion brand]
33. [Rocky Mountain Metals, Inc]
34. [Security Metal Products; a brand of ASSA ABLOY]
35. [Steelcraft; Allegion plc]
36. [Steward Steel, Door & Frame Division]
37. [Stiles Custom Metal, Inc]
38. [Titan Metal Products]
39. [Trillium Steel Doors Limited]
40. [West Central Manufacturing, Inc.]
41. <Insert manufacturer's name>

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
 - 2. Oversize Fire-Rated Frames: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that frames comply with standard construction requirements for tested and labeled fire-rated assemblies except for size.
- B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 STANDARD STEEL FRAMES

- A. Construct hollow-metal frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Interior Standard Steel Frames: SDI A250.8. **[At locations indicated in the Door and Frame Schedule on Drawings]<Insert locations>.**
 - 1. Materials: **[Uncoated][Metallic-coated]** steel sheet, minimum thickness of **[0.042 inch (1.0 mm)][0.053 inch (1.3 mm)][0.067 inch (1.7 mm)]**.
 - 2. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - 3. Construction: **[Knocked down][Slip-on drywall][Face welded][Full profile welded]**.
 - 4. Exposed Finish: **[Prime][Factory]**.
- C. Exterior Standard Steel Frames: SDI A250.8. **[At locations indicated in the Door and Frame Schedule on Drawings]<Insert locations>.**
 - 1. Materials: Metallic-coated steel sheet, minimum thickness of **[0.053 inch (1.3 mm)][0.067 inch (1.7 mm)]**, with minimum **[A40 (ZF120)][A60 (ZF180)]** coating.
 - 2. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - 3. Construction: **[Knocked down][Face welded][Full profile welded]**.
 - 4. Exposed Finish: **[Prime][Factory]**.

2.4 CUSTOM HOLLOW-METAL FRAMES

- A. Interior Custom Hollow-Metal Frames: NAAMM-HMMA 861. **[At locations indicated in the Door and Frame Schedule on Drawings]<Insert locations>.**
 - 1. Materials: **[Uncoated][Metallic-coated]** steel sheet, minimum thickness of **0.053 inch (1.3 mm)**.
 - 2. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - 3. Construction: **[Knocked down][Slip-on drywall][Face welded][Full profile welded]**.
 - 4. Exposed Finish: Prime.
- B. Exterior Custom Hollow-Metal Frames: NAAMM-HMMA 861. **[At locations indicated in the Door and Frame Schedule on Drawings]<Insert locations>.**
 - 1. Materials: Metallic-coated steel sheet, minimum thickness of **0.053 inch (1.3 mm)**.

2. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
3. Construction: **[Knocked down][Face welded][Full profile welded]**.
4. Exposed Finish: Prime.

2.5 BORROWED LITES

- A. Fabricate of **[uncoated][metallic-coated]** steel sheet, minimum thickness of **[0.053 inch (1.3 mm)][0.042 inch (1.0 mm)]**.
- B. Construction: **[Knocked down][Face welded][Full profile welded]**.
- C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.
- D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.6 FRAME ANCHORS

- A. Jamb Anchors:
 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each **24 inches (610 mm)** of frame height above **7 feet (2.1 m)**.
 3. Postinstalled Expansion Anchor: Minimum **3/8-inch- (9.5-mm-)** diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than **2-inch (51-mm)** height adjustment. Terminate bottom of frames at top of underlayment.
- D. Material: ASTM A879/A879M, Commercial Steel (CS), **04Z (12G)** coating designation; mill phosphatized.
 1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.7 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- B. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or

surface defects; pickled and oiled.

- D. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- G. Glazing: Comply with requirements in Section 088000 "Glazing."

2.8 FABRICATION

- A. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
 - 1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding[, or by rigid mechanical anchors].
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
 - 4. Terminated Stops: Terminate stops [6 inches (152 mm)]<Insert dimension> above finish floor with a [45][90]-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- B. Hardware Preparation: Factory prepare hollow-metal frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule on Drawings, and templates.
 - 1. Reinforce frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with BHMA A156.115 for preparing hollow-metal frames for hardware.
- C. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with [butted][or][mitered] hairline joints.
 - 1. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 2. Provide fixed frame moldings on outside of exterior and on secure side of interior frames. Provide loose stops and moldings on inside of hollow-metal frames.
 - 3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
 - 4. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

2.9 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
- B. Factory Finish: Clean, pretreat, and apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, complying with SDI A250.3.
 - 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Drill and tap frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

- A. General: Install hollow-metal frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions. Comply with **[SDI A250.11][NAAMM-HMMA 840]**.
- B. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
 - 1. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
 - 2. Install frames with removable stops located on secure side of opening.
- C. Fire-Rated Openings: Install frames according to NFPA 80.
- D. Floor Anchors: Secure with postinstalled expansion anchors.
 - 1. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
- E. Solidly pack mineral-fiber insulation inside frames.
- F. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
- G. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion

anchors.[**Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.**]

H. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

1. Squareness: Plus or minus **1/16 inch (1.6 mm)**, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus **1/16 inch (1.6 mm)**, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs at floor.

I. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 CLEANING AND TOUCHUP

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- C. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 12 13 00



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Task	Specification	Specification Description
08 12 13 13	08 05 13 00	Stainless-Steel Doors and Frames
08 12 13 13	08 12 13 00	Hollow Metal Frames



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SECTION 08 12 16 00 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed entrance and storefront systems.

B. Related Requirements:

1. Section 014339 "Mockups" for preconstruction laboratory mockup testing.
2. Section 084126 "All-Glass Entrances and Storefronts" for systems without aluminum support framing.
3. Section 081116.13 "Interior Aluminum Doors and Frames" for interior aluminum framing.

1.2 ALLOWANCES

- A. See Section 012100 "Allowances" for description of allowances affecting items specified in this Section.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings:

1. Plans, elevations, sections, full-size details, and attachments to other work.
2. Details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
3. Full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrance and storefront systems, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
4. Connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
5. Point-to-point wiring diagrams showing the following:

- a. Power requirements for each electrically operated door hardware.
 - b. Location and types of switches, signal device, conduit sizes, and number and size of wires.
6. **<Insert requirements>**.
7. Signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.
- D. Samples for Verification: Actual sample of finished products for each type of exposed finish.
 1. Size: **[Manufacturers' standard size]<Insert size>**.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from **12-inch (300-mm)** lengths of full-size components and showing details of the following:
 1. Joinery, including concealed welds.
 2. Anchorage.
 3. Expansion provisions.
 4. Glazing.
 5. Flashing and drainage.
- F. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- G. Delegated Design Submittals: For aluminum-framed entrances and storefront systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- H. Sustainable Design Submittals:
 1. Product Data: For sealants, indicating VOC content.
 2. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.
 3. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
 4. Environmental Product Declaration (EPD): For each product.
 5. Health Product Declaration (HPD): For each product.
 6. Environmental Product Declaration (EPD): For each product.
 7. Health Product Declaration (HPD): For each product.
 8. Environmental Product Declaration (EPD): For each product.
 9. Environmental Product Declaration (EPD): For each product.
 10. Environmental Product Declaration (EPD): For each product.
 11. Third-Party Certifications: For each product.
 12. Third-Party-Certified Life-Cycle Assessment: For each product.

1.5 INFORMATIONAL SUBMITTALS

- A. Energy Performance Certificates: For aluminum-framed entrance and storefront systems, accessories, and components, from manufacturer.
 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed

entrance and storefront system.

- B. Product Test Reports: For aluminum-framed entrance and storefront systems, for tests performed by [a **qualified testing agency**][**manufacturer and witnessed by a qualified testing agency**].
- C. Preconstruction Test Reports: For aluminum-framed entrance and storefront systems.
 - 1. Testing Program: Developed specifically for Project.
 - 2. Test Reports: Prepared by a qualified preconstruction testing agency for each preconstruction test.
 - 3. Record Drawings: As-built drawings of preconstruction laboratory mockups showing changes made during preconstruction laboratory mockup testing.
- D. Source Quality-Control Reports: For aluminum-framed entrance and storefront systems.
- E. Field Quality-Control Reports: For aluminum-framed entrance and storefront systems.
- F. Quality-Control Program: Developed specifically for Project, including fabrication and installation, in accordance with recommendations in ASTM C1401. Include periodic quality-control reports.
- G. Qualification Statements:
 - 1. For Installer[**and laboratory mockup preconstruction testing agency**][**and field testing agency**][**and egress door inspector**].
- H. Delegated Design Engineer Qualifications: For aluminum-framed entrance and storefront systems.
- I. Sample Warranties: For aluminum-framed entrance and storefront systems.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For aluminum-framed entrance and storefront systems.
- B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Fabricator of products.
 - 2. Entity that employs installers and supervisors who are trained and approved by manufacturer.
 - 3. Authorized representative who is trained and approved by manufacturer.
 - 4. Entity that is certified under the North American Contractor Certification Program (NACC) and that employs installers and supervisors who are trained and approved by manufacturer[**and who are certified under the Architectural Glass and Metal Technician (AGMT) certification program**].
- B. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in [state]<Insert jurisdiction> where Project is located and who is experienced in providing engineering services of the type indicated.
- C. Laboratory Mockup Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing

indicated[**and accredited by the International Accreditation Service or the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement as complying with ISO/IEC 17025**].

- D. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated[**and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025**] and acceptable to Owner and Architect.
- E. Egress Door Inspector Qualifications:
 - 1. Inspector for field quality-control inspections of egress door assemblies to comply with qualifications set forth in NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."
 - 2. Inspector for field quality-control inspections of egress door assemblies to be certified under DHI's certification program as a Fire and Egress Door Assembly Inspector (FDAI) or a Certified Fire and Egress Door Assembly Inspector (CFDAI).
- F. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- G. Structural-Sealant Glazing: Comply with ASTM C1401 for design and installation of storefront systems that include structural glazing.

1.8 MOCKUPS

- A. Build mockups [**to verify selections made under Sample submittals**][**to demonstrate aesthetic effects**][**to set quality standards for materials and execution**][**to set quality standards for fabrication and installation**].
 - 1. Build mockup [**as indicated on Drawings**]**<Insert mockup requirements>**.
 - 2. Testing to be performed on mockups in accordance with requirements in "Field Quality Control" Article.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: [**Owner will engage**][**Engage**] a qualified testing agency to perform preconstruction testing on laboratory mockups.
 - 1. Build preconstruction laboratory mockups at testing agency facility; use personnel, products, and methods of construction that will be used at Project site.
 - 2. Size and Configuration: As indicated on Drawings.
 - 3. Notify Architect [**seven**]**<Insert number>** days in advance of the dates and times when preconstruction laboratory mockups will be constructed and tested.

- B. Preconstruction Laboratory Mockup Testing: Performed by a qualified testing agency on manufacturer's standard assemblies.
1. Test preconstruction laboratory mockups in accordance with requirements in "Performance Requirements" Article. Perform the following tests in the following order:
 - a. Structural, 50 Percent: ASTM E330/E330M at 50 percent of positive test load.
 - b. Air Leakage: ASTM E283.
 - c. Water Penetration under Static Pressure: ASTM E331.
 - d. Water Penetration under Dynamic Pressure: AAMA 501.1.
 - e. Thermal Cycling: AAMA 501.5. Repeat the following:
 - 1) Air Leakage: ASTM E283.
 - 2) Water Penetration under Static Pressure: ASTM E331.
 - f. Structural, 100 Percent: ASTM E330/E330M at 100 percent of positive and negative test loads. Repeat the following:
 - 1) Air Leakage: ASTM E283.
 - 2) Water Penetration under Static Pressure: ASTM E331.
 - 3) Water Penetration under Dynamic Pressure: AAMA 501.1.
 - g. Structural, 150 Percent: ASTM E330/E330M at 150 percent of positive and negative test loads.
- C. Preconstruction Adhesion and Compatibility Testing: Submit to structural glazing sealant manufacturer, for testing indicated below, Samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that is in close proximity to or is touching the structural or nonstructural sealants of a structural glazed system.
1. Compatibility: Test materials or components using ASTM C1087.
 2. Adhesion: Test for adhesion or lack of adhesion of a structural sealant to the surface of another material or component using ASTM C1135.
 3. Submit no fewer than **[eight]<Insert number>** pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 5. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
 6. Testing will not be required if data based on previous testing of current sealant products match those submitted.

1.10 WARRANTY

- A. Special Warranty: **[Manufacturer agrees][Installer agrees][Manufacturer and Installer agree]** to repair or replace components of aluminum-framed entrance and storefront systems that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures, including **<Insert type of failure>**.
 - b. Faulty operation of **<Insert components>**.
 - c. Deterioration of metals[, **metal finishes**,] and other materials beyond normal **[weathering][use]**.
 - d. **<Insert conditions relating to specified products>**.
 - e. **<Insert failure modes>**.

2. Warranty Period: **[Two][Five][10]<Insert number>** years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: **[Five][10][20]<Insert number>** years from date of Substantial Completion.
- C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D 4214.
 - c. Cracking, peeling, or chipping.
 2. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain all components of aluminum-framed entrance and storefront system, including framing **[spandrel panels][venting windows]** and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrance and storefront systems.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrance and storefront systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Aluminum-framed entrance and storefront systems to withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.

- e. Failure of operating units.
- C. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: **[As indicated on Drawings]<Insert loads>**.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
 - 1. Deflection Normal to Wall Plane: Limited to **[1/175 of length of span of the framing member for lengths of up to 13 feet 6 inches (4.1 m) and to 1/240 of length of span of the framing member plus 1/4 inch (6.35 mm) for lengths greater than 13 feet 6 inches (4.1 m)]<Insert deflection limit>**.
 - 2. Deflection Parallel to Glazing Plane: Limited to **[amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm)]<Insert deflection limit>**.
 - a. Operable Units: Provide a minimum **1/16-inch (1.6-mm)** clearance between framing members and operable units.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
 - 1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
 - 2. When tested at **[150]<Insert number>** percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding **[0.2]<Insert number>** percent of span.
 - 3. Test Durations: As required by design wind velocity, but not less than **[10]<Insert number>** seconds.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
 - 1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than **[6.24 lbf/sq. ft. (300 Pa)][10 lbf/sq. ft. (480 Pa)][15 lbf/sq. ft. (720 Pa)]<Insert value>**.
- G. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:
 - 1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than **[6.24 lbf/sq. ft. (300 Pa)][10 lbf/sq. ft. (480 Pa)][15 lbf/sq. ft. (720 Pa)]<Insert value>**.
 - 2. Maximum Water Leakage: **[In accordance with AAMA 501.1][No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation]**. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.
- H. Seismic Performance: Aluminum-framed entrance and storefront systems to withstand the effects of earthquake motions determined in accordance with **[ASCE/SEI 7]<Insert requirement>**.
 - 1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.6 at design displacement**[and 1.5 times the design displacement]**.

- I. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than [0.41 Btu/sq. ft. x h x deg F (2.33 W/sq. m x K)][0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K)][0.57 Btu/sq. ft. x h x deg F (3.23 W/sq. m x K)][0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K)]<Insert value> as determined in accordance with NFRC 100.
 - b. Entrance Doors: U-factor of not more than [0.68 Btu/sq. ft. x h x deg F (3.86 W/sq. m x K)][0.77 Btu/sq. ft. x h x deg F (4.37 W/sq. m x K)][0.83 Btu/sq. ft. x h x deg F (4.71 W/sq. m x K)][1.10 Btu/sq. ft. x h x deg F (6.253 W/sq. m x K)]<Insert value> as determined in accordance with NFRC 100.
 - c. Venting Windows: Whole window U-factor of not more than [0.37 Btu/sq. ft. x h x deg F (2.10 W/sq. m x K)][0.43 Btu/sq. ft. x h x deg F (2.44 W/sq. m x K)][0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K)][0.60 Btu/sq. ft. x h x deg F (3.40 W/sq. m x K)][0.65 Btu/sq. ft. x h x deg F (3.69 W/sq. m x K)]<Insert value> as determined in accordance with NFRC 100.
 2. Solar Heat-Gain Coefficient (SHGC):
 - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than [0.26][0.35][0.40][0.45]<Insert value> as determined in accordance with NFRC 200.
 - b. Entrance Doors: SHGC of not more than [0.22][0.25][0.35][0.40][0.45]<Insert value> as determined in accordance with NFRC 200.
 - c. Venting Windows: Whole window SHGC of not more than [0.22][0.27][0.30][0.40]<Insert value> as determined in accordance with NFRC 200.
 3. Air Leakage:
 - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than [0.06 cfm/sq. ft. (0.30 L/s per sq. m)]<Insert value> at a static-air-pressure differential of [1.57 lbf/sq. ft. (75 Pa)][6.24 lbf/sq. ft. (300 Pa)]<Insert value> when tested in accordance with ASTM E283.
 - b. Entrance Doors: Air leakage of not more than [1.0 cfm/sq. ft. (5.08 L/s per sq. m)]<Insert value> at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
 - c. Venting Windows: Whole window air leakage of not more than [0.3 cfm/sq. ft. (0.30 L/s per sq. m)]<Insert value> at a static-air-pressure differential of [6.24 lbf/sq. ft. (300 Pa)]<Insert value> when tested in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
 4. Condensation Resistance Factor (CRF):
 - a. Fixed Glazing and Framing Areas: CRF for the system of not less than [35][55][70]<Insert value> as determined in accordance with AAMA 1503.
 - b. Entrance Doors: CRF of not less than [57][63][68]<Insert value> as determined in accordance with AAMA 1503.
 - c. Venting Windows: Whole window CRF of not less than [45][52][55]<Insert value> as determined in accordance with AAMA 1503.
- J. Noise Reduction: Test in accordance with ASTM E90, with ratings determined by ASTM E1332, as follows.
1. Outdoor-Indoor Transmission Class: Minimum [26][30][34]<Insert number>.
- K. Blast Resistance:

1. Hazard Rating: **[No Break][No Hazard][Minimal Hazard][Very Low Hazard][Low Hazard][Moderate Hazard][High Hazard]** in accordance with ASTM F2912, tested in accordance with ASTM F1642/F1642M.
- L. Performance Condition: **[1][2][3a][3b][4][5]** in accordance with GSA-TS01.
- M. Ballistic Resistance, UL 752: **[Listed and labeled as][Level 1][Level 2][Level 3][Level 4][Level 5][Level 6][Level 7][Level 8][Level 9][Level 10][Level 1-SG][Level 2-SG][Level 3-SG][Level 4-SG][Level 5-SG][Level 6-SG][Level 7-SG][Level 8-SG][Level 9-SG][Level 10-SG]** when tested in accordance with UL 752.
- N. Ballistic Resistance, ASTM F1233: **[Class/Level HG1][Class/Level HG2][Class/Level HG3][Class/Level HG4][Class/Level SMG][Class/Level R1][Class/Level R2][Class/Level R3][Class/Level R4-AP][Class/Level R5][Class/Level SH1][Class/Level SH2]** when tested in accordance with ASTM F1233.
- O. Ballistic Resistance, HPW-TP-0500.03: **[A][B][C][D][E]** when tested in accordance with HPW-TP-0500.03.
- P. Ballistic Resistance, SD-STD-01.01: **[R][SH]** when tested in accordance with SD-STD-01.01.
- Q. Ballistic Resistance, NIJ STD-0108.01: **[Level I][Level IIA][Level II][Level IIIA][Level III][Level IV]** when tested in accordance with NIJ STD-0108.01.
- R. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone **[1][2][3][4]** for **[basic][enhanced]** protection.
 1. Large-Missile Test: For glazing located within **[30 feet (9.1 m)]<Insert dimension>** of grade.
 2. Small-Missile Test: For glazing located between **30 feet (9.1 m)** and **[60 feet (18.3 m)]<Insert dimension>** above grade.
- S. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
 1. Temperature Change: **120 deg F (67 deg C)**, ambient; **180 deg F (100 deg C)**, material surfaces.
 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of **[180 deg F (82 deg C)]<Insert temperature>**.
 - b. Low Exterior Ambient-Air Temperature: **[0 deg F (minus 18 deg C)]<Insert temperature>**.
 - c. Interior Ambient-Air Temperature: **[75 deg F (24 deg C)]<Insert temperature>**.
- T. Structural-Sealant Joints:
 1. Designed to carry gravity loads of glazing.
- U. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed, aluminum-framed entrance and storefront systems without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant to occur before adhesive failure.
 1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.3 ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

1. **[Arcadia Inc.]**
2. **[Boyd Aluminum Mfg. Co.]**
3. **[CMI Architectural Products, Inc.]**
4. **[Coral Architectural Products; Coral Industries, Inc.]**
5. **[EFCO Corporation]**
6. **[Kawneer Company, Inc.; Arconic Corporation]**
7. **[Leed Himmel Industries, Inc.]**
8. **[Manko Window Systems, Inc.]**
9. **[OldCastle BuildingEnvelope (OBE)]**
10. **[Pittco Architectural Metals, Inc.]**
11. **[Trulite Glass & Aluminum Solutions, LLC.]**
12. **[Tubelite Inc.]**
13. **[U.S. Aluminum; C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
14. **[YKK AP America Inc.]**
15. **<Insert manufacturer's name>**

- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

1. **[Arcadia Inc.]**
2. **[Boyd Aluminum Mfg. Co.]**
3. **[CMI Architectural Products, Inc.]**
4. **[Coral Architectural Products; Coral Industries, Inc.]**
5. **[EFCO Corporation]**
6. **[Kawneer Company, Inc.; Arconic Corporation]**
7. **[Leed Himmel Industries, Inc.]**
8. **[Manko Window Systems, Inc.]**
9. **[OldCastle BuildingEnvelope (OBE)]**
10. **[Pittco Architectural Metals, Inc.]**
11. **[Trulite Glass & Aluminum Solutions, LLC.]**
12. **[Tubelite Inc.]**
13. **[U.S. Aluminum; C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
14. **[YKK AP America Inc.]**
15. **<Insert manufacturer's name>**

- C. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: **[Thermally broken][Thermally improved][Nonthermal]<Insert description>**.
2. Interior Vestibule Framing Construction: **[Nonthermal]<Insert description>**.
3. Glazing System: **[Retained mechanically with gaskets on four sides][Retained mechanically with gaskets on two sides and structural sealant on two sides]**.
4. Glazing Plane: **[Front]<Insert location>**.
5. Finish: **[Clear anodic finish][Color anodic finish][Baked-enamel or powder-coat finish][High-performance organic finish][Superior-performance organic finish]**.
6. Fabrication Method: Field-fabricated stick system.
7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
8. Steel Reinforcement: As required by manufacturer.

- D. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- F. Insulated Spandrel Panels:
1. Comply with Section 074213.19 "Insulated Metal Wall Panels."
 2. Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.
 - a. Overall Panel Thickness: **[As indicated][1 inch (25.4 mm)]<Insert thickness>**.
 - b. Exterior Skin: Aluminum.
 - 1) Thickness: **[Manufacturer's standard for finish and texture indicated]<Insert thickness>**.
 - 2) Finish: **[Match framing system]<Insert finish>**.
 - 3) Texture: **[Smooth][Embossed]<Insert texture>**.
 - 4) Backing Sheet: **[1/8-inch- (3.2-mm-) thick tempered hardboard][0.157-inch- (4-mm-) thick cement board][0.125-inch- (3.2-mm-) thick, corrugated, high-density polyethylene]<Insert material>**.
 - c. Interior Skin: Aluminum.
 - 1) Thickness: **[Manufacturer's standard for finish and texture indicated]<Insert thickness>**.
 - 2) Finish: **[Matching storefront framing][Low-gloss, white baked enamel][Mill finish]<Insert finish>**.
 - 3) Texture: **[Smooth][Embossed]<Insert texture>**.
 - 4) Backing Sheet: **[1/8-inch- (3.2-mm-) thick tempered hardboard][0.157-inch- (4-mm-) thick cement board][1/2-inch- (12.7-mm-) thick gypsum board with proprietary fire-resistance-rated core][0.125-inch- (3.2-mm-) thick, corrugated, high-density polyethylene]<Insert material>**.
 - d. Thermal Insulation Core: Manufacturer's standard **[rigid, closed-cell, polyisocyanurate board][extruded-polystyrene board][expanded-perlite, mineral-insulation board]<Insert insulation>**.
 - e. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1) Flame-Spread Index: **[25]<Insert value>** or less.
 - 2) Smoke-Developed Index: **[50][450]<Insert value>** or less.
- G. Venting Windows:
1. As specified in Section 085113 "Aluminum Windows."
 2. Manufacturer's standard units, complying with AAMA/WDMA/CSA 101/I.S.2/A440, with self-flashing mounting fins, and as follows:
 - a. Window Type: **[Awning][Casement][As indicated on Drawings]<Insert type>**.
 - b. Minimum Performance Class: **[CW][AW]<Insert class>**.
 - c. Minimum Performance Grade: **[30][40][60][70][80][90][As indicated on Drawings]<Insert number>**.
 - d. Hardware: Manufacturer's standard; of aluminum, stainless steel, die-cast steel, malleable iron, or bronze; including the following:

- 1) Cam handle locking system.
 - 2) Multi-point locking system.
 - 3) Pole-operated, cam handle locking system, where rail is more than **72 inches (1830 mm)** above floor.
 - 4) Rotary operator.
 - 5) Steel or bronze operating arms.
 - 6) Limit Devices: **[Concealed friction adjustor and adjustable stay bar]<Insert type>** limit devices designed to restrict sash opening.
 - a) Limit clear opening to **[4 inches (100 mm)]<Insert dimension>** for ventilation; with custodial key release.
- e. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
- f. Insect Screens: Provide removable insect screen on each operable exterior sash, with screen frame finished to match window unit, complying with SMA 1004 or SMA 1201, and as follows:
- 1) Aluminum Wire Fabric: 18-by-18, **0.0445-inch-by-0.0445-inch (1.1-by-1.1-mm)**; 18-by-16, **0.0445-inch-by-0.0515-inch (1.1-by-1.3-mm)**; or 18-by-14, **0.0445-inch-by-0.0624-inch (1.1-by-1.5-mm)** mesh of **0.013-inch- (0.3-mm-)** diameter, coated aluminum wire.
 - 2) Glass-Fiber Mesh Fabric: 18-by-16 **0.0445-inch-by-0.0515-inch (1.1-by-1.3-mm)** or 18-by-14 **0.0445-inch-by-0.0624-inch (1.1-by-1.5-mm)** mesh of PVC-coated, glass-fiber threads, woven and fused to form a fabric mesh; complying with ASTM D3656/D3656M.
 - 3) Fabric: Manufacturer's standard aluminum wire fabric or glass-fiber mesh fabric.
- g. Glazing: **[Same as adjacent aluminum-framed entrances and storefront glazing]<Insert glazing>**.
- h. Finish: **[Match adjacent aluminum-framed entrances and storefront finish]<Insert finish>**.
- H. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
1. Door Construction: **[1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-)]****[2-inch (50.8-mm) overall thickness, with minimum 0.188-inch- (4.8-mm-)]****[2- to 2-1/4-inch (50.8- to 57.2-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-)]** thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - a. Thermal Construction: **[High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior]<Insert description>**.
 2. Door Design: **[As indicated]****[Narrow stile; 2-1/8-inch (54-mm) nominal width]****[Medium stile; 3-1/2-inch (88.9-mm) nominal width]****[Wide stile; 5-inch (127-mm) nominal width]<Insert description>**.
 3. Glazing Stops and Gaskets: **[Beveled]****[Square]<Insert description>**, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.
 4. Finish: Match adjacent storefront framing finish.

2.4 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in [Section 087100 "Door Hardware."][Section 087111 "Door Hardware (Descriptive Specification)."]
- B. General: Provide entrance door hardware and [entrance door hardware sets indicated in door and frame schedule][entrance door hardware sets indicated in "Entrance Door Hardware Sets" Article] for each entrance door, to comply with requirements in this Section.
 - 1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and [named manufacturers' products][products equivalent in function and comparable in quality to named products][products complying with BHMA standard referenced].
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 - 3. Opening-Force Requirements:
 - a. Egress Doors: Not more than **15 lbf (67 N)** to release the latch and not more than **30 lbf (133 N)** to set the door in motion[**and not more than 15 lbf (67 N) to open the door to its minimum required width**].
 - b. Accessible Interior Doors: Not more than **5 lbf (22.2 N)** to fully open door.
- C. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
 - 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- D. Pivot Hinges: BHMA A156.4, Grade 1.
 - 1. Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.
- E. Butt Hinges: BHMA A156.1, Grade 1, radius corner.
 - 1. Nonremovable Pins: Provide setscrew in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
 - 2. Exterior Hinges: [Stainless steel, with stainless steel pin][Nonferrous]<Insert material>.
 - 3. Quantities:
 - a. For doors up to [87 inches (2210 mm)]<Insert dimension> high, provide three hinges per leaf.
 - b. For doors more than [87 and up to 120 inches (2210 and up to 3048 mm)]<Insert dimensions> high, provide four hinges per leaf.
- F. Continuous-Gear Hinges: BHMA A156.26.
- G. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.
- H. Manual Flush Bolts: BHMA A156.16, Grade 1.
- I. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.
- J. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency

acceptable to authorities having jurisdiction, for panic protection, based on testing in accordance with UL 305.

K. Cylinders:

1. **[As specified in Section 087100 "Door Hardware."][As specified in Section 087111 "Door Hardware (Descriptive Specification)."]**
2. BHMA A156.5, Grade 1.

- a. Keying: **[No master][Master]** key system. Permanently inscribe each key with a visual key control number and include notation **["DO NOT DUPLICATE"]****[to be furnished by Owner]**.

L. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

M. Operating Trim: BHMA A156.6.

N. Removable Mullions: BHMA A156.3 extruded aluminum.

1. When used with panic exit devices, provide **[keyed]** removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing in accordance with UL 305. Use only mullions that have been tested with exit devices to be used.

O. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.

P. Concealed Overhead Holders and Stops: BHMA A156.8, Grade 1.

Q. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

R. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.
2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

S. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

T. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of **1/2 inch (12.7 mm)**.

U. Finger Guards: Manufacturer's standard collapsible neoprene or PVC gasket anchored to frame hinge-jamb at center-pivoted doors.

2.5 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

- B. Glazing Gaskets: **[Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.][Comply with Section 088000 "Glazing."]**
- C. Glazing Sealants: **[As recommended by manufacturer.][Comply with Section 088000 "Glazing."]**
 - 1. Product Data: Verify architectural sealant has a VOC content of 250 g/L or less.
- D. Structural Glazing Sealants: ASTM C1184 chemically curing silicone formulation that is compatible with system components with which it comes in contact; specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in storefront system indicated.
 - 1. Color: **[Black][Gray][As selected by Architect from manufacturer's full range of colors]<Insert color>**.
- E. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.
 - 1. Color: Match structural sealant.

2.6 MATERIALS

- A. Sheet and Plate: **ASTM B209 (ASTM B209M)**.
- B. Extruded Bars, Rods, Profiles, and Tubes: **ASTM B221 (ASTM B221M)**.
- C. Structural Profiles: ASTM B308/B308M.
- D. Steel Reinforcement:
 - 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.
- F. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- G. Regional Materials: Verify products are manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- H. Regional Materials: Verify products are manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, multiply the distance by 0.25 to determine the distance to Project site.

2.7 ACCESSORIES

- A. Automatic Door Operators: **[Section 087113 "Power Door Operators."][Section 084229.33 "Swinging Automatic Entrances."]**
- B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads[, **finished to match framing system**][, **fabricated from 300 series stainless steel**].
- C. Anchors: Three-way adjustable anchors with minimum adjustment of **[1 inch (25.4 mm)]<Insert dimension>** that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- D. Concealed Flashing: **[Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials][Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, complying with ASTM A240/A240M, of type recommended by manufacturer]**.
- E. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for **30-mil (0.762-mm)** thickness per coat.
- F. Rigid PVC filler.

2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from **[exterior][interior][interior for vision glass and exterior for spandrel glazing or metal panels]**.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

- F. Storefront Framing: Fabricate components for assembly using **[shear-block system][screw-spline system][head-and-sill-receptor system with shear blocks at intermediate horizontal members]<Insert system>**.
- G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 - 1. At interior and exterior doors, provide compression weather stripping at fixed stops.
- H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 - 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- J. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.9 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, **[AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm]** or thicker.
- B. Color Anodic Finish: AAMA 611, **[AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm]** or thicker.
 - 1. Color: **[Light bronze][Medium bronze][Dark bronze][Champagne][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- D. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with **[AAMA 2604][AAMA 2605]** and containing not less than **[50][70]** percent PVDF resin by weight in color coat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- E. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's**

sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.

- F. Superior-Performance Organic Finish, Four-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- G. Superior-Performance Organic Finish, Single-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- H. Superior-Performance Organic Finish, Two-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

2.10 SOURCE QUALITY CONTROL

- A. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.

- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Seal perimeter and other joints watertight unless otherwise indicated.
- G. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.
- I. Install joint filler behind sealant as recommended by sealant manufacturer.
- J. Install components plumb and true in alignment with established lines and grades.
- K. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- L. Install entrance doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.
- M. Install glazing as specified in Section 088000 "Glazing."
- N. Install structural glazing as follows:
 - 1. Prepare surfaces that will contact structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
 - 2. Set glazing into framing in accordance with sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
 - 3. Set glazing with proper orientation so that coatings face exterior or interior as specified.
 - 4. Hold glazing in place using temporary retainers of type and spacing recommended by manufacturer, until structural sealant joint has cured.
 - 5. Apply structural sealant to completely fill cavity, in accordance with sealant manufacturer and framing manufacturer's written instructions and in compliance with local codes.
 - 6. Apply structural sealant at temperatures indicated by sealant manufacturer for type of sealant.
 - 7. Allow structural sealant to cure in accordance with manufacturer's written instructions.
 - 8. Clean and protect glass as indicated in Section 088000 "Glazing."
 - 9. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass as recommended by sealant manufacturer.
 - 10. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.

3.3 ERECTION TOLERANCES

- A. Install aluminum-framed entrance and storefront systems to comply with the following maximum tolerances:
1. Plumb: **1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).**
 2. Level: **1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).**
 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to **1/2 inch (12.7 mm)** wide, limit offset from true alignment to **1/16 inch (1.6 mm)**.
 - b. Where surfaces are separated by reveal or protruding element from **1/2 to 1 inch (12.7 to 25.4 mm)** wide, limit offset from true alignment to **1/8 inch (3.2 mm)**.
 - c. Where surfaces are separated by reveal or protruding element of **1 inch (25.4 mm)** wide or more, limit offset from true alignment to **1/4 inch (6 mm)**.
 4. Location: Limit variation from plane to **1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm)** over total length.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests.
- B. Tests: Perform the following tests on **[representative areas of aluminum-framed entrance and storefront systems][mockups]<Insert requirements>**.
1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect to be tested in accordance with AAMA 501.2 and to not evidence water penetration.
 - a. Perform a minimum of **[two][three]<Insert number>** tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to **[10, 35, and 70 percent completion]<Insert requirements>**.
 2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than **0.09 cfm/sq. ft. (0.45 L/s per sq. m)** at a static-air-pressure differential of **1.57 lbf/sq. ft. (75 Pa)**.
 - a. Perform a minimum of **[two][three]<Insert number>** tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to **[10, 35, and 70 percent completion]<Insert requirements>**.
 3. Water Penetration: ASTM E1105 at a minimum **[uniform][and][cyclic]** static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than **6.24 lbf/sq. ft. (300 Pa)**, and to not evidence water penetration.
 4. Structural-Sealant Adhesion: Test structural sealant in accordance with recommendations in ASTM C1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
 - a. Test a minimum of **[two][four][six]<Insert number>** areas on each building facade.
 - b. Repair installation areas damaged by testing.
- C. Inspection Agency: **[Owner will engage][Engage]** a qualified inspector to perform inspections.

D. Inspections:

1. Egress Door Inspections: Inspect each aluminum-framed entrance door equipped with panic hardware, located in an exit enclosure, electrically controlled, and equipped with special locking arrangements, in accordance with NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."

E. Aluminum-framed entrance and storefront systems will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.5 MAINTENANCE SERVICE

A. Entrance Door Hardware Maintenance:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
2. Initial Maintenance Service: Beginning at Substantial Completion, provide **[six]<Insert number>** months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

3.6 ENTRANCE DOOR HARDWARE SETS

A. **<Insert schedule>**.

END OF SECTION 08 12 16 00

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Task	Specification	Specification Description
08 13 13 13	08 05 13 00	Stainless-Steel Doors and Frames
08 13 73 00	08 35 13 00	Folding Doors



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SECTION 08 14 16 00 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core five-ply flush wood veneer-faced doors and transom panels for transparent finish.
2. Solid-core five-ply flush wood doors and transom panels for opaque finish.
3. Solid-core seven-ply flush wood veneer-faced doors and transom panels for transparent finish.
4. Solid-core seven-ply flush wood doors and transom panels for opaque finish.
5. Solid-core flush wood doors and transom panels with plastic-laminate faces.
6. Hollow-core flush wood veneer-faced doors for transparent finish.
7. Hollow-core flush wood doors for opaque finish.
8. Hollow-core flush wood doors with plastic-laminate faces.
9. Fire-rated wood door frames.
10. Light frames and louvers.

B. Related Requirements:

1. Section 064023 "Interior Architectural Woodwork" for wood door frames [**including 20-minute fire-rated wood door frames**] .
2. Section 064216 "Flush Wood Paneling" for requirements for veneers from the same flitches for both flush wood doors and flush wood paneling.
3. Section 083473.16 "Wood Sound Control Door Assemblies" for acoustic flush wood doors.
4. **[Section 087100 "Door Hardware"] [Section 087111 "Door Hardware (Descriptive Specification)"]** for door hardware for flush wood doors.
5. Section 088000 "Glazing" for glass view panels in flush wood doors.
6. **[Section 099113 "Exterior Painting"] [Section 099114 "Exterior Painting (MPI Standards)"] [Section 099123 "Interior Painting"] [Section 099124 "Interior Painting (MPI Standards)"] [and] [Section 099300 "Staining and Transparent Finishing"] [Section 099301 "Staining and Transparent Finishing (MPI Standards)"]** for field finishing doors.
7. Section 134900 "Radiation Protection" for lead-lined flush wood doors.

1.2 COORDINATION

- ##### A.
- Coordinate requirements for installing door hardware, including electrified door hardware, and access control and security systems.

1.3 PREINSTALLATION MEETINGS

- ##### A.
- Preinstallation Conference: Conduct conference [at Project site][by web conference]<Insert location> .

1.4 ACTION SUBMITTALS

- ##### A.
- Product Data: For each type of specified product. Include information indicating compliance with performance requirements indicated.

1. Door core materials and construction.
 2. Door edge construction.
 3. Door face type and characteristics.
 4. Door louvers.
 5. Door trim for openings.
 6. Door frame construction.
 7. Factory-machining criteria.
 8. Factory- **[priming][finishing]** specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in product data; and the following:
1. Door schedule indicating door [**and frame**] location, type, size, fire protection rating, and swing.
 2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
 3. Details of frame for each frame type, including dimensions and profile.
 4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 5. Dimensions and locations of blocking for hardware attachment.
 6. Dimensions and locations of mortises and holes for hardware.
 7. Clearances and undercuts.
 8. Requirements for veneer matching.
 9. Doors to be factory **[primed][finished]** and application requirements.
 10. Apply **[AWI Quality Certification][WI Certified Compliance]** Program label to Shop Drawings.
- C. Samples for Initial Selection: For **[plastic-laminate faces][polymer edging][factory-finished doors][and][factory-finished door frames]** .
- D. Samples for Verification:
1. Factory finishes applied to actual door face materials, approximately **8 by 10 inches (200 by 250 mm)**, for each material and finish. [**For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.**]
 2. Plastic-laminate, **6 inches (150 mm)** square, for each color, texture, and pattern selected.
 3. Polymer edging, in manufacturer's standard colors.
 4. Corner sections of doors, approximately **8 by 10 inches (200 by 250 mm)**, with door faces and edges representing actual materials to be used.
 5. Louver blade and frame sections, **6 inches (150 mm)** long, for each material and finish specified.
 6. Frames for light openings, **6 inches (150 mm)** long, for each material, type, and finish required.
- E. Sustainable Design Submittals:
1. Environmental Product Declaration (EPD): For each product.
 2. Health Product Declaration (HPD): For each product.
 3. Environmental Product Declaration (EPD): For each product.
 4. Health Product Declaration (HPD): For each product.
 5. Environmental Product Declaration (EPD): For each product.
 6. Environmental Product Declaration (EPD): For each product.
 7. Environmental Product Declaration (EPD): For each product.
 8. Third-Party Certifications: For each product.
 9. Third-Party-Certified Life-Cycle Assessment: For each product.
 10. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.

11. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
12. Chain-of-Custody Qualification Data: For manufacturer and vendor.
13. Laboratory Test Reports: For adhesives, indicating compliance with VOC requirements in the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
14. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
15. Laboratory Test Reports: For composite wood products, indicating compliance with the formaldehyde emissions evaluation.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For tests performed by **[a qualified testing agency][manufacturer and witnessed by a qualified testing agency]** for the following:
 1. Fire-rated door assemblies.
 2. Smoke- and draft-control door assemblies.
- B. Oversize Construction Certification: For assemblies required to be fire-rated that exceed limitations of labeled assemblies.
- C. Field quality control reports.
- D. Qualification Statements: For field testing and inspecting agency **[and][Fire-Rated Door Inspector][Egress Door Inspector]** .
- E. Sample Warranties: For specified special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Quality Standard Compliance Certificates: **[AWI Quality Certification][WI Certified Compliance]** Program certificates.
- B. Record Documents: For **[fire-rated][and][smoke- and draft-control]** door assemblies, list of door numbers and applicable room name and number to which door provides access.

1.7 QUALITY ASSURANCE

- A. Certified Wood: Provide an invoice, including vendor's chain-of-custody number, product cost, and entity being invoiced.
- B. Vendor Qualifications: Provide proof of use of vendors that are certified for chain of custody by an FSC-accredited certification body.
- C. Manufacturer's Certification: Licensed participant in **[AWI's Quality Certification Program][WI's Certified Compliance Program]** .
- D. Fire-Rated Door Inspector Qualifications: Documented as complying with requirements in NFPA 80 **[and having Door and Hardware Institute's Certified Fire + Egress Door Assembly Inspector (CFDAI) credentials]<Insert requirements>** .
- E. Egress Door Inspector Qualifications: Documented as complying with requirements in NFPA 101 **[and having Door and Hardware Institute's Certified Fire + Egress Door Assembly Inspector (CFDAI)**

credentials]<Insert requirements> .

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in **[plastic bags or cardboard cartons][cardboard cartons, and wrap bundles of doors in plastic sheeting] .**
- C. Mark each door on **[top and]** bottom rail with opening number used on Shop Drawings.

1.9 FIELD CONDITIONS

- A. Environmental Limitations:
 - 1. Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.
 - 2. Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between **60 and 90 deg F (16 and 32 deg C)** and relative humidity between **[25 and 55][43 and 70][17 and 50]<Insert numbers>** percent during remainder of construction period.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors **[and frames]** that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Delamination of veneer.
 - b. Warping (bow, cup, or twist) more than **1/4 inch (6.4 mm)** in a **42-by-84-inch (1067-by-2134-mm)** section.
 - c. Telegraphing of core construction in face veneers exceeding **0.01 inch in a 3-inch (0.25 mm in a 76.2-mm)** span.
 - 2. Warranty also includes installation and finishing that may be required due to repair or replacement of defective doors **[and frames]** .
 - 3. Warranty Period for Solid-Core Exterior Doors: **[Two][Five]<Insert number>** years from date of Substantial Completion.
 - 4. Warranty Period for Solid-Core Interior Doors: Life of installation.
 - 5. Warranty Period for Hollow-Core Interior Doors: **[One][Two]<Insert number>** year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain flush wood doors **[indicated to be blueprint matched with paneling][and wood paneling]**

from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings [**and temperature-rise limits**] indicated [**on Drawings**][**in schedules**] , based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
 - 1. Temperature-Rise Limit: Where indicated [**on Drawings**][**in schedules**] , provide doors that have a maximum transmitted temperature end point of not more than **450 deg F (250 deg C)** above ambient after 30 minutes of standard fire-test exposure.
 - 2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
- B. Smoke- and Draft-Control Door and Frame Assemblies: Listed and labeled for smoke and draft control based on testing in accordance with UL 1784 by a qualified testing agency acceptable to authorities having jurisdiction.

2.3 FLUSH WOOD DOORS AND FRAMES, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with [**AWI/AWMAC/WI's "Architectural Woodwork Standards."**][**ANSI/WDMA I.S. 1A.**]
 - 1. Provide [**labels**][**and**][**certificates**] from [**AWI**][**WI**] certification program indicating that doors [**and frames**] comply with requirements of grades specified.
 - a. This project has been registered with AWI as AWI Quality Certification Program Number **<Insert number>** .
 - b. Contractor registers the Work under this Section with the AWI Quality Certification Program at www.awiqcp.org or by calling 855-345-0991.
 - 2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.
- B. Regional Materials: Wood doors shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- C. Indigenous Materials: Wood doors shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- D. Certified Wood: Verify wood doors are certified as "FSC Pure" [**or "FSC Mixed Credit"**] in accordance with FSC STD-01-001 and FSC STD-40-004.
- E. Certified Wood: Verify wood doors are labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" in accordance with FSC STD-01-001 and FSC STD-40-004, or be certified and labeled in accordance with the standards of the Programme for Endorsement of Forest Certification.
- F. Certified Wood: Verify wood doors are certified in accordance with the American Tree Farm System's

"ATFS 2021 Standards of Sustainability," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.

- G. Adhesives: Use adhesives that comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- H. Adhesives: Do not use adhesives that contain urea formaldehyde.
- I. Composite Wood Products: Verify products are made using ultra-low-emitting formaldehyde resins, as defined in CARB 93120, "Airborne Toxic Control Measure (ATCM) for Formaldehyde Emissions from Composite Wood Products," or are made with no added formaldehyde.
- J. Composite Wood Products: Verify formaldehyde emission rates are not greater than the following when tested in accordance with ASTM D6007 or ASTM E1333:
 - 1. Hardwood Plywood: 0.05 ppm.
 - 2. Particleboard: 0.09 ppm.
 - 3. MDF More Than 5/16 Inch (8 mm) Thick: 0.11 ppm.
 - 4. MDF 5/16 Inch (8 mm) or Less in Thickness: 0.13 ppm.

2.4 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS AND TRANSOM PANELS FOR TRANSPARENT FINISH

- A. Exterior Doors, Solid-Core Five-Ply Veneer-Faced :
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Lambton Doors]**
 - b. **[Oregon Door]**
 - c. **[Oshkosh Door Company]**
 - d. **[VT Industries, Inc.]**
 - e. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Lambton Doors]**
 - b. **[Oregon Door]**
 - c. **[Oshkosh Door Company]**
 - d. **[VT Industries, Inc.]**
 - e. **<Insert manufacturer's name>**
 - 3. Performance Grade: ANSI/WDMA I.S. 1A **[Extra Heavy Duty][Heavy Duty][as indicated on Drawings]** .
 - 4. ANSI/WDMA I.S. 1A Quality Grade: **[Premium][Custom]** .
 - 5. Architectural Woodwork Standards Quality Grade: **[Premium][Custom]** .
 - 6. Faces: Single-ply wood veneer not less than **1/50 inch (0.508 mm)** thick.
 - a. Species: **[Anigre][Select white ash][Figured select white ash][Select white**

- birch][Select red birch][Cherry][Select red gum][Figured select red gum][Select white maple][Red oak][White oak][Persimmon][Sapele][Sycamore][Walnut]<Insert species> .
 - b. Cut: [Rotary cut][Plain sliced (flat sliced)][Quarter sliced][Rift cut] .
 - c. Match between Veneer Leaves: [Book][Slip][Random] match.
 - d. Assembly of Veneer Leaves on Door Faces: [Center-balance][Balance][Running] match.
 - e. Pair and Set Match: Provide for doors hung in same opening [or separated only by mullions] .
 - 7. Exposed Vertical and Top Edges: [Same species as faces or a compatible species - Architectural Woodwork Standards edge Type A][Same species as faces - Architectural Woodwork Standards edge Type A][Applied wood-veneer edges of same species as faces and covering edges of faces - Architectural Woodwork Standards edge Type B][Applied wood edges of same species as faces and covering edges of crossbands - Architectural Woodwork Standards edge Type D] .
 - 8. Core: Structural Composite Lumber.
 - a. Screw Withdrawal, Door Face: [550 lbf (2440 N)][475 lbf (2110 N)] in accordance with WDMA T.M. 10.
 - b. Screw Withdrawal, Vertical Door Edge: [550 lbf (2440 N)][475 lbf (2110 N)] in accordance with WDMA T.M. 10.
 - 9. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.
 - 10. Adhesives: Type I in accordance with WDMA T.M. 6.
- B. Interior Doors, Solid-Core Five-Ply Veneer-Faced :
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [Forte Openings]
 - b. [Lambton Doors]
 - c. [Lynden Door, Inc.]
 - d. [Oregon Door]
 - e. [Oshkosh Door Company]
 - f. [VT Industries, Inc.]
 - g. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Forte Openings]
 - b. [Lambton Doors]
 - c. [Lynden Door, Inc.]
 - d. [Oregon Door]
 - e. [Oshkosh Door Company]
 - f. [VT Industries, Inc.]
 - g. <Insert manufacturer's name>
 - 3. Performance Grade: ANSI/WDMA I.S. 1A [Extra Heavy Duty][Heavy Duty][Standard Duty][as indicated on Drawings] .
 - 4. Performance Grade by Location:

- a. ANSI/WDMA I.S. 1A Extra Heavy Duty: **[Classrooms][public toilets]janitor's closets[assembly spaces][exits][and][patient rooms]<Insert locations>[and where indicated on Drawings]** .
 - b. ANSI/WDMA I.S. 1A Standard Duty: **[Closets (not including janitor's closets)][and][private toilets]<Insert locations>[and where indicated on Drawings]** .
5. ANSI/WDMA I.S. 1A Quality Grade: **[Premium][Custom]** .
 6. Architectural Woodwork Standards Quality Grade: **[Premium][Custom]** .
 7. Faces: Single-ply wood veneer not less than **1/50 inch (0.508 mm)** thick.
 - a. Species: **[Anigre][Select white ash][Figured select white ash][Select white birch][Select red birch][Cherry][Select red gum][Figured select red gum][Select white maple][Red oak][White oak][Persimmon][Sapele][Sycamore][Walnut]<Insert species>** .
 - b. Cut: **[Rotary cut][Plain sliced (flat sliced)][Quarter sliced][Rift cut]** .
 - c. Match between Veneer Leaves: **[Book][Slip][Random]** match.
 - d. Assembly of Veneer Leaves on Door Faces: **[Center-balance][Balance][Running]** match.
 - e. Pair and Set Match: Provide for doors hung in same opening **[or separated only by mullions]** .
 - f. Room Match:
 - 1) Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by **[10 ft. (3 m)][20 ft. (6 m)]<Insert dimension>** or more.
 - 2) Provide door faces of compatible color and grain within each separate room or area of building.
 - g. Transom Match: **[Continuous match][End match][As indicated]** .
 - h. Blueprint Match: Where indicated, provide doors with faces produced from same flitches as adjacent wood paneling and arranged to provide blueprint match with wood paneling. Comply with requirements in Section 064216 "Flush Wood Paneling."
 8. Exposed Vertical and Top Edges: **[Same species as faces or a compatible species - Architectural Woodwork Standards edge Type A][Same species as faces - Architectural Woodwork Standards edge Type A][Applied wood-veneer edges of same species as faces and covering edges of faces - Architectural Woodwork Standards edge Type B][Applied wood edges of same species as faces and covering edges of crossbands - Architectural Woodwork Standards edge Type D]** .
 - a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
 - b. Fire-Rated Pairs of Doors:
 - 1) Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - 2) Provide formed-steel edges and astragals with intumescent seals.
 - a) Finish steel edges and astragals with baked enamel **[same color as doors]** .
 - b) Finish steel edges and astragals to match door hardware (locksets or exit devices).
 - c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

- 1) Screw-Holding Capability: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
 9. Core for Non-Fire-Rated Doors:
 - a. Particleboard: ANSI A208.1, **[Grade LD-1][Grade LD-2]** .
 - 1) Blocking: Provide wood blocking in particleboard-core doors as **[needed to eliminate through-bolting hardware.][follows:]**
 - a) **5-inch (125-mm)** top-rail blocking, in doors indicated to have closers.
 - b) **5-inch (125-mm)** bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 - c) **5-inch (125-mm)** midrail blocking, in doors indicated to have exit devices.
 - 2) Provide doors with structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in **[Section 087100 "Door Hardware."][Section 087111 "Door Hardware (Descriptive Specification)."]**
 - b. Structural Composite Lumber:
 - 1) Screw Withdrawal, Door Face: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
 - 2) Screw Withdrawal, Vertical Door Edge: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
 10. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
 - a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as **[needed to eliminate through-bolting hardware.][follows:]**
 - 1) **5-inch (125-mm)** top-rail blocking.
 - 2) **5-inch (125-mm)** bottom-rail blocking, in doors indicated to have protection plates.
 - 3) **5-inch (125-mm)** midrail blocking, in doors indicated to have armor plates.
 - 4) **4-1/2-by-10-inch (114-by-250-mm)** lock blocks, in doors without exit devices.
 - 5) **5-inch (125-mm)** midrail blocking, in doors indicated to have exit devices.
 11. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.
- 2.5 SOLID-CORE FIVE-PLY FLUSH WOOD DOORS AND TRANSOM PANELS FOR OPAQUE FINISH
- A. Exterior Doors, Solid-Core Five-Ply for Opaque Finish :
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Lambton Doors]**
 - b. **[Oregon Door]**
 - c. **[Oshkosh Door Company]**
 - d. **[VT Industries, Inc.]**
 - e. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Lambton Doors]**
 - b. **[Oregon Door]**
 - c. **[Oshkosh Door Company]**
 - d. **[VT Industries, Inc.]**
 - e. **<Insert manufacturer's name>**
3. Performance Grade: ANSI/WDMA I.S. 1A **[Extra Heavy Duty][Heavy Duty][as indicated on Drawings]** .
4. ANSI/WDMA I.S. 1A Quality Grade: **[Premium][Custom]** .
5. Architectural Woodwork Standards Quality Grade: **[Premium][Custom]** .
6. Faces: **[MDO][Any closed-grain hardwood of mill option]** .
 - a. Apply MDO to **[standard-thickness, closed-grain, hardwood face veneers][or][directly to high-density hardboard crossbands]** .
7. Exposed Vertical and Top Edges: Any closed-grain hardwood.
8. Core: Structural Composite Lumber.
 - a. Screw Withdrawal, Door Face: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
 - b. Screw Withdrawal, Vertical Door Edge: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
9. Construction: Five plies, hot-pressed, bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.
10. Adhesives: Type I in accordance with WDMA T.M. 6.

B. Interior Doors, Solid-Core Five-Ply for Opaque Finish :

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Forte Openings]**
 - b. **[Lambton Doors]**
 - c. **[Lynden Door, Inc.]**
 - d. **[Oregon Door]**
 - e. **[Oshkosh Door Company]**
 - f. **[VT Industries, Inc.]**
 - g. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Forte Openings]**
 - b. **[Lambton Doors]**
 - c. **[Lynden Door, Inc.]**
 - d. **[Oregon Door]**
 - e. **[Oshkosh Door Company]**

- f. **[VT Industries, Inc.]**
- g. **<Insert manufacturer's name>**
3. Performance Grade: ANSI/WDMA I.S. 1A **[Extra Heavy Duty][Heavy Duty][Standard Duty][as indicated on Drawings]** .
4. Performance Grade by Location:
 - a. ANSI/WDMA I.S. 1A Extra Heavy Duty: **[Classrooms][public toilets][janitor's closets][assembly spaces][exits][and][patient rooms]<Insert locations>[and where indicated on Drawings]** .
 - b. ANSI/WDMA I.S. 1A Standard Duty: **[Closets (not including janitor's closets)][and][private toilets]<Insert locations>[and where indicated on Drawings]** .
5. ANSI/WDMA I.S. 1A Quality Grade: **[Premium][Custom]** .
6. Architectural Woodwork Standards Quality Grade: **[Premium][Custom]** .
7. Faces: **[MDO][Any closed-grain hardwood of mill option][Hardboard or MDF]** .
 - a. Apply MDO to **[standard-thickness, closed-grain, hardwood face veneers][or][directly to high-density hardboard crossbands]** .
 - b. Hardboard Faces: ANSI A135.4, Class 1 (tempered) or Class 2 (standard).
 - c. MDF Faces: ANSI A208.2, Grade 150 or Grade 160.
8. Exposed Vertical and Top Edges: Any closed-grain hardwood.
 - a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
 - b. Fire-Rated Pairs of Doors:
 - 1) Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - 2) Provide formed-steel edges and astragals with intumescent seals.
 - a) Finish steel edges and astragals with baked enamel **[same color as doors]** .
 - b) Finish steel edges and astragals to match door hardware (locksets or exit devices).
 - c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - 1) Screw-Holding Capability: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
9. Core for Non-Fire-Rated Doors:
 - a. Particleboard: ANSI A208.1, **[Grade LD-1][Grade LD-2]** .
 - 1) Blocking: Provide wood blocking in particleboard-core doors as **[needed to eliminate through-bolting hardware.][follows:]**
 - a) **5-inch (125-mm)** top-rail blocking, in doors indicated to have closers.
 - b) **5-inch (125-mm)** bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 - c) **5-inch (125-mm)** midrail blocking, in doors indicated to have exit devices.

- 2) Provide doors with structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in **[Section 087100 "Door Hardware."][Section 087111 "Door Hardware (Descriptive Specification)."]**
- b. Structural Composite Lumber:
 - 1) Screw Withdrawal, Door Face: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
 - 2) Screw Withdrawal, Vertical Door Edge: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
10. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
 - a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as **[needed to eliminate through-bolting hardware.][follows:]**
 - 1) **5-inch (125-mm)** top-rail blocking.
 - 2) **5-inch (125-mm)** bottom-rail blocking, in doors indicated to have protection plates.
 - 3) **5-inch (125-mm)** midrail blocking, in doors indicated to have armor plates.
 - 4) **4-1/2-by-10-inch (114-by-250-mm)** lock blocks.
 - 5) **5-inch (125-mm)** midrail blocking, in doors indicated to have exit devices.
11. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.6 SOLID-CORE SEVEN-PLY FLUSH WOOD VENEER-FACED DOORS AND TRANSOM PANELS FOR TRANSPARENT FINISH

A. Exterior Doors, Seven-Ply Veneer-Faced :

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Haley Brothers, Inc]**
 - b. **[Lambton Doors]**
 - c. **[Vancouver Door Company]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Haley Brothers, Inc]**
 - b. **[Lambton Doors]**
 - c. **[Vancouver Door Company]**
 - d. **<Insert manufacturer's name>**
3. Performance Grade: ANSI/WDMA I.S. 1A **[Extra Heavy Duty][Heavy Duty][as indicated on Drawings]** .
4. ANSI/WDMA I.S. 1A Quality Grade: **[Premium][Custom]** .
5. Architectural Woodwork Standards Quality Grade: **[Premium][Custom]** .

6. Faces: **[Single-ply wood veneer not less than 1/50 inch (0.508 mm) thick][or][two-ply wood panel with wood veneer not less than 1/50 inch (0.508 mm) thick]** .
 - a. Species: **[Anigre][Select white ash][Figured select white ash][Select white birch][Select red birch][Cherry][Select red gum][Figured select red gum][Select white maple][Red oak][White oak][Persimmon][Sapele][Sycamore][Walnut]<Insert species>** .
 - b. Cut: **[Rotary cut][Plain sliced (flat sliced)][Quarter sliced][Rift cut]** .
 - c. Match between Veneer Leaves: **[Book][Slip][Random]** match.
 - d. Assembly of Veneer Leaves on Door Faces: **[Center-balance][Balance][Running]** match.
 - e. Pair and Set Match: Provide for doors hung in same opening **[or separated only by mullions]** .
 7. Exposed Vertical and Top Edges: **[Same species as faces or a compatible species - Architectural Woodwork Standards edge Type A][Same species as faces - Architectural Woodwork Standards edge Type A][Applied wood-veneer edges of same species as faces and covering edges of faces - Architectural Woodwork Standards edge Type B][Applied wood edges of same species as faces and covering edges of crossbands - Architectural Woodwork Standards edge Type D]** .
 8. Core: Structural Composite Lumber.
 - a. Screw Withdrawal, Door Face: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
 - b. Screw Withdrawal, Vertical Door Edge: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
 9. Construction: Seven plies, **[hot-pressed][or][cold-pressed]** bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.
 10. Adhesives: Type I in accordance with WDMA T.M. 6.
- B. Interior Doors, Seven-Ply Veneer-Faced :**
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Haley Brothers, Inc]**
 - b. **[Lambton Doors]**
 - c. **[Vancouver Door Company]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Haley Brothers, Inc]**
 - b. **[Lambton Doors]**
 - c. **[Vancouver Door Company]**
 - d. **<Insert manufacturer's name>**
 3. Performance Grade: ANSI/WDMA I.S. 1A **[Extra Heavy Duty][Heavy Duty][Standard Duty][as indicated on Drawings]** .
 4. Performance Grade by Location:
 - a. ANSI/WDMA I.S. 1A Extra Heavy Duty: **[Classrooms][public toilets][janitor's closets][assembly spaces][exits][and][patient rooms]<Insert locations>[and where**

- indicated on Drawings] .
- b. ANSI/WDMA I.S. 1A Standard Duty: **[Closets (not including janitor's closets)][and][private toilets]<Insert locations>[and where indicated on Drawings]** .
 5. ANSI/WDMA I.S. 1A Quality Grade: **[Premium][Custom]** .
 6. Architectural Woodwork Standards Quality Grade: **[Premium][Custom]** .
 7. Faces: **[Single-ply wood veneer not less than 1/50 inch (0.508 mm) thick][or][two-ply wood panel with wood veneer not less than 1/50 inch (0.508 mm) thick]** .
 - a. Species: **[Anigre][Select white ash][Figured select white ash][Select white birch][Select red birch][Cherry][Select red gum][Figured select red gum][Select white maple][Red oak][White oak][Persimmon][Sapele][Sycamore][Walnut]<Insert species>** .
 - b. Cut: **[Rotary cut][Plain sliced (flat sliced)][Quarter sliced][Rift cut]** .
 - c. Match between Veneer Leaves: **[Book][Slip][Random]** match.
 - d. Assembly of Veneer Leaves on Door Faces: **[Center-balance][Balance][Running]** match.
 - e. Pair and Set Match: Provide for doors hung in same opening **[or separated only by mullions]** .
 - f. Room Match:
 - 1) Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by **[10 ft. (3 m)][20 ft. (6 m)]<Insert dimension>** or more.
 - 2) Provide door faces of compatible color and grain within each separate room or area of building.
 - g. Transom Match: **[Continuous match][End match][As indicated on Drawings]** .
 - h. Blueprint Match: Where indicated, provide doors with faces produced from same flitches as adjacent wood paneling and arranged to provide blueprint match with wood paneling. Comply with requirements in Section 064216 "Flush Wood Paneling."
 8. Exposed Vertical and Top Edges: **[Same species as faces or a compatible species - Architectural Woodwork Standards edge Type A][Same species as faces - Architectural Woodwork Standards edge Type A][Applied wood-veneer edges of same species as faces and covering edges of faces - Architectural Woodwork Standards edge Type B][Applied wood edges of same species as faces and covering edges of crossbands - Architectural Woodwork Standards edge Type D]** .
 - a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
 - b. Fire-Rated Pairs of Doors:
 - 1) Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - 2) Provide formed-steel edges and astragals with intumescent seals.
 - a) Finish steel edges and astragals with baked enamel **[same color as doors]** .
 - b) Finish steel edges and astragals to match door hardware (locksets or exit devices).
 - c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - 1) Screw-Holding Capability: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in

accordance with WDMA T.M. 10.

9. Particleboard Core for Non-Fire-Rated Doors: ANSI A208.1, **[Grade LD-1][Grade LD-2]** .
 - a. Blocking: Provide wood blocking in particleboard-core doors as **[needed to eliminate through-bolting hardware.][follows:]**
 - 1) **5-inch (125-mm)** top-rail blocking, in doors indicated to have closers.
 - 2) **5-inch (125-mm)** bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 - 3) **5-inch (125-mm)** midrail blocking, in doors indicated to have exit devices.
 - b. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in **[Section 087100 "Door Hardware."][Section 087111 "Door Hardware (Descriptive Specification)."]**
10. Structural Composite Lumber Core for Non-Fire-Rated Doors:
 - a. Screw Withdrawal, Door Face: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
 - b. Screw Withdrawal, Vertical Door Edge: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
11. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
 - a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as **[needed to eliminate through-bolting hardware.][follows:]**
 - 1) **5-inch (125-mm)** top-rail blocking.
 - 2) **5-inch (125-mm)** bottom-rail blocking, in doors indicated to have protection plates.
 - 3) **5-inch (125-mm)** midrail blocking, in doors indicated to have armor plates.
 - 4) **4-1/2-by-10-inch (114-by-250-mm)** lock blocks.
 - 5) **5-inch (125-mm)** midrail blocking, in doors indicated to have exit devices.
12. Construction: Seven plies, **[hot-pressed][or][cold-pressed]** , bonded or unbonded.

2.7 SOLID-CORE SEVEN-PLY FLUSH WOOD DOORS AND TRANSOM PANELS FOR OPAQUE FINISH

A. Exterior Doors, Seven-Ply for Opaque Finish :

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Haley Brothers, Inc]**
 - b. **[Lambton Doors]**
 - c. **[Vancouver Door Company]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Haley Brothers, Inc]**
 - b. **[Lambton Doors]**
 - c. **[Vancouver Door Company]**
 - d. **<Insert manufacturer's name>**
3. Performance Grade: ANSI/WDMA I.S. 1A **[Extra Heavy Duty][Heavy Duty][as indicated on Drawings]** .
4. ANSI/WDMA I.S. 1A Quality Grade: **[Premium][Custom]** .
5. Architectural Woodwork Standards Quality Grade: **[Premium][Custom]** .
6. Faces: **[MDO][Any closed-grain hardwood of mill option]** .
 - a. Apply MDO to **[standard-thickness, closed-grain, hardwood face veneers][or][directly to high-density hardboard crossbands]** .
7. Exposed Vertical and Top Edges: Any closed-grain hardwood.
8. Core: Structural Composite Lumber.
 - a. Screw Withdrawal, Door Face: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
 - b. Screw Withdrawal, Vertical Door Edge: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
9. Construction: Seven plies, **[hot-pressed][or][cold-pressed]** , bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.
10. Adhesives: Type I in accordance with WDMA T.M. 6.

B. Interior Doors, Seven-Ply for Opaque Finish :

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Haley Brothers, Inc]**
 - b. **[Lambton Doors]**
 - c. **[Vancouver Door Company]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Haley Brothers, Inc]**
 - b. **[Lambton Doors]**
 - c. **[Vancouver Door Company]**
 - d. **<Insert manufacturer's name>**
3. Performance Grade: ANSI/WDMA I.S. 1A **[Extra Heavy Duty][Heavy Duty][Standard Duty][as indicated on Drawings]** .
4. Performance Grade by Location:
 - a. ANSI/WDMA I.S. 1A Extra Heavy Duty: **[Classrooms][public toilets][janitor's closets][assembly spaces][exits][and][patient rooms]<Insert locations>[and where indicated on Drawings]** .
 - b. ANSI/WDMA I.S. 1A Standard Duty: **[Closets (not including janitor's**

closets)][and][private toilets]<Insert locations>[and where indicated on Drawings] .

5. ANSI/WDMA I.S. 1A Quality Grade: **[Premium][Custom]** .
6. Architectural Woodwork Standards Quality Grade: **[Premium][Custom]** .
7. Faces: **[MDO][Any closed-grain hardwood of mill option][Hardboard or MDF]** .
 - a. Apply MDO to **[standard-thickness, closed-grain, hardwood face veneers][or][directly to high-density hardboard crossbands]** .
 - b. Hardboard Faces: ANSI A135.4, Class 1 (tempered) or Class 2 (standard).
 - c. MDF Faces: ANSI A208.2, Grade 150 or Grade 160.
8. Exposed Vertical and Top Edges: Any closed-grain hardwood.
 - a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
 - b. Fire-Rated Pairs of Doors:
 - 1) Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - 2) Provide formed-steel edges and astragals with intumescent seals.
 - a) Finish steel edges and astragals with baked enamel **[same color as doors]** .
 - b) Finish steel edges and astragals to match door hardware (locksets or exit devices).
 - c. Mineral Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - 1) Screw-Holding Capability: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
9. Particleboard Core for Non-Fire-Rated Doors: ANSI A208.1, **[Grade LD-1][Grade LD-2]** .
 - a. Blocking: Provide wood blocking in particleboard-core doors as **[needed to eliminate through-bolting hardware.][follows:]**
 - 1) **5-inch (125-mm)** top-rail blocking, in doors indicated to have closers.
 - 2) **5-inch (125-mm)** bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 - 3) **5-inch (125-mm)** midrail blocking, in doors indicated to have exit devices.
 - b. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in **[Section 087100 "Door Hardware."][Section 087111 "Door Hardware (Descriptive Specification)."]**
10. Structural Composite Lumber Core for Non-Fire-Rated Doors:
 - a. Screw Withdrawal, Door Face: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
 - b. Screw Withdrawal, Vertical Door Edge: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
11. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.

- a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as **[needed to eliminate through-bolting hardware.][follows:]**

- 1) **5-inch (125-mm)** top-rail blocking.
- 2) **5-inch (125-mm)** bottom-rail blocking, in doors indicated to have protection plates.
- 3) **5-inch (125-mm)** midrail blocking, in doors indicated to have armor plates.
- 4) **4-1/2-by-10-inch (114-by-250-mm)** lock blocks.
- 5) **5-inch (125-mm)** midrail blocking, in doors indicated to have exit devices.

- 12. Construction: Seven plies, **[hot-pressed][or][cold-pressed]** .

2.8 SOLID-CORE FLUSH WOOD DOORS AND TRANSOM PANELS WITH PLASTIC-LAMINATE FACES

A. Interior Doors, Solid Core with Plastic-Laminate Faces :

- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Forte Openings]**
 - b. **[Haley Brothers, Inc]**
 - c. **[Lambton Doors]**
 - d. **[Lynden Door, Inc.]**
 - e. **[Oregon Door]**
 - f. **[Oshkosh Door Company]**
 - g. **[Vancouver Door Company]**
 - h. **[VT Industries, Inc.]**
 - i. **<Insert manufacturer's name>**
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Forte Openings]**
 - b. **[Haley Brothers, Inc]**
 - c. **[Lambton Doors]**
 - d. **[Lynden Door, Inc.]**
 - e. **[Oregon Door]**
 - f. **[Oshkosh Door Company]**
 - g. **[Vancouver Door Company]**
 - h. **[VT Industries, Inc.]**
 - i. **<Insert manufacturer's name>**
- 3. Performance Grade: ANSI/WDMA I.S. 1A **[Extra Heavy Duty][Heavy Duty][Standard Duty][as indicated on Drawings]** .
- 4. Performance Grade by Location:
 - a. ANSI/WDMA I.S. 1A Extra Heavy Duty: **[Classrooms][public toilets][janitor's closets][assembly spaces][exits][and][patient rooms]<Insert locations>[and where indicated on Drawings]** .
 - b. ANSI/WDMA I.S. 1A Standard Duty: **[Closets (not including janitor's closets)][and][private toilets]<Insert locations>[and where indicated on Drawings]** .

5. ANSI/WDMA I.S. 1A Quality Grade: **[Premium][Custom]** .
6. Architectural Woodwork Standards Quality Grade: **[Premium][Custom]** .
7. Plastic-Laminate Faces: High-pressure decorative laminates complying with ISO 4586-3, **[Grade HGS][Grade HSH]** .
8. Colors, Patterns, and Finishes: **[As indicated][As selected by Architect from laminate manufacturer's full range of products]** .
9. Exposed Vertical and Top Edges: **[Hardwood edges for staining to match faces][Hardwood edges for painting][Plastic-laminate that matches faces, applied before faces][or][impact-resistant polymer edging, applied after faces]** .
 - a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
 - b. Fire-Rated Pairs of Doors:
 - 1) Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - 2) Provide formed-steel edges and astragals with intumescent seals.
 - a) Finish steel edges and astragals with baked enamel [**same color as doors**] .
 - b) Finish steel edges and astragals to match door hardware (locksets or exit devices).
 - c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - 1) Screw-Holding Capability: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
10. Core for Non-Fire-Rated Doors:
 - a. Particleboard: ANSI A208.1, **[Grade LD-1][Grade LD-2]** .
 - 1) Blocking: Provide wood blocking in particleboard-core doors as **[needed to eliminate through-bolting hardware.][follows:]**
 - a) **5-inch (125-mm)** top-rail blocking, in doors indicated to have closers.
 - b) **5-inch (125-mm)** bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 - c) **5-inch (125-mm)** midrail blocking, in doors indicated to have exit devices.
 - 2) Provide doors with structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in **[Section 087100 "Door Hardware."][Section 087111 "Door Hardware (Descriptive Specification)."]**
 - b. Structural Composite Lumber:
 - 1) Screw Withdrawal, Door Face: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
 - 2) Screw Withdrawal, Vertical Door Edge: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
11. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
 - a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding

capability approved for use in doors of fire-protection ratings indicated on Drawings as **[needed to eliminate through-bolting hardware.]****[follows:]**

- 1) **5-inch (125-mm)** top-rail blocking.
- 2) **5-inch (125-mm)** bottom-rail blocking, in doors indicated to have protection plates.
- 3) **5-inch (125-mm)** midrail blocking, in doors indicated to have armor plates.
- 4) **4-1/2-by-10-inch (114-by-250-mm)** lock blocks.
- 5) **5-inch (125-mm)** midrail blocking, in doors indicated to have exit devices.

12. Construction:

- a. Three plies, **[hot-pressed]****[or]****[cold-pressed]** bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before faces are applied.
- b. Five plies, **[hot-pressed]****[or]****[cold-pressed]** bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before faces and crossbands are applied.

2.9 HOLLOW-CORE FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors, Hollow-Core Veneer Faced :

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following]****[provide products by one of the following]****[available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Haley Brothers, Inc]**
 - b. **[Lambton Doors]**
 - c. **[Lynden Door, Inc.]**
 - d. **[Oregon Door]**
 - e. **[Vancouver Door Company]**
 - f. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Haley Brothers, Inc]**
 - b. **[Lambton Doors]**
 - c. **[Lynden Door, Inc.]**
 - d. **[Oregon Door]**
 - e. **[Vancouver Door Company]**
 - f. **<Insert manufacturer's name>**
3. Performance Grade: ANSI/WDMA I.S. 1A Standard Duty.
4. ANSI/WDMA I.S. 1A Quality Grade: **[Premium]****[Custom]** .
5. Architectural Woodwork Standards Quality Grade: **[Premium]****[Custom]** .
6. Species: **[Anigre]****[Select white ash]****[Figured select white ash]****[Select white birch]****[Select red birch]****[Cherry]****[Select red gum]****[Figured select red gum]****[Select white maple]****[Red oak]****[White oak]****[Persimmon]****[Sapele]****[Sycamore]****[Walnut]****<Insert species>** .
7. Cut: **[Rotary cut]****[Plain sliced (flat sliced)]****[Quarter sliced]****[Rift cut]** .
8. Match between Veneer Leaves: **[Book]****[Slip]****[Random]** match.
9. Assembly of Veneer Leaves on Door Faces: **[Center-balance]****[Balance]****[Running]** match.
10. Pair and Set Match: Provide for doors hung in same opening **[or separated only by mullions]** .
11. Exposed Vertical and Top Edges: **[Same species as faces or a compatible species -**

Architectural Woodwork Standards edge Type A[Same species as faces - **Architectural Woodwork Standards edge Type A**][Applied wood-veneer edges of same species as faces and covering edges of faces - **Architectural Woodwork Standards edge Type B**][Applied wood edges of same species as faces and covering edges of crossbands - **Architectural Woodwork Standards edge Type D**] .

12. Construction: **[Institutional][Standard]** hollow core.
13. Blocking: Provide wood blocking with minimum dimensions as follows:
 - a. **5-by-18-inch (125-by-460-mm)** lock blocks [**at both stiles**] .
 - b. **5-inch (125-mm)** top- [**and bottom-**] rail blocking.
 - c. **10-inch (250-mm)**[**top- and**] bottom-rail blocking.
 - d. **2-1/2-inch (64-mm)** midrail blocking.

2.10 HOLLOW-CORE FLUSH WOOD DOORS FOR OPAQUE FINISH

A. Interior Doors, Hollow Core for Opaque Finish :

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Haley Brothers, Inc]**
 - b. **[Lambton Doors]**
 - c. **[Lynden Door, Inc.]**
 - d. **[Oregon Door]**
 - e. **[Vancouver Door Company]**
 - f. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Haley Brothers, Inc]**
 - b. **[Lambton Doors]**
 - c. **[Lynden Door, Inc.]**
 - d. **[Oregon Door]**
 - e. **[Vancouver Door Company]**
 - f. **<Insert manufacturer's name>**
3. Performance Grade: WDMA ANSI/I.S. 1A Standard Duty.
4. ANSI/WDMA I.S. 1A Quality Grade: **[Premium][Custom]** .
5. Architectural Woodwork Standards Quality Grade: **[Premium][Custom]** .
6. Faces: **[Any closed-grain hardwood of mill option][Hardboard or MDF]** .
 - a. Hardboard Faces: ANSI A135.4, Class 1 (tempered) or Class 2 (standard).
 - b. MDF Faces: ANSI A208.2, Grade 150 or Grade 160.
7. Exposed Vertical and Top Edges: Any closed-grain hardwood.
8. Construction: **[Institutional][Standard]** hollow core.
9. Blocking: Provide wood blocking with minimum dimensions as follows:
 - a. **5-by-18-inch (125-by-460-mm)** lock blocks [**at both stiles**] .
 - b. **5-inch (125-mm)** top- [**and bottom-**] rail blocking.
 - c. **10-inch (250-mm)**[**top- and**] bottom-rail blocking.

- d. **2-1/2-inch (64-mm)** midrail blocking.

2.11 HOLLOW-CORE FLUSH WOOD DOORS WITH PLASTIC-LAMINATE FACES

A. Interior Doors, Hollow Core with Plastic-Laminate Faces :

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Haley Brothers, Inc]**
 - b. **[Lambton Doors]**
 - c. **[Vancouver Door Company]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Haley Brothers, Inc]**
 - b. **[Lambton Doors]**
 - c. **[Vancouver Door Company]**
 - d. **<Insert manufacturer's name>**
3. Performance Grade: ANSI/WDMA I.S. 1A Standard Duty.
4. ANSI/WDMA I.S. 1A Quality Grade: **[Premium][Custom]** .
5. Architectural Woodwork Standards Quality Grade: **[Premium][Custom]** .
6. Plastic-Laminate Faces: High-pressure decorative laminates complying with ISO 4586-3, **[Grade HGS][Grade HSH]** .
 - a. Colors, Patterns, and Finishes: **[As indicated][As selected by Architect from laminate manufacturer's full range of products]** .
7. Exposed Vertical and Top Edges: **[Hardwood edges for staining to match faces][Hardwood edges for painting][Plastic-laminate that matches faces, applied before faces][Impact-resistant polymer edging, applied after faces]** .
 - a. Polymer Edging Color: **[Beige][Brown][Same color as faces]** .
8. Construction: **[Institutional][Standard]** hollow core.
9. Blocking: Provide wood blocking with minimum dimensions as follows:
 - a. **5-by-18-inch (125-by-460-mm)** lock blocks **[at both stiles]** .
 - b. **5-inch (125-mm)** top- **[and bottom-]** rail blocking.
 - c. **10-inch (250-mm)[top- and]** bottom-rail blocking.
 - d. **2-1/2-inch (64-mm)** midrail blocking.

2.12 FIRE-RATED WOOD DOOR FRAMES

A. Interior Fire-Rated Door Frames:

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Forte Openings]**
 - b. **[Lambton Doors]**
 - c. **[Oshkosh Door Company]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Forte Openings]**
 - b. **[Lambton Doors]**
 - c. **[Oshkosh Door Company]**
 - d. **<Insert manufacturer's name>**
3. ANSI/WDMA I.S. 1A Quality Grade: **[Premium][Custom]** .
4. Architectural Woodwork Standards Quality Grade: **[Premium][Custom]** .
5. Wood Species and Cut: Match species and cut indicated for wood doors unless otherwise indicated.
6. Species: **[Anigre][Select white ash][Figured select white ash][Select white birch][Select red birch][Cherry][Select red gum][Figured select red gum][Select white maple][Red oak][White oak][Persimmon][Sapele][Sycamore][Walnut]<Insert species>** .
7. Cut: **[Plain sliced/plain sawn][Quarter cut/quarter sawn][Rift cut/rift sawn]** .
8. Wood Moisture Content: **[5 to 10][8 to 13][4 to 9]** percent.
9. Profile: **[T-stop][Flat][Single rabbet][Double rabbet][As indicated on Drawings]** .
10. Construction: Solid lumber, fire-retardant particleboard, or fire-retardant medium density fiberboard (MDF) with veneered exposed surfaces and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated on Drawings.

2.13 LIGHT FRAMES AND LOUVERS

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
 1. Wood Species: **[Same species as door faces][Species compatible with door faces][Any closed-grain hardwood]** .
 2. Profile: **[Flush rectangular beads][Recessed tapered beads][Recessed tapered beads with exposed banding][Lipped tapered beads][Manufacturer's standard shape]** .
 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated on Drawings. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.
- C. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of **0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; [factory primed for paint][with baked-enamel- or powder-coated]** finish; and approved for use in doors of fire-protection rating indicated on Drawings.

- D. Wood Louvers: Door manufacturer's standard solid-wood louvers unless otherwise indicated.
1. Wood Species: **[Same species as door faces][Species compatible with door faces][Any closed-grain hardwood]** .
 2. Profile: **[Flat][Chevron]** .
- E. Metal Louvers:
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Allegion plc]**
 - b. **[Anemostat Air Distribution; Anemostat, Inc.; Mestek, Inc.]**
 - c. **[ASSA ABLOY]**
 - d. **[JL Industries; Activar Construction Products Group, Inc.]**
 - e. **[L & L Louvers, Inc.]**
 - f. **[McGill Architectural Products]**
 - g. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Allegion plc]**
 - b. **[Anemostat Air Distribution; Anemostat, Inc.; Mestek, Inc.]**
 - c. **[ASSA ABLOY]**
 - d. **[JL Industries; Activar Construction Products Group, Inc.]**
 - e. **[L & L Louvers, Inc.]**
 - f. **[McGill Architectural Products]**
 - g. **<Insert manufacturer's name>**
 3. Blade Type: **[Vision-proof, inverted V][Vision-proof, inverted Y][Darkroom-type, double inverted V]** .
 4. Metal and Finish:
 - a. Hot-Dip Galvanized Steel: **0.040 inch (1.0 mm)** thick, **[factory primed for paint][with baked-enamel- or powder-coated]** finish.
 - b. Extruded Aluminum: **[Class II, clear anodic finish, AA-M12C22A31][Class II, color anodic finish, AA-M12C22A32/A34]** .
 - 1) Color: **[Light bronze][Medium bronze][Dark bronze][Black][As indicated][As selected by Architect from manufacturer's full range]** .
- F. Louvers for Fire-Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire-protection rating of 1-1/2 hours and less.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[Allegion plc]**
 - b. **[Anemostat Air Distribution; Anemostat, Inc.; Mestek, Inc.]**

- c. [ASSA ABLOY]
 - d. [JL Industries; Activar Construction Products Group, Inc.]
 - e. [L & L Louvers, Inc.]
 - f. [McGill Architectural Products]
 - g. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Allegion plc]
 - b. [Anemostat Air Distribution; Anemostat, Inc.; Mestek, Inc.]
 - c. [ASSA ABLOY]
 - d. [JL Industries; Activar Construction Products Group, Inc.]
 - e. [L & L Louvers, Inc.]
 - f. [McGill Architectural Products]
 - g. <Insert manufacturer's name>
 3. Metal and Finish: Hot-dip galvanized steel, **0.040 inch (1.0 mm)** thick, [factory primed for paint][with baked-enamel- or powder-coated] finish.
 - a. Color: [As indicated][As selected by Architect from manufacturer's full range] .

2.14 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated.
 1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 2. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied.
 1. Locate hardware to comply with DHI-TDH-007.
 2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
 3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
 4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
 5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Transom and Side Panels:
 1. Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors.
 2. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
 3. Fabricate door and transom panels with full-width, solid-lumber [, rabbeted,] meeting rails.
 4. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.
- D. Openings: Factory cut and trim openings through doors.
 1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable

- requirements in Section 088000 "Glazing."
3. Louvers: Factory install louvers in prepared openings.

- E. Exterior Doors: Factory treat exterior doors with water repellent after fabrication has been completed but before factory **[priming][finishing]** .

1. Flash top of outswinging doors with manufacturer's standard metal flashing.

2.15 FACTORY PRIMING

- A. Doors for Opaque Finish: Factory prime faces, all four edges, edges of cutouts, and mortises with one coat of wood primer specified in **[Section 099113 "Exterior Painting."]****[Section 099114 "Exterior Painting (MPI Standards)."]****[Section 099123 "Interior Painting."]****[Section 099124 "Interior Painting (MPI Standards)."]**

2.16 FACTORY FINISHING

- A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on **[top and]** bottom edges, edges of cutouts, and mortises.

- B. Factory finish doors where indicated in schedules or on Drawings as factory finished.

- C. Transparent Finish:

1. Architectural Woodwork Standards Grade: **[Premium][Custom]** .
 - a. System-5, Varnish, Conversion.
 - b. System-9, UV Curable, Acrylated Epoxy, Polyester or Urethane.
 - c. System-10, UV Curable, Water Based.
 - d. System-11, Polyurethane, Catalyzed.
2. ANSI/WDMA I.S. 1A Grade: **[Premium][Custom]** .
 - a. TR-4 Conversion Varnish.
 - b. TR-6 Catalyzed Polyurethane.
 - c. TR-8 UV Cured Acrylated Polyester/Urethane.
3. Staining: **[Match Architect's sample][As selected by Architect from manufacturer's full range][None required]** .
4. Sheen: **[Satin][Semigloss]** .

- D. Opaque Finish:

1. Architectural Woodwork Standards Grade: **[Premium][Custom]** .
 - a. System-5, Varnish, Conversion.
 - b. System-9, UV Curable, Acrylated Epoxy, Polyester, or Urethane.
 - c. System-10, UV Curable, Water Based.

- d. System-11, Polyurethane, Catalyzed.
- 2. ANSI/WDMA I.S. 1A Grade: **[Premium][Custom]** .
 - a. OP-4 Conversion Varnish.
 - b. OP-6 Catalyzed Polyurethane.
- 3. Color: **[Match Architect's sample][As selected by Architect from manufacturer's full range]** .
- 4. Sheen: **[Satin][Semigloss][Gloss]** .

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF FLUSH WOOD DOORS AND TRANSOM PANELS

- A. Hardware: For installation, see **[Section 087100 "Door Hardware."][Section 087111 "Door Hardware (Descriptive Specification)."]**
- B. Install doors [, **transom panels,**][**and frames**] to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Install frames level, plumb, true, and straight.
 - 1. Shim as required with concealed shims. Install level and plumb to a tolerance of **1/8 inch in 96 inches (3.2 mm in 2400 mm)**.
 - 2. Anchor frames to anchors or blocking built in or directly attached to substrates.
 - a. Secure with countersunk, concealed fasteners and blind nailing.
 - b. Use fine finishing nails [**or finishing screws**] for exposed fastening, countersunk and filled flush with woodwork.
 - 1) For factory-finished items, use filler matching finish of items being installed.
 - 3. Fire-Rated Door and Frame Assemblies: Install in accordance with NFPA 80.
 - 4. Smoke- and Draft-Control Door and Frame Assemblies: Install in accordance with NFPA 105.
- D. Job-Fitted Doors:
 - 1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
 - a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.

2. Machine doors for hardware.
 3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 4. Clearances:
 - a. Provide **1/8 inch (3.2 mm)** at heads, jambs, and between pairs of doors.
 - b. Provide **1/8 inch (3.2 mm)** from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
 - c. Where threshold is shown or scheduled, provide **1/4 inch (6.4 mm)** from bottom of door to top of threshold unless otherwise indicated.
 - d. Comply with NFPA 80 for fire-rated doors.
 5. Bevel non-fire-rated doors **1/8 inch in 2 inches (3-1/2 degrees)** at lock and hinge edges.
 6. Bevel fire-rated doors **1/8 inch in 2 inches (3-1/2 degrees)** at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: **[Owner will engage][Engage]** a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections: Provide inspection of installed Work through **[AWI's Quality Certification Program][WI's Certified Compliance Program]** , certifying that wood doors and frames, including installation, comply with the specified grade.
- C. Fire-Rated Door and Frame Acceptance Testing: Test and inspect smoke- and draft-control door and frame assemblies in accordance with NFPA 105.
- D. Egress-Door Acceptance Testing: Test and inspect egress doors in accordance with NFPA 101.
- E. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- F. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- G. Inspection Report: Prepared and submitted in writing to Architect and Contractor within 24 hours after testing.

3.4 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Factory Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.



END OF SECTION 08 14 16 00



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SECTION 08 14 16 00A - STILE AND RAIL WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior stile and rail wood doors.
2. Interior stile and rail wood doors.
3. Interior fire-rated stile and rail wood doors.
4. Fire-rated wood door frames.

B. Related Requirements:

1. Section 064214 "Stile and Rail Wood Paneling" for requirements for veneers from the same flitches for both wood paneling and stile and rail wood doors.
2. **[Section 099113 "Exterior Painting"]****[Section 099123 "Interior Painting"]****[Section 099300 "Staining and Transparent Finishing"]** for field finishing stile and rail doors.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]**<Insert location>.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Exterior stile and rail wood doors.
2. Interior stile and rail wood doors.
3. Interior fire-rated stile and rail wood doors.
4. Fire-rated wood door frames.

B. Sustainable Design Submittals:

1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
2. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
3. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
4. Chain-of-Custody Qualification Data: For manufacturer and vendor.
5. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
6. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
7. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
8. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
9. Product Data: For adhesives, indicating that product contains no urea formaldehyde.

10. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
11. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
12. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
13. Product Data: For composite wood products, indicating compliance with requirements for formaldehyde emissions.
14. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data, including those for stiles, rails, panels, and moldings (sticking); and other pertinent data, including the following:

1. Door schedule indicating door[**and frame**] location, type, size, fire protection rating, and swing.
2. Door elevations, dimensions and location of hardware, lite locations, and glazing thickness.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of mortises and holes for hardware.
6. Clearances and undercuts.
7. Requirements for veneer matching.
8. Doors to be factory [**primed**][**finished**] and application requirements.
9. Apply [**AWI Quality Certification**][**WI Certified Compliance**] Program label to Shop Drawings.

D. Samples for Initial Selection: For [**factory-finished doors**][**and**][**factory-finished door frames**].

E. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately **8 by 10 inches (200 by 250 mm)**, for each material and finish.[**For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.**]
2. Corner sections of doors, approximately **8 by 10 inches (200 by 250 mm)**, with door faces and edges representing actual materials to be used.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
3. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Field quality control reports.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Special warranties.

- B. Quality Standard Compliance Certificates: **[AWI Quality Certification][WI Certified Compliance]** Program certificates.
- C. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.
- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- D. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- E. Manufacturer's Certification: Licensed participant in **[AWI's Quality Certification Program][WI's Certified Compliance Program]**.
- F. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies must meet the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
 - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.
- G. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies must meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
 - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in opaque plastic bags or cardboard cartons.
- C. Mark each door on **[top and]** bottom rail with opening number used on Shop Drawings.

1.8 FIELD CONDITIONS

- A. Environmental Limitations:
 - 1. Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity levels designed for building occupants for the remainder of construction period.
 - 2. Do not deliver or install doors until building is enclosed and weathertight, wet work is complete and dry, and HVAC system is operating and maintaining temperature between **60 and 90 deg F (16 and 32 deg C)** and relative humidity between **[25 and 55][43 and 70][17 and 50]<Insert numbers>** percent during remainder of construction period.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors[**and frames**] that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Delamination of veneer.
 - b. Warping (bow, cup, or twist) more than **1/4 inch (6.4 mm)** in a **42-by-84-inch (1067-by-2134-mm)** section.
 - c. Telegraphing of core construction in face veneers exceeding **0.01 inch in a 3-inch (0.25 mm in a 76.2-mm)** span.
 2. Warranty must also include installation and finishing that may be required due to repair or replacement of defective doors[**and frames**].
 3. Warranty must be in effect during specified period of time from date of Substantial Completion.
 4. Warranty Period for Exterior Doors: [**Two years**][**Five years**].
 5. Warranty Period for Interior Doors: [**One year**][**Five years**][**Life of installation**].
 6. Insulating[**Leaded**] Glass Vision Panels: [**Three**][**Five**] years.

PART 2 - PRODUCTS**2.1 SOURCE LIMITATIONS**

- A. Obtain [**stile and rail wood doors**][**each type of stile and rail wood door**] from single manufacturer.
- B. Obtain[**custom**] stile and rail wood doors from same fabricator as work in Section 064214 "Stile and Rail Wood Paneling."
- C. Provide[**custom**] stile and rail wood doors finished in same shop as work in Section 064214 "Stile and Rail Wood Paneling."

2.2 PERFORMANCE REQUIREMENTS

- A. Exterior Door Thermal Transmittance: Maximum whole fenestration product U-factor of [**0.25 (1.41)**][**0.30 (1.70)**][**0.35 (1.98)**][**0.40 (2.27)**][**0.45 (2.55)**][**0.65 (3.69)**], <Insert Btu/sq. ft. x h x deg F (W/sq. m x K)>, in accordance with AAMA 1503, ASTM E1423, or NFRC 100.
- B. Fire-Rated Wood Door and Frame Assemblies: Complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings [**and temperature-rise limits**] indicated on Drawings, based on testing at positive pressure in accordance with [**UL 10C**][**or**][**NFPA 252**].
1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 2. Temperature-Rise Limit: [**Where indicated on Drawings**][**At vertical exit enclosures and exit passageways**], provide doors that have a maximum transmitted temperature end point of not more than **450 deg F (250 deg C)** above ambient after 30 minutes of standard fire-test exposure.
- C. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a

qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.3 MATERIALS

- A. Use only materials that comply with referenced standards and other requirements specified.
 - 1. Assemble exterior doors, including components, with wet-use adhesives complying with ASTM D5572 for finger joints and with ASTM D5751 for joints other than finger joints.
 - 2. Assemble interior doors, including components, with either dry-use or wet-use adhesives complying with ASTM D5572 for finger joints and with ASTM D5751 for joints other than finger joints.
- B. Regional Materials: Wood doors shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- C. Regional Materials: Wood doors shall be manufactured within **500 miles (800 km)** of Project site.
- D. Regional Materials: Wood doors shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- E. Indigenous Materials: Wood doors shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- F. Regional Materials: Wood doors shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- G. Certified Wood: Wood doors shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-00 and FSC STD-40-004.
- H. Certified Wood: Wood doors shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.
- I. Certified Wood: Wood doors shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
- J. Certified Wood: Wood doors shall [**contain not less than 60 percent**][**be made from**] certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "Technical Barriers to Trade."
- K. Certified Wood: Wood doors shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
- L. Adhesives: Do not use adhesives that contain urea formaldehyde.
- M. Adhesives: Use adhesives that meet the testing and product requirements of the California Department

of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

- N. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- O. Adhesives: Do not use adhesives that contain urea formaldehyde.
- P. Adhesives: Do not use adhesives that contain urea formaldehyde.
- Q. Composite Wood Products: Products shall be made without urea formaldehyde.
- R. Composite Wood Products: Products shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- S. Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
- T. Composite Wood Products: Formaldehyde emission rates shall not be greater than the following when tested according to ASTM D6007 or ASTM E1333:
 - 1. Hardwood Plywood: 0.05 ppm.
 - 2. Particleboard: 0.09 ppm.
 - 3. MDF More Than **5/16 Inch (8 mm)** Thick: 0.11 ppm.
 - 4. MDF **5/16 Inch (8 mm)** or Less in Thickness: 0.13 ppm.
- U. Composite Wood Products: Products shall be made without urea formaldehyde.
- V. Panel Products: Any of the following unless otherwise indicated:
 - 1. Particleboard: ANSI A208.1, Grade M-2.
 - 2. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
 - 3. Medium-density fiberboard (MDF), complying with ANSI A208.2, Grade 130.
 - 4. Hardboard complying with ANSI A135.4.
 - 5. Veneer-core plywood.
- W. Safety Glass: Provide products complying with testing requirements in 16 CFR 1201, for Category II materials, unless those of Category I are expressly indicated and permitted.

2.4 EXTERIOR STILE AND RAIL WOOD DOORS

- A. Exterior Stile and Rail Wood Doors: Exterior **[stock][custom]** doors complying with **[the AWI, AWMAC, and WI's Architectural Woodwork Standards,][or][WDMA I.S. 6A,]** and with other requirements specified.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the**

following]:

- a. **[Masonite Architectural]**
 - b. **[VT Industries, Inc.]**
 - c. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Masonite Architectural]**
 - b. **[VT Industries, Inc.]**
 - c. **<Insert manufacturer's name>**
3. Performance Grade: ANSI/WDMA I.S. 1A **[Extra Heavy Duty][Heavy Duty][as indicated on Drawings]**.
4. ANSI/WDMA I.S. 1A Quality Grade: **[Premium][Custom]**.
5. Architectural Woodwork Standards Quality Grade: **[Premium][Custom]**.
6. Panel Designs: As indicated on Drawings.
 - a. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval.
 - b. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
7. Finish: **[Transparent][Opaque]**.
8. Wood Species and Cut for Transparent Finish: **[Idaho white, lodgepole, ponderosa, or sugar pine, plain sawed/sliced][Douglas fir or western hemlock, quarter sawed/sliced (vertical grain)][Red oak, quarter sawed/sliced stiles and rails, plain sawed/sliced panels][Species indicated on Drawings, plain sawed/sliced]<Insert species and cut>**.
9. Door Construction for Transparent Finish:
 - a. Stile and Rail Construction:
 - 1) Clear lumber; may be edge glued for width. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.
 - 2) Veneered, structural composite lumber **[or veneered, edge- and end-glued clear lumber]**. Select veneers for similarity of grain and color, and arrange for optimum match between adjacent pieces. **[Use veneers not less than 1/16 inch (1.6 mm) thick.]**
 - b. Raised-Panel Construction:
 - 1) Clear lumber; edge glued for width. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.
 - 2) Edge-glued, clear lumber; glued to both sides of a wood-based panel product. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.
 - 3) Veneered, wood-based panel product with mitered, raised rims made from matching clear lumber.
 - 4) Veneered, shaped, wood-based panel product with veneer conforming to raised-panel shape.
10. Door Construction for Opaque Finish:
 - a. Stile and Rail Construction:

- 1) Clear softwood; may be edge glued for width and finger jointed.
 - 2) Veneered, structural composite lumber[**or veneered edge- and end-glued lumber**].
- b. Raised-Panel Construction: [**Clear softwood lumber; edge glued for width**][**Veneered, wood-based panel product**].
11. Stile and Rail Widths: [**As indicated on Drawings.**][**Manufacturer's standard, but not less than the following:**]
- a. Stiles, Top and Intermediate Rails: [**5-3/8 inches (137 mm)**]<Insert dimension>.
 - b. Bottom Rails: [**11-3/8 inches (289 mm)**]<Insert dimension>.
12. Raised-Panel Thickness: [**As indicated on Drawings**][**1-3/4 inches (44 mm)**][**1-3/8 inches (35 mm)**][**Manufacturer's standard, but not less than 1-1/8 inches (29 mm)**].
13. Molding Profile (Sticking): [**Bead and cove**][**Ogee**][**Ovalo**][**Recessed bevel**][**Recessed square**][**Manufacturer's standard**][**As selected by Architect from manufacturer's full range**].
14. Glass: Uncoated, clear, [**fully tempered float glass, 5.0 mm thick**][**laminated glass made from two lites of 3.0-mm-thick annealed glass**][**insulating-glass units made from two lites of 3.0-mm-thick, fully tempered glass with 1/4-inch (6.4-mm) interspace**]<Insert requirements>, complying with Section 088000 "Glazing."
15. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S. 6A and grade specified.

2.5 INTERIOR STILE AND RAIL WOOD DOORS

- A. Interior Stile and Rail Wood Doors: Interior [**stock**][**custom**] doors complying with [**AWI, AWMAC, and WI's Architectural Woodwork Standards**][**WDMA I.S. 6A**] and with other requirements specified.
1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
 - a. [**ETO Doors Corp.**]
 - b. [**Karona by JELD-WEN**]
 - c. [**VT Industries, Inc.**]
 - d. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert **manufacturer's name; product name or designation**> or comparable product by one of the following:
 - a. [**ETO Doors Corp.**]
 - b. [**Karona by JELD-WEN**]
 - c. [**VT Industries, Inc.**]
 - d. <Insert manufacturer's name>
 3. Performance Grade: ANSI/WDMA I.S. 1A [**Extra Heavy Duty**][**Heavy Duty**][**Standard Duty**][**as indicated on Drawings**].
 4. ANSI/WDMA I.S. 1A Quality Grade: Custom.
 5. Architectural Woodwork Standards Quality Grade: Custom.
 6. Panel Designs: Indicated on Drawings. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit

- comprehensive explanatory data to Architect for review.
7. Finish: **[Transparent][Opaque]**.
 8. Wood Species and Cut for Transparent Finish: **[Idaho white, lodgepole, ponderosa, or sugar pine, plain sawed/sliced][Douglas fir or western hemlock, quarter sawed/sliced (vertical grain)][Red oak, quarter sawed/sliced stiles and rails, plain sawed/sliced panels][Species indicated on Drawings, plain sawed/sliced]<Insert species and cut>**.
 9. Door Construction for Transparent Finish:
 - a. Stile and Rail Construction:
 - 1) Clear lumber; may be edge glued for width. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.
 - 2) Veneered, structural composite lumber **[or veneered, edge- and end-glued clear lumber]**. Select veneers for similarity of grain and color, and arrange for optimum match between adjacent pieces. **[Use veneers not less than 1/16 inch (1.6 mm) thick.]**
 - b. Raised-Panel Construction:
 - 1) Clear lumber; edge glued for width. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.
 - 2) Edge-glued, clear lumber; glued to both sides of a wood-based panel product. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.
 - 3) Veneered, wood-based panel product with mitered, raised rims made from matching clear lumber.
 - 4) Veneered, shaped, wood-based panel product with veneer conforming to raised-panel shape.
 - c. Flat-Panel Construction: Veneered, wood-based panel product.
 10. Door Construction for Opaque Finish:
 - a. Stile and Rail Construction:
 - 1) Clear softwood; may be edge glued for width and finger jointed.
 - 2) Veneered, structural composite lumber **[or veneered edge- and end-glued lumber]**.
 - b. Raised-Panel Construction: **[Clear softwood lumber; edge glued for width][Raised-Panel Construction: Shaped, medium-density fiberboard]**.
 - c. Flat-Panel Construction: **[Veneered, wood-based panel product][Medium-density fiberboard]**.
 11. Stile and Rail Widths: **[As indicated.][Manufacturer's standard, but not less than the following:]**
 - a. Stiles, Top and Intermediate Rails: **[4-1/2 inches (114 mm)]<Insert dimension>**.
 - b. Bottom Rails: **[9 inches (229 mm)]<Insert dimension>**.
 12. Raised-Panel Thickness: **[As indicated][1-3/4 inches (44 mm)][1-3/8 inches (35 mm)][Manufacturer's standard, but not less than 1-1/8 inches (29 mm)][Manufacturer's standard, but not less than 3/4 inch (19 mm)]**.
 13. Flat-Panel Thickness: **[As indicated][1/2 inch (13 mm)][3/8 inch (10 mm)][1/4 inch (6.4 mm)]**.
 14. Molding Profile (Sticking): **[Bead and cove][Ogee][Ovalo][Recessed bevel][Recessed square][Manufacturer's standard][As selected by Architect from manufacturer's full range]**.

15. Glass: Uncoated, clear, **[fully tempered float glass, 5.0 mm thick][laminated glass made from two lites of 3.0-mm-thick annealed glass]<Insert requirements>**, complying with Section 088000 "Glazing."
16. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S. 6A and grade specified.

2.6 INTERIOR FIRE-RATED STILE AND RAIL WOOD DOORS

- A. 20-Minute, Interior Fire-Rated Stile and Rail Wood Doors: Fire-rated (20-minute rating) doors complying with **[AWI, AWMAC, and WI's Architectural Woodwork Standards][WDMA I.S. 6A]** and with other requirements specified.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ETO Doors Corp.]**
 - b. **[Karona by JELD-WEN]**
 - c. **[VT Industries, Inc.]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ETO Doors Corp.]**
 - b. **[Karona by JELD-WEN]**
 - c. **[VT Industries, Inc.]**
 - d. **<Insert manufacturer's name>**
 3. Performance Grade: ANSI/WDMA I.S. 1A **[Extra Heavy Duty][Heavy Duty][Standard Duty][as indicated on Drawings]**.
 4. ANSI/WDMA I.S. 1A Quality Grade: Custom.
 5. Architectural Woodwork Standards Quality Grade: Custom.
 6. Panel Designs: Indicated on Drawings. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
 7. Finish: **[Transparent][Opaque]**.
 8. Wood Species and Cut for Transparent Finish: **[Idaho white, lodgepole, ponderosa, or sugar pine, plain sawed/sliced][Douglas fir or western hemlock, quarter sawed/sliced (vertical grain)][Red oak, quarter sawed/sliced stiles and rails, plain sawed/sliced panels][Species indicated on Drawings, plain sawed/sliced]<Insert species and cut>**.
 9. Door Construction for Transparent Finish: **1-3/4-inch- (44-mm-) thick stiles and rails and veneered [flat panels not less than 5/8 inch (16 mm) thick][raised panels not less than 1-1/8 inches (29 mm) thick]**.
 - a. Stile and Rail Construction: Veneered, structural composite lumber **[or veneered, edge-and end-glued clear lumber]**. Select veneers for similarity of grain and color, and arrange for optimum match between adjacent pieces. **[Use veneers not less than 1/16 inch (1.6 mm) thick.]**
 - b. Raised-Panel Construction: Veneered, shaped, wood-based panel product with veneer conforming to raised-panel shape.
 - c. Flat-Panel Construction: Veneered, wood-based panel product.

- d. Edge Construction for Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 - e. Edge Construction for Fire-Rated Pairs of Doors:
 - 1) Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - 2) Provide formed-steel edges and astragals with intumescent seals.
 - a) Finish steel edges and astragals with baked enamel[**same color as doors**].
 - b) Finish steel edges and astragals to match door hardware (locksets or exit devices).
10. Door Construction for Opaque Finish: **1-3/4-inch- (44-mm-)** thick stiles and rails and veneered **[flat panels not less than 5/8 inch (16 mm) thick][raised panels not less than 1-1/8 inches (29 mm) thick]**.
- a. Stile and Rail Construction: Veneered, structural composite lumber[**or veneered edge- and end-glued lumber**].
 - b. Raised-Panel Construction: Shaped medium-density fiberboard (MDF.)
 - c. Flat-Panel Construction: **[Veneered, wood-based panel product][Medium-density fiberboard (MDF)]**.
 - d. Edge Construction for Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 - e. Edge Construction for Fire-Rated Pairs of Doors:
 - 1) Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - 2) Provide formed-steel edges and astragals with intumescent seals.
 - a) Finish steel edges and astragals with baked enamel[**same color as doors**].
 - b) Finish steel edges and astragals to match door hardware (locksets or exit devices).
11. Stile and Rail Widths: **[As indicated on Drawings.][Manufacturer's standard, but not less than the following:]**
- a. Stiles, Top and Intermediate Rails: **[4-1/2 inches (114 mm)]<Insert dimension>**.
 - b. Bottom Rails: **[9 inches (229 mm)]<Insert dimension>**.
12. Molding Profile (Sticking): **[Bead and cove][Ogee][Ovalo][Recessed bevel][Recessed square][Manufacturer's standard][As selected by Architect from manufacturer's full range]**.
13. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S. 6A and grade specified.
- B. 45-Minute, Interior Fire-Rated Stile and Rail Wood Doors: Fire-rated (45-minute rating) doors complying with AWI, AWMAC, and WI's Architectural Woodwork Standards and with other requirements specified.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Karona by JELD-WEN]**

- b. **[VT Industries, Inc.]**
 - c. **<Insert manufacturer's name>**
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Karona by JELD-WEN]**
 - b. **[VT Industries, Inc.]**
 - c. **<Insert manufacturer's name>**
- 3. Performance Grade: ANSI/WDMA I.S. 1A **[Extra Heavy Duty][Heavy Duty][Standard Duty][as indicated on Drawings]**.
- 4. ANSI/WDMA I.S. 1A Quality Grade: Custom.
- 5. Architectural Woodwork Standards Quality Grade: Custom.
- 6. Panel Designs: Indicate on Drawings. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- 7. Finish: **[Transparent][Opaque]**.
- 8. Wood Species and Cut for Transparent Finish: **[Idaho white, lodgepole, ponderosa, or sugar pine, plain sawed/sliced][Douglas fir or western hemlock, quarter sawed/sliced (vertical grain)][Red oak, quarter sawed/sliced stiles and rails, plain sawed/sliced panels][Species indicated on Drawings, plain sawed/sliced]<Insert species and cut>**.
- 9. Interior Fire-Rated Door Construction: **1-3/4-inch- (44-mm-)** thick, edged and veneered mineral-core stiles and rails and **1-1/8-inch- (29-mm-)** thick, veneered mineral-core raised panels.
- 10. Edge Construction for Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 - a. At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - 1) Screw-Holding Capability: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
- 11. Edge Construction for Fire-Rated Pairs of Doors:
 - a. Fire-Retardant Stiles: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - 1) At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - a) Screw-Holding Capability: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf (1780 N)]** in accordance with WDMA T.M. 10.
 - b. Steel Edges and Astragals: Provide formed-steel edges and astragals with intumescent seals.
 - 1) At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - a) Screw-Holding Capability: **[550 lbf (2440 N)][475 lbf (2110 N)][400 lbf**

(1780 N)) in accordance with WDMA T.M. 10.

- 2) Finish steel edges and astragals with baked enamel[**same color as doors**].
 - 3) Finish steel edges and astragals to match door hardware (locksets or exit devices).
12. Stile and Rail Widths: **[As indicated.][Manufacturer's standard, but not less than the following:]**
- a. Stiles, Top and Intermediate Rails: **[4-1/2 inches (114 mm)]<Insert dimension>**.
 - b. Bottom Rails: **[9 inches (229 mm)]<Insert dimension>**.
13. Molding Profile (Sticking): **[Bead and cove][Ogee][Ovalo][Recessed bevel][Recessed square][Manufacturer's standard][As selected by Architect from manufacturer's full range]**.

2.7 FIRE-RATED WOOD DOOR FRAMES

A. Interior Frames:

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **<Insert manufacturer's name>**
3. Architectural Woodwork Standards Quality Grade: **[Premium][Custom]**.
4. WDMA I.S. 6A Quality Grade: **[Premium][Custom]**.
5. Wood Species and Cut: Match species and cut indicated for wood doors unless otherwise indicated.
6. Species: **[Anigre][Select white ash][Figured select white ash][Select white birch][Select red birch][Cherry][Select red gum][Figured select red gum][Select white maple][Red oak][White oak][Persimmon][Sapele][Sycamore][Walnut]<Insert species>**.
7. Cut: **[Plain sliced/plain sawn][Quarter cut/quarter sawn][Rift cut/rift sawn]**.
8. Wood Moisture Content: **[5 to 10][8 to 13][4 to 9]** percent.
9. Profile: **[T-stop][Flat][Single rabbet][Double rabbet][As indicated on Drawings]**.
10. Construction: Solid lumber, fire-retardant particleboard, or fire-retardant medium density fiberboard (MDF) with veneered exposed surfaces and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated on Drawings.

2.8 STILE AND RAIL WOOD DOOR FABRICATION

- ### A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels unless otherwise indicated:
1. Clearances:

- a. Provide **[1/8 inch (3 mm)]<Insert dimension>** at heads, jambs, and between pairs of doors.
 - b. Provide **[1/2 inch (13 mm)]<Insert dimension>** from bottom of door to top of decorative floor finish or covering.
 - c. Where threshold is shown on Drawings or scheduled, provide not more than **[3/8 inch (10 mm)]<Insert dimension>** from bottom of door to top of threshold.
 - d. Comply with NFPA 80 requirements for fire-rated doors.
2. Bevel non-fire-rated doors **1/8 inch in 2 inches (3-1/2 degrees)** at lock and hinge edges.
 3. Bevel fire-rated doors **1/8 inch in 2 inches (3-1/2 degrees)** on lock edge; trim stiles and rails only to extent permitted by labeling agency.

B. Fabricate stile and rail wood doors in sizes indicated for field fitting.

C. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
3. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
4. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

D. Glazed Openings:

1. Trim openings indicated for glazing with solid-wood moldings, with one side removable. Miter wood moldings at corner joints.
2. Factory install glazing in doors, complying with Section 088000 "Glazing." Install glass using manufacturer's standard elastomeric glazing sealant complying with ASTM C920. Secure glass in place with removable wood moldings. Miter wood moldings at corner joints.

E. Transom and Side Panels:

1. Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors.
2. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
3. Fabricate door and transom panels with full-width, solid-lumber[, **rabbeted,**] meeting rails.
4. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

F. Exterior Doors: Factory treat exterior doors with water-repellent preservative after fabrication has been completed but before **[shop priming][factory finishing]**.

1. Comply with WDMA I.S. 4.
2. Flash top of outswinging doors with manufacturer's standard metal flashing.

2.9 FACTORY PRIMING

A. Doors for Opaque Finish: Shop prime faces, all four edges, edges of cutouts, and mortises with one coat of wood primer specified in **[Section 099113 "Exterior Painting."]****[Section 099123 "Interior Painting."]**

2.10 FACTORY FINISHING

- A. Comply with referenced quality standard for factory finishing.
 - 1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 2. Finish faces, all four edges, edges of cutouts, and mortises.
 - 3. Stains and fillers may be omitted on **[top and]** bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Factory finish doors that are indicated to receive transparent finish.
- D. Factory finish doors where indicated in schedules or on Drawings.
- E. Transparent Finish:
 - 1. Architectural Woodwork Standards Grade: **[Premium][Custom]**.
 - a. System 5, varnish, conversion.
 - b. System 9, UV Curable, Acrylated Epoxy, Polyester, or Urethane.
 - c. System 10, UV Curable, Water Based.
 - d. System 11, Polyurethane, Catalyzed.
 - 2. WDMA I.S. 6A Grade: **[Premium][Custom]**.
 - a. TR-4 Conversion Varnish.
 - b. TR-6 Catalyzed Polyurethane.
 - c. TR-8 UV Cured Acrylated Polyester/Urethane.
 - 3. Staining: **[Match Architect's sample][As selected by Architect from manufacturer's full range][None required]**.
 - 4. Effect: **[Open-grain finish][Filled finish][Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores]**.
 - 5. Sheen: **[Satin][Semigloss]**.
- F. Opaque Finish:
 - 1. Architectural Woodwork Standards Grade: **[Premium][Custom]**.
 - a. System 5, Varnish, Conversion.
 - b. System 9, UV Curable, Acrylated Epoxy, Polyester, or Urethane.
 - c. System 10, UV Curable, Water Based.
 - d. System 11, Polyurethane, Catalyzed.
 - 2. WDMA I.S. 6A Grade: **[Premium][Custom]**.
 - a. OP-4 Conversion Varnish.
 - b. OP-6 Catalyzed Polyurethane.
 - 3. Color: **[Match Architect's sample][As selected by Architect from manufacturer's full range]**.
 - 4. Sheen: **[Satin][Semigloss][Gloss]**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see [Section 087100 "Door Hardware."][Section 087111 "Door Hardware (Descriptive Specification)."]
- B. Install doors[**and frames**] to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 - 1. Install fire-rated door frames in accordance with NFPA 80.
 - a. Install frames level, plumb, true, and straight.
 - 1) Shim as required with concealed shims. Install level and plumb to a tolerance of **1/8 inch in 96 inches (3.2 mm in 2400 mm)**.
 - b. Anchor frames to anchors or blocking built in or directly attached to substrates.
 - 1) Secure with countersunk, concealed fasteners and blind nailing.
 - 2) Use fine finishing nails[**or finishing screws**] for exposed fastening, countersunk and filled flush with woodwork.
 - c. For shop-finished items, use filler matching finish of items being installed.
 - 2. Install fire-rated doors in accordance with NFPA 80.
 - 3. Install smoke- and draft-control doors in accordance with NFPA 105.
- C. Job-Fitted Doors:
 - 1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
 - a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
 - 2. Machine doors for hardware.
 - 3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 - 4. Clearances:
 - a. Provide **1/8 inch (3.2 mm)** at heads, jambs, and between pairs of doors.
 - b. Provide [**1/8 inch (3.2 mm)**][**1/4 inch (6.4 mm)**][**3/8 inch (10 mm)**][**1/2 inch (13 mm)**] from bottom of door to top of decorative floor finish or covering unless otherwise indicated on

- Drawings.
- c. Where threshold is shown on Drawings or scheduled, provide **[1/4 inch (6.4 mm)][3/8 inch (10 mm)]** from bottom of door to top of threshold unless otherwise indicated.
- d. Comply with NFPA 80 for fire-rated doors.
- 5. Bevel non-fire-rated doors **1/8 inch in 2 inches (3-1/2 degrees)** at lock and hinge edges.
- 6. Bevel fire-rated doors **1/8 inch in 2 inches (3-1/2 degrees)** on lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory- Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: **[Owner will engage][Engage]** a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 - 1. Provide inspection of installed Work through **[AWI's Quality Certification Program][WI's Certified Compliance Program]**, certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
 - 2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
 - 3. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in **[NFPA 80][and][NFPA 101]**.

3.4 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16 00A



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Task	Specification	Specification Description
08 14 23 13	01 11 19 00	No Specification Required
08 14 23 16	08 14 16 00	Flush Wood Doors
08 14 23 16	08 14 16 00a	Stile And Rail Wood Doors
08 14 23 19	08 14 16 00	Flush Wood Doors
08 14 23 19	08 14 16 00a	Stile And Rail Wood Doors
08 14 66 00	01 11 19 00	No Specification Required
08 14 73 00	08 14 16 00	Flush Wood Doors
08 16 13 00	08 05 13 00	Stainless-Steel Doors and Frames
08 17 23 00	08 14 16 00	Flush Wood Doors



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SECTION 08 18 16 00 - SLIDING ALUMINUM-FRAMED GLASS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior sliding aluminum-framed glass doors.

B. Related Requirements:

1. Section 084113 "Aluminum-Framed Entrances and Storefronts" for coordinating finish among aluminum fenestration units.
2. Section 085113 "Aluminum Windows" for **[transom and sidelite windows, mullions, and]**coordinating finishes among aluminum fenestration units.
3. **[Section 087100 "Door Hardware"]****[Section 087111 "Door Hardware (Descriptive Specification)"]** for hardware not specified in this Section.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **[Project site]**<Insert location>.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review, discuss, and coordinate the interrelationship of sliding aluminum-framed glass doors with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.
 - a. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, and finishes.

B. Shop Drawings:

1. Include plans, elevations, sections, hardware, accessories, insect screens, and details of installation, including anchor, flashing, and sealant installation.
2. **<Insert requirements>**.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

- D. Samples for Verification: Actual sample of finished products for each type of exposed finish.
 - 1. Main Framing Member: **12-inch-long (300-mm-long)** section with weather stripping, glazing bead, and factory-applied color finish.
 - 2. Hardware: Full-size units with factory-applied finish.
 - 3. **<Insert requirements>**.
- E. Product Schedule: For sliding aluminum-framed glass doors. Use same designations indicated on Drawings.
- F. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Environmental Product Declaration: For each product.
 - 3. Health Product Declaration: For each product.
 - 4. Environmental Product Declaration: For each product.
 - 5. Environmental Product Declaration: For each product.
 - 6. Environmental Product Declaration: For each product.
 - 7. Third-Party Certifications: For each product.
 - 8. Third-Party Certified Life Cycle Assessment: For each product.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each configuration of sliding aluminum-framed glass door, for tests performed by **[a qualified testing agency][manufacturer and witnessed by a qualified testing agency]**.
- B. Field Quality-Control Reports. For sliding aluminum-framed glass doors,
- C. Qualification Statements: For **[manufacturer][Installer][and][testing agency]<Insert entity or specialist>**.
- D. Sample Warranties: For sliding aluminum-framed glass doors.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes, weather stripping, operable panels, and operating hardware to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating sliding aluminum-framed glass doors that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.
- B. Installer Qualifications: Entity acceptable to sliding aluminum-framed glass door manufacturer for installation of units required for this Project.

1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, demonstrate aesthetic effects, and set quality standards for materials and execution.
1. Build mockups **[as indicated on Drawings]<Insert mockup requirements>**.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of sliding aluminum-framed glass doors that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures, including excessive deflection, water penetration, and air leakage.
 - b. Faulty operation of operable panels and hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Failure of insulating glass **[and laminated glass]**.
 - e. **<Insert requirements>**.
 2. Warranty Period:
 - a. Sliding Aluminum-Framed Glass Doors: **[Two][Three][Five][10]<Insert number>** years from date of Substantial Completion.
 - b. Insulating-Glass Units: **[Five][10][20]<Insert number>** years from date of Substantial Completion.
 - c. Laminated Glass: **[Five][10]<Insert number>** years from date of Substantial Completion.
 - d. Aluminum Finish: **[Five][10][20]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
1. Product Certification: AAMA certified with label attached to each door.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
1. Minimum Performance Class: **[Class R][Class LC][Class CW][Class AW][As indicated on Drawings]<Insert requirements>**.
 2. Minimum Performance Grade: **[Grade 15][Grade 25][Grade 30][Grade 35][Grade 40][Grade 50][Grade 60][Grade 80][As indicated on Drawings]<Insert requirements>**.
- C. Thermal Transmittance: NFRC 100 maximum whole-unit U-factor of **[0.33 Btu/sq. ft. x h x deg F]**

(1.87 W/sq. m x K)][0.50 Btu/sq. ft. x h x deg F (2.84 W/sq. m x K)]<Insert value>.

- D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 whole-unit maximum SHGC of [0.41][0.27]<Insert value>.
- E. Condensation-Resistance Factor (CRF): AAMA 1503, minimum [39][46]<Insert value> CRF.
- F. Thermal Movements: Provide sliding aluminum-framed glass doors, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): [120 deg F (67 deg C), ambient; 180 deg F (100 deg C)]<Insert temperature range>, material surfaces.
- G. Sound Transmission Class (STC): Rated for not less than [30][39]<Insert rating> STC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E413.
- H. Outside-Inside Transmission Class (OITC): Rated for not less than [25][30]<Insert rating> OITC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E1332.
- I. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone [1][2][3][4] for [basic][enhanced] protection.
 - 1. Large-Missile Test: For glazing [located within 30 ft. (9.1 m) of grade]<Insert requirements>.
 - 2. Small-Missile Test: For glazing located [between 30 ft. (9.1 m) and 60 ft. (18.3 m)][greater than 30 ft. (9.1 m)]<Insert requirements> above grade.

2.2 EXTERIOR SLIDING ALUMINUM-FRAMED GLASS DOORS

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - 1. [Arcadia Inc.]
 - 2. [Boyd Aluminum Mfg. Co.]
 - 3. [EFCO Corporation]
 - 4. [Fleetwood Windows & Doors]
 - 5. [Graham Architectural Products Corporation]
 - 6. [Kawneer Company, Inc.; Arconic Corporation]
 - 7. [Milgard Manufacturing, LLC]
 - 8. [Northern Architectural Systems]
 - 9. [PGT Custom Windows + Doors; PGT Innovations (PGTI)]
 - 10. [PRL Glass Systems Inc.]
 - 11. [Solar Innovations, Inc.]
 - 12. [Thermal Windows, Inc.]
 - 13. [Wausau Window and Wall Systems; Apogee Wausau Group, Inc.]
 - 14. [WinDoor; a PGTI brand]
 - 15. [Wojan Window & Door Corporation]
 - 16. [YKK AP America Inc.]
 - 17. <Insert manufacturer's name>

- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. [Arcadia Inc.]
 2. [Boyd Aluminum Mfg. Co.]
 3. [EFCO Corporation]
 4. [Fleetwood Windows & Doors]
 5. [Graham Architectural Products Corporation]
 6. [Kawneer Company, Inc.; Arconic Corporation]
 7. [Milgard Manufacturing, LLC]
 8. [Northern Architectural Systems]
 9. [PGT Custom Windows + Doors; PGT Innovations (PGTI)]
 10. [PRL Glass Systems Inc.]
 11. [Solar Innovations, Inc.]
 12. [Thermal Windows, Inc.]
 13. [Wausau Window and Wall Systems; Apogee Wausau Group, Inc.]
 14. [WinDoor; a PGTI brand]
 15. [Wojan Window & Door Corporation]
 16. [YKK AP America Inc.]
 17. **<Insert manufacturer's name>**
- C. Source Limitations: Obtain sliding aluminum-framed glass doors from single source from single manufacturer.
- D. Door Assemblies: Fabricate frames and glazed panels from aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.
1. Thermally Broken Construction: Fabricate frames and glazed panels with an integral, concealed, low-conductance thermal barrier (break) located between separate exterior and interior aluminum profiles in a manner that eliminates direct metal-to-metal contact.
 2. Door Panels: Provide stationary panels and sliding panels **[in configurations indicated on Drawings]<Insert requirements>**.
 3. Transoms: Provide manufacturer's standard fixed transoms held within the same frame as door panels in configuration **[indicated on Drawings]<Insert requirements>**.
 4. Sidelites: Provide manufacturer's standard fixed sidelites held within the same frame as door panels in configuration **[indicated on Drawings]<Insert requirements>**.
 5. Mullions: Provide mullions and mullion casing and cover plates as indicated on Drawings, matching door units, complete with anchors for support to structure and installation of sliding aluminum-framed glass door units. Allow for erection tolerances and provide for movement of door units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design loads of door units.
 6. True Divided Lites: Fabricate glazed panels with true muntins resulting in individually glazed lites; provide muntin configuration and profile indicated on Drawings.
- E. Threshold and Sill Cap/Track: Provide extruded-aluminum threshold and track of dimensions and profile indicated on Drawings; designed to comply with performance requirements indicated and to drain to the exterior; with manufacturer's standard finish.
1. Low-Profile Threshold and Sill Cap/Track: Provide ADA-ABA compliant thresholds and tracks **[where indicated on Drawings][where indicated in schedules]<Insert requirements>**.

2.3 GLAZING

- A. Glass and Glazing: Manufacturer's standard glazing system that produces weathertight seal. **[Comply with requirements for windborne-debris impact resistance.][Comply with requirements indicated**

in Section 088000 "Glazing."

1. Glass: ASTM C1036, Type 1, q3, Category II safety glass complying with testing requirements in 16 CFR 1201.
 2. Safety Glazing Labeling: Permanently mark safety glazing with **[manufacturer's][or][SGCC]** certification label indicating manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
 3. Tint: **[Clear][Gray][Bronze][Green]<Insert tint>**.
 4. Insulating-Glass Units: ASTM E2190[, **certified through IGCC as complying with requirements of IGCC**].
 - a. Filling: Fill space between glass lites with **[air][argon]**.
 - b. Lites: **[Two][Three]<Insert requirements>**.
 - c. Low-E Coating: **[Manufacturer's standard][Pyrolytic on second surface][Sputtered on second surface][Sputtered on third surface][Sputtered on second or third surface]<Insert requirements>**.
 - d. Spacer Color: **[Manufacturer's standard]<Inset color>**.
- B. Simulated Divided Lites: Provide grilles in configuration indicated on Drawings; finished to match panels.
1. Location: **[Between lites of insulating-glass units][Permanently applied to outside face of glazing units][Permanently applied to outside and inside faces of glazing units]<Insert requirements>**.
 2. Profile: **[Flat][Manufacturer's standard contoured profile][As indicated on Drawings]<Insert requirements>**.
 3. Width: **[5/8-inch (16-mm)][3/4-inch (19-mm)][1-inch (25-mm)][1-1/16-inch (27-mm)][As indicated on Drawings]<Insert requirements>**.

2.4 HARDWARE

- A. General: Manufacturer's **[standard]<Insert requirements>** hardware complying with requirements in AAMA 907; fabricated from a corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock sliding aluminum-framed glass doors; and sized to accommodate panel weight and dimensions.
- B. Door Pulls: **[Provide manufacturer's standard pull]<Insert requirements>**.
1. Color and Finish: **[As indicated by manufacturer's designations][Match door frame][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and finish>**.
- C. Lock: Manufacturer's keyed cylinder lock and **[multipoint]** locking device to secure each operable panel, lockable from the inside **[only][and outside]**. Adjust locking device to allow unobstructed movement of the panel across adjacent panel in the direction indicated.
1. Keying System: **[All cylinders keyed alike][Keyed to match other building entrances]<Insert requirements>**.
- D. Rollers: On each operable panel, dual **[corrosion-resistant][stainless steel]** ball-bearing rollers.

2.5 INSECT SCREENS

- A. General: Design sliding aluminum-framed glass doors to accommodate screens in a tight-fitting, removable arrangement, fully integrated with door frame. Provide screen for each operable door panel.
- B. Aluminum Frames: Manufacturer's standard extruded-aluminum profile finished to match door frame; fabricated from aluminum alloy complying with requirements in SMA 1201; with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC or PE spline/anchor concealing edge of frame.
 - 1. Fiberglass Mesh Fabric: ASTM D3656/D3656M, **[manufacturer's standard]<Insert requirements>** mesh of PVC-coated fiberglass.
 - a. Mesh Color: **[Manufacturer's standard][Charcoal gray][Silver gray]<Insert color>**.
 - 2. Aluminum Wire Fabric: **[Manufacturer's standard]<Insert requirements>** mesh of coated aluminum wire.
 - a. Wire-Fabric Finish: **[Manufacturer's standard][Silver][Charcoal gray]<Insert color>**.
- C. Hardware: **[Manufacturer's standard noncorrosive pull and keyless locking device; lockable from inside only; designed to allow unobstructed movement of panels and screen]<Insert requirements>**.

2.6 ACCESSORIES

- A. Fasteners: Noncorrosive and compatible with door members, trim, hardware, anchors, and other components.
 - 1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.
- B. Anchors, Clips, and Accessories: Provide anchors, clips, and accessories of aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron for sliding aluminum-framed glass doors, complying with ASTM B456 or ASTM B633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
 - 1. Windborne-Debris Impact Resistance: Provide anchors of same design used in windborne-debris impact-resistance testing.
- C. Nail Fins: Manufacturer's standard.

2.7 FABRICATION

- A. Fabricate sliding aluminum-framed glass doors in sizes and with stile and rail dimension indicated on Drawings. Include a complete system for assembling components and anchoring doors.
- B. Fabricate sliding aluminum-framed glass doors that are reglazable without dismantling panel framing.
- C. Weather Stripping: Provide full-perimeter weather stripping for each door panel.
- D. Weep Holes: Provide weep holes and internal drainage passages to conduct infiltrating water to exterior.

- E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.
- F. Factory-Glazed Fabrication: Glaze sliding aluminum-framed glass doors in the factory. Comply with requirements in **[Section 088000 "Glazing" and] AAMA/WDMA/CSA 101/I.S.2/A440**.

2.8 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, **[AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm]** or thicker.
- B. Color Anodic Finish: AAMA 611, **[AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A34, Class II, 0.010 mm]** or thicker.
 - 1. Color: **[Light bronze][Medium bronze][Dark bronze][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry-film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and curing finish.
 - 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- D. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with **[AAMA 2604][AAMA 2605]** and containing not less than **[50][70]** percent PVDF resin by weight in color coat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- E. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.

- F. Superior-Performance Organic Finish, Four-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations]****[Match Architect's sample]****[As selected by Architect from manufacturer's full range]**<Insert color and gloss>.
- G. Superior-Performance Organic Finish, Single-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations]****[Match Architect's sample]****[As selected by Architect from manufacturer's full range]**<Insert color and gloss>.
- H. Superior-Performance Organic Finish, Two-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations]****[Match Architect's sample]****[As selected by Architect from manufacturer's full range]**<Insert color and gloss>.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of threshold/track substrate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight sliding aluminum-framed glass door installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF SLIDING ALUMINUM-FRAMED GLASS DOORS

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing doors, hardware, accessories, and other components.
- B. Windborne-Debris Impact Resistance: Anchor sliding aluminum-framed glass doors that have been tested for windborne-debris impact resistance to structure using anchoring method, fastener type, and fastening frequency identical to that used in windborne-debris impact-resistance testing.
- C. Install sliding aluminum-framed glass doors level, plumb, square, true in line, without distortion, without warp or rack of frames and panels, and without impeding thermal movement; anchored securely in place to structural support; and in proper relation to wall flashing, vapor retarders, air barriers, water/weather barriers, and other adjacent construction.

- D. Set sill members in bed of sealant, as indicated on Drawings, to provide weathertight construction.
- E. Install sliding aluminum-framed glass doors and components to drain condensation, water penetrating joints, and moisture migrating within doors to the exterior.
- F. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
- B. Testing Services: Test and inspect installed sliding aluminum-framed glass doors as follows:
 - 1. Testing Methodology: Test sliding aluminum-framed glass doors for air-leakage and water-penetration resistance in accordance with AAMA 502.
 - 2. Air-Leakage Resistance Testing:
 - a. Test Pressure: Pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
 - b. Allowable Air-Leakage Rate: **[1.5]<Insert number>** times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
 - 3. Water-Penetration Resistance Testing:
 - a. Test Pressure: **[Two-thirds]<Insert number>** times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
 - b. Allowable Water Infiltration: No water penetration.
 - 4. Testing Extent: **[Three][Three mockup]<Insert number or description>** sliding aluminum-framed glass doors of each type as selected by Architect and a qualified independent testing and inspecting agency. Conduct tests after perimeter sealants have cured.
 - 5. Test Reports: Prepared in accordance with AAMA 502.
- C. Sliding aluminum-framed glass door will be considered defective if it does not pass tests and inspections.

3.4 ADJUSTING, CLEANING, AND PROTECTION

- A. Lubricate hardware and moving parts in accordance with manufacturer's written instructions.
- B. Adjust operating panels and screens to provide a tight fit at contact points and weather stripping for smooth operation, without binding, and a weathertight closure.
- C. Adjust hardware for proper alignment, smooth operation, and proper latching without requiring unnecessary force or having excessive clearance.
- D. Clean exposed surfaces immediately after installing sliding aluminum-framed glass doors. Avoid damaging protective coatings and finishes. Remove nonpermanent labels, excess sealants, glazing materials, dirt, and other substances.

- E. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- F. Protect sliding aluminum-framed glass door surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances contact sliding aluminum-framed glass door surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.
- G. Refinish or replace sliding aluminum-framed glass doors with damaged finishes.
- H. Replace damaged components.

END OF SECTION 08 18 16 00

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SECTION 08 18 16 00A - MULTIPANEL SLIDING ALUMINUM-FRAMED GLASS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Multipanel sliding aluminum-framed glass doors.

B. Related Requirements:

1. Section 083513.13 "Multipanel Folding Aluminum-Framed Glass Doors" for multipanel aluminum-framed glass doors that operate by folding.
2. Section 084113 "Aluminum-Framed Entrances and Storefronts" for coordinating finish among aluminum fenestration units on the building exterior.
3. Section 085113 "Aluminum Windows" for coordinating finishes among aluminum fenestration units on the building exterior.
4. **[Section 087100 "Door Hardware"]****[Section 087111 "Door Hardware (Descriptive Specification)"]** for hardware not specified in this Section.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Multipanel sliding aluminum-framed glass doors.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for multipanel sliding aluminum-framed glass doors.

C. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Environmental Product Declaration: For each product.
3. Health Product Declaration: For each product.
4. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
5. Environmental Product Declaration: For each product.
6. Environmental Product Declaration: For each product.
7. Environmental Product Declaration: For each product.
8. Third-Party Certifications: For each product.
9. Third-Party Certified Life Cycle Assessment: For each product.

D. Shop Drawings:

1. Include plans, elevations, sections, and installation details.
2. Indicate dimensions, configuration of panels, and stacking layout.

E. Samples: For each multipanel sliding aluminum-framed glass door and for each color specified, 12-

inch-long (300-mm-long) section with factory-applied color finish.

- F. Samples for Initial Selection: For doors and hardware with factory-applied color finish.
- G. Samples for Verification: For multipanel sliding aluminum-framed glass doors and components required, prepared on Samples of size indicated below:
 - 1. Main Framing Member: **12-inch-long (300-mm-long)** section with weather stripping, glazing bead, and factory-applied color finish.
 - 2. Hardware: Full-size units with factory-applied finish.
 - 3. **<Insert component>: <Insert description>.**
- H. Product Schedule: For multipanel sliding aluminum-framed glass doors. [**Use same designations indicated on Drawings.**]

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For [Installer][manufacturer][and][testing agency].
- B. Product Test Reports: For each multipanel sliding aluminum-framed glass door, for tests performed by [manufacturer and witnessed by a qualified testing agency][a qualified testing agency]; and for each class and performance grade indicated, tested at AAMA gateway size.
- C. Field quality-control reports.
- D. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For multipanel sliding aluminum-framed glass doors to include in maintenance manuals. Include finishes, weather stripping, operable panels, and operating hardware.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating multipanel sliding aluminum-framed glass doors that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.
- B. Installer Qualifications: An installer acceptable to multipanel sliding aluminum-framed glass door manufacturer for installation of units required for this Project.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup for multipanel sliding aluminum-framed glass doors, as shown on Drawings.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace multipanel sliding aluminum-framed glass doors that fail(s) in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures, including excess deflection.
 - c. Excessive water leakage or air infiltration.
 - d. Faulty operation of movable panels and hardware.
 - e. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - f. Failure of insulating glass[**and laminated glass**].
 - g. **<Insert failure modes>**.
 2. Warranty Period:
 - a. Multipanel Sliding Aluminum-Framed Glass Doors: **[Five][Ten][20]<Insert number>** year(s) from date of Substantial Completion.
 - b. Insulating-Glass Units: **[10][20]<Insert number>** years from date of Substantial Completion.
 - c. Laminated Glass: **[Five]<Insert number>** years from date of Substantial Completion.
 - d. Aluminum Finish: **[Five][10][20]<Insert number>** years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: **[Five][10][20]<Insert number>** years from date of Substantial Completion.
- C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, peeling, or chipping.
 2. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Product Certification: AAMA certified with label attached to each door.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
 - 1. Minimum Performance Class: **[Class R][Class LC][Class CW][Class AW][As indicated on Drawings]<Insert class>**.
 - 2. Minimum Performance Grade: **[Grade 15][Grade 20][Grade 25][Grade 30][Grade 35][Grade 40][Grade 45][Grade 50][As indicated on Drawings]<Insert grade>**.
- C. Thermal Transmittance: NFRC 100 maximum total fenestration product U-factor of **[0.30 Btu/sq. ft. x h x deg F (1.71 W/sq. m x K)][0.32 Btu/sq. ft. x h x deg F (1.83 W/sq. m x K)][0.35 Btu/sq. ft. x h x deg F (2.0 W/sq. m x K)][0.60 Btu/sq. ft. x h x deg F (3.43 W/sq. m x K)]<Insert value>**.
- D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum total fenestration product SHGC of **[0.40][0.30][0.27]<Insert value>**.
- E. Condensation-Resistance Factor (CRF): Provide multipanel sliding aluminum-framed glass doors tested for thermal performance in accordance with AAMA 1503, showing a CRF of **[45][52]<Insert value>**.
- F. Thermal Movements: Provide multipanel sliding aluminum-framed glass doors, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C)]<Insert temperature range>**, material surfaces.
- G. Sound Transmission Class (STC): Rated for not less than **[28][32]<Insert rating>** STC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E413.
- H. Outside-Inside Transmission Class (OITC): Rated for not less than **[23][27][29]<Insert rating>** OITC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E1332.
- I. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone **[1][2][3][4]** for **[basic][enhanced]** protection.
 - 1. Large-Missile Test: For glazing located within **30 feet (9.1 m) <Insert height>** of grade.
 - 2. Small-Missile Test: For glazing located between **30 feet (9.1 m) and [60 feet (18.3 m)]<Insert height>** above grade.
- J. **<Insert requirements>**.

2.2 MULTIPANEL SLIDING ALUMINUM-FRAMED GLASS DOORS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[Andersen Windows, Inc.; Andersen Corporation]**
 2. **[Arcadia Inc.]**
 3. **[Euro-Wall Systems, LLC]**
 4. **[LaCantina Doors; a division of JELD-WEN]**
 5. **[Milgard Manufacturing, LLC]**
 6. **[Nana Wall Systems, Inc.]**
 7. **[Panda Windows & Doors]**
 8. **[Ply-Gem]**
 9. **[Solar Innovations, Inc.]**
 10. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Andersen Windows, Inc.; Andersen Corporation]**
 2. **[Arcadia Inc.]**
 3. **[Euro-Wall Systems, LLC]**
 4. **[LaCantina Doors; a division of JELD-WEN]**
 5. **[Milgard Manufacturing, LLC]**
 6. **[Nana Wall Systems, Inc.]**
 7. **[Panda Windows & Doors]**
 8. **[Ply-Gem]**
 9. **[Solar Innovations, Inc.]**
 10. **<Insert manufacturer's name>**
- C. Multipanel Sliding Aluminum-Framed Glass Doors: Provide extruded-aluminum-framed, multipanel sliding glass doors, designed for exterior use, complete with glazing, threshold, flashings, support, and anchorage devices.
1. Stack Storage Configuration: **[Panels open from center to both sides and are stored within opening][Panels open from one side stack into storage area outside of opening][As shown on Drawings]<Insert configuration>**.
- D. Frames and Door Panels: Fabricate from aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440 and indicated requirements. Provide factory-assembled door panels that are reglazable without dismantling panel framing and **[factory-assembled][or][field-assembled]** frames.
1. Thermally Improved Construction: Fabricate frames and door panels with an integral, concealed, low-conductance thermal barrier located between exterior and interior surfaces in a manner that eliminates direct metal-to-metal contact.
 2. Door Panel Design: **[As indicated][Narrow stile][Medium stile][Wide stile]<Insert dimensions> design[, with 10-inch (254-mm) nominal height bottom rail]**.
 3. Grilles (False Muntins): Provide between-glass grilles in designs indicated to each panel lite, with material and finish to match adjacent door panel finish.
 - a. Bar Width: Not less than **[3/4 inch (19 mm)][7/8 inch (22 mm)][1-1/8 inches (28 mm)]<Insert dimension>** wide.
 - b. Bar Profile: **[Beveled][Ovolo][Square]**.

2.3 GLAZING

- A. Glass and Glazing: Manufacturer's standard glazing system that produces weathertight seal. **[Comply with requirements for windborne-debris resistance][Comply with requirements indicated in Section 088000 "Glazing"]<Insert glazing requirements>.**
1. Glass: ASTM C1036, Type 1, q3; Category II safety glass complying with testing requirements in 16 CFR 1201.
 2. Safety Glazing Labeling: Permanently mark safety glazing with certification label of **[the SGCC][the SGCC or another certification agency acceptable to authorities having jurisdiction][or][the manufacturer]**. Label must indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
 3. Tint: **[Clear][Gray][Bronze][Green]<Insert tint>.**
 4. Insulating-Glass Units: ASTM E2190[, **certified through IGCC as complying with requirements of IGCC**].
 - a. Filling: Fill space between glass lites with **[air][argon]**.
 - b. Lites: **[Two][Three]**.
 - c. Low-E Coating: **[Manufacturer's standard][Pyrolytic on second surface][Sputtered on second surface][Sputtered on third surface][Sputtered on second or third surface]<Insert coating>.**

2.4 HARDWARE

- A. Provide manufacturer's standard hardware, fabricated from a corrosion-resistant material compatible with door panels and other components, and complying with AAMA 907. Provide hardware designed to smoothly operate, tightly close, and securely lock multipanel sliding aluminum-framed glass doors. Size hardware to accommodate panel weights and dimensions. Provide full-perimeter weatherstripping for each door panel.
- B. Bottom-Supported Panel System: Provide panel support system designed for size, weight, and performance requirements of multipanel sliding aluminum-framed glass doors indicated, capable of being adjusted for smooth operation and clearances without needing to remove panels from tracks.
1. Bottom Carriers: Provide carrier system designed to roll on track within threshold, with overhead wheeled guide that engages upper track. Provide carriers with sealed ball bearings.
 2. Lock: Provide manufacturer's standard multipoint locking device on primary door panel, lockable from the inside. Provide exterior cylinder lock on primary panel. Provide manufacturer's standard lock mechanism on each secondary door panel operable from the inside. Adjust locking devices to allow unobstructed movement of the panel across adjacent panel in the direction indicated.
 - a. Trim Design: **[As selected from manufacturer's full range]<Insert design>.**
 - b. Trim Finish: **[As selected from manufacturer's full range of finishes][Polished brass][Antique brass][Satin chrome][Oil-rubbed bronze][Dark bronze][Painted white]<Insert finish>.**
 - c. Cylinders: **[Manufacturer's standard.][ANSI/BHMA A156.5, Grade 1.][As specified in Section 087100 "Door Hardware."][As specified in Section 087111 "Door Hardware (Descriptive Specification)."]**
 3. Threshold Configuration: Extruded-aluminum [, **thermally broken,**] multitrack threshold with **[raised, weather-resistant profile][low profile, compliant with United States Access Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines"]<Insert finish>.**

- a. Aluminum Finish: **[To match panel][Clear anodized][Dark bronze anodized]**.
- C. Lift-and-Slide Panel System: Provide panel support system designed for size, weight, and performance requirements of multipanel sliding aluminum-framed glass doors indicated, capable of being adjusted for smooth operation and clearances without needing to remove panels from tracks.
1. Bottom Carriers: Provide carrier system designed to roll on track within threshold, with overhead wheeled guide that engages upper track. Provide carriers with sealed ball bearings, incorporating lift-and-slide mechanism operated by locking handle.
 2. Lock: Provide multipoint locking system on each door panel designed to unlock and raise panel from track, and engage bottom carrier. Provide exterior cylinder lock on primary panel. Provide **[interior][and][exterior]** finger pulls on each panel. Adjust locking device to allow unobstructed movement of the panel across adjacent panel in the direction indicated.
 - a. Trim Design: **[As selected from manufacturer's full range]<Insert design>**.
 - b. Trim Finish: **[As selected from manufacturer's full range of finishes][Polished brass][Antique brass][Satin chrome][Oil-rubbed bronze][Dark bronze][Painted white]<Insert finish>**.
 - c. Cylinders: **[Manufacturer's standard.][ANSI/BHMA A156.5, Grade 1.][As specified in Section 087100 "Door Hardware."][As specified in Section 087111 "Door Hardware (Descriptive Specification)."]**
 3. Threshold Configuration: Extruded-aluminum [, **thermally broken,**] multitrack threshold with **[raised, weather-resistant profile][low profile, compliant with the United States Access Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines"]****[recessed flush profile][with concealed drainage system]**.
- a. Aluminum Finish: **[To match panel][Clear anodized][Dark bronze anodized]**.
- D. Multitrack Top-Supported Panel System: Provide panel support system designed for size, weight, and performance requirements of multipanel sliding aluminum-framed glass doors indicated, capable of being adjusted for smooth operation and clearances without needing to remove panels from tracks.
1. Overhead Carriers: Provide multiwheeled overhead carriers suspended from steel or aluminum track, with lower guide system engaged in threshold for smooth operation. Limit track deflection to no more than **[0.10 inch (2.54 mm)]<Insert dimension>** between supports when fully loaded. Provide carriers with sealed ball bearings.
 2. Lock: Provide manufacturer's standard keyed cylinder lock and multipoint locking device on primary door panel, lockable from the inside. Provide exterior cylinder lock on primary panel. Provide manufacturer's standard lock mechanism on each secondary door panel operable from the inside. Adjust locking device to allow unobstructed movement of the panel across adjacent panel in the direction indicated.
 - a. Trim Design: **[As selected from manufacturer's full range]<Insert design>**.
 - b. Trim Finish: **[As selected from manufacturer's full range of finishes][Polished brass][Antique brass][Satin chrome][Oil-rubbed bronze][Dark bronze][Painted white]<Insert finish>**.
 - c. Cylinders: **[Manufacturer's standard.][ANSI/BHMA A156.5, Grade 1.][As specified in Section 087100 "Door Hardware."][As specified in Section 087111 "Door Hardware (Descriptive Specification)."]**
 3. Threshold Configuration: Extruded-aluminum [, **thermally broken,**] threshold with **[raised, weather-resistant profile][low profile, compliant with the United States Access Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines"]****[recessed flush profile][with concealed drainage system]**.

a. Aluminum Finish: **[To match panel][Clear anodized][Dark bronze anodized]**.

E. Single-Track Top-Supported Panel System: Provide panel support system designed for size, weight, and performance requirements of multipanel sliding aluminum-framed glass doors indicated, capable of being adjusted for smooth operation and clearances without needing to remove panels from tracks.

1. Overhead Carriers: Provide overhead carriers suspended from steel or aluminum track, with lower guide system engaged in threshold for smooth operation. Limit track deflection to no more than **[0.10 inch (2.54 mm)]<Insert dimension>** between supports when fully loaded. Provide carriers with sealed ball bearings.
2. Stacking Track System: Provide intersections, switches, and accessories required for operation, storage, track configuration, and layout indicated for multipanel sliding wood-framed glass doors. Fabricate track intersections and switches from steel or aluminum.
3. Lock: Provide manufacturer's standard multipoint locking device on each movable panel, lockable from the inside. Provide exterior cylinder lock on primary panel. Adjust locking device to allow unobstructed movement of the panel across adjacent panel in the direction indicated.

a. Trim Design: **[As selected from manufacturer's full range]<Insert design>**.

b. Trim Finish: **[As selected from manufacturer's full range of finishes][Polished brass][Antique brass][Satin chrome][Oil-rubbed bronze][Dark bronze][Painted white]<Insert finish>**.

c. Cylinders: **[Manufacturer's standard.][ANSI/BHMA A156.5, Grade 1.][As specified in Section 087100 "Door Hardware."][As specified in Section 087111 "Door Hardware (Descriptive Specification)."]**

4. Threshold Configuration: Extruded-aluminum [, **thermally broken,**] threshold with **[raised, weather-resistant profile][low profile, compliant with the United States Access Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines"]**[recessed flush profile][with concealed drainage system].

a. Aluminum Finish: **[To match panel][Clear anodized][Dark bronze anodized]**.

2.5 ACCESSORIES

A. Trim: Provide interior and exterior casings, jamb extensions, and other components in material and finish to match door frames.

B. Fasteners: Noncorrosive and compatible with door members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

C. Anchors, Clips, and Accessories: Provide anchors, clips, and accessories of aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron for multipanel sliding aluminum-framed glass doors, complying with ASTM B456 or ASTM B633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

1. Windborne-Debris Resistance: Provide anchors of same design used in windborne-debris resistance testing.

2.6 INSECT SCREENS

- A. Screen Fabric: Provide screen mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration; and complying with ASTM D3656/D3656M.
 - 1. Fabric Color: **[Manufacturer's standard][Charcoal gray][Silver gray]<Insert color>**.
- B. Pleated Insect Screen: Screen suspended from the top, with bottom guide, and finish **[to match exterior door face][as selected from manufactures' standard colors]**. Provide single- or two-function operation with screen meeting rails at same location as primary entrance of door.
- C. Coiling Insect Screen: Coiling screen housed in jamb-mounted cartridge, guided by upper and lower tracks. Finish **[to match exterior door face][as selected from manufactures' standard colors]**. Provide single- or two-function operation with screen meeting rails at same location as primary entrance of door.

2.7 FABRICATION

- A. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.
- B. Factory-Glazed Fabrication: Glaze sliding aluminum-framed glass doors in the factory.

2.8 GENERAL FINISH REQUIREMENTS

- A. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - 1. Color: **[Light bronze][Medium bronze][Dark bronze][Champagne][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603, except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- D. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with **[AAMA 2604][AAMA 2605]** and containing not less than **[50][70]** percent PVDF resin by weight in color coat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.

2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- E. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- F. Superior-Performance Organic Finish, Four-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- G. Superior-Performance Organic Finish, Single-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- H. Superior-Performance Organic Finish, Two-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of Work.
- B. Verify rough opening dimensions, levelness of threshold substrate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight hinged-door installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing multipanel sliding aluminum-framed glass doors, hardware, accessories, and other components.
- B. Windborne-Debris Resistance: Anchor multipanel sliding aluminum-framed glass doors that have been tested for windborne-debris resistance to structure, using anchoring method, fastener type, and fastening frequency identical to that used in windborne-debris resistance testing.
- C. Install multipanel sliding aluminum-framed glass doors level, plumb, square, true to line; without distortion, warp, or rack of frames and panels, and without impeding thermal movement; anchored securely in place to structural support; and in proper relation to wall flashing, vapor retarders, air barriers, water/weather barriers, and other adjacent construction.
- D. Set threshold members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.
- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
 - 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing Services: Test and inspect installed multipanel sliding aluminum-framed glass doors as follows:
 - 1. Testing Methodology: Test multipanel sliding aluminum-framed glass doors for air infiltration and water resistance in accordance with AAMA 502.
 - 2. Air-Infiltration Testing:
 - a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
 - b. Allowable Air-Leakage Rate: **[1.5]<Insert number>** times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
 - 3. Water-Resistance Testing:
 - a. Test Pressure: **[Two-thirds]<Insert number>** times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
 - b. Allowable Water Infiltration: No water penetration.
 - 4. Testing Extent: **[Three][Three mockup]<Insert number or description>** multipanel sliding aluminum-framed glass doors of each type as selected by Architect and a qualified independent testing and inspecting agency. Conduct tests after perimeter sealants have cured.
 - 5. Test Reports: Prepared in accordance with AAMA 502.
- C. Multipanel sliding aluminum-framed glass door will be considered defective if it does not pass tests and inspections.

3.4 ADJUSTING

- A. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.
- B. Adjust hardware and operable panels to function smoothly, and lubricate as recommended by manufacturer.

3.5 CLEANING

- A. Clean exposed surfaces immediately after installation. Avoid damaging protective coatings and finishes. Remove nonpermanent labels, excess sealants, glazing materials, dirt, and other substances.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

3.6 PROTECTION

- A. Protect multipanel sliding aluminum-framed glass door surfaces from contact with contaminating substances resulting from construction operations. Remove contaminants immediately in accordance with manufacturer's written instructions.
- B. Refinish or replace sliding aluminum-framed glass doors with damaged finishes.

END OF SECTION 08 18 16 00A

SECTION 08 18 16 00B - SLIDING WOOD-FRAMED GLASS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-clad sliding wood-framed glass doors.
2. Vinyl-clad sliding wood-framed glass doors.
3. Unclad sliding wood-framed glass doors.

B. Related Requirements:

1. Section 085200 "Wood Windows" for **[transom and sidelite windows, mullions, and]** coordinating finishes among fenestration units.
2. **[Section 087100 "Door Hardware"]****[Section 087111 "Door Hardware (Descriptive Specification)"]** for hardware not specified in this Section.
3. Section 099300 "Staining and Transparent Finishing" for on-site finishing of unfinished sliding wood-framed glass doors.
4. **[Section 099113 "Exterior Painting"]****[and]****[Section 099123 "Interior Painting"]** for on-site finishing of **[unfinished]****[and]****[factory-primed]** sliding wood-framed glass doors.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **[Project site]**<Insert location>.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review, discuss, and coordinate the interrelationship of sliding wood-framed glass doors with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.
 - a. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, and finishes.

B. Shop Drawings:

1. Include plans, elevations, sections, hardware, accessories, insect screens, and details of installation, including anchor, flashing, and sealant installation.

2. **<Insert requirements>.**

- C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.
- D. Samples for Verification: Actual sample of finished products for each type of exposed finish.
 - 1. Main Framing Member: **12-inch-long (300-mm-long)** section with weather stripping, glazing bead, and specified finishes.
 - 2. Exposed Hardware: Full-size units with factory-applied finish.
 - 3. **<Insert requirements>.**
- E. Product Schedule: For sliding wood-framed glass doors. Use same designations indicated on Drawings.
- F. Sustainable Design Submittals:
 - 1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
 - 2. Chain-of-Custody Qualification Data: For manufacturer and vendor.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each configuration of sliding wood-framed glass door, for tests performed by **[a qualified testing agency][manufacturer and witnessed by a qualified testing agency]**.
- B. Field Quality-Control Reports. For sliding wood-framed glass doors,
- C. Qualification Statements: For **[manufacturer][vendor][Installer][and][testing agency]<Insert entity or specialist>.**
- D. Sample Warranties: For sliding wood-framed glass doors.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For **[factory-applied finishes,]**weather stripping, operable panels, and operating hardware to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.
- B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- C. Manufacturer Qualifications: A manufacturer capable of fabricating sliding wood-framed glass doors that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.
- D. Installer Qualifications: Entity acceptable to sliding wood-framed glass door manufacturer for installation of units required for this Project.

1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, demonstrate aesthetic effects, and set quality standards for materials and execution.
 - 1. Build mockups **[as indicated on Drawings]<Insert mockup requirements>**.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of sliding wood-framed glass doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including excessive deflection, water penetration, and air leakage.
 - b. Faulty operation of operable panels and hardware.
 - c. Deterioration of materials and factory-applied finishes beyond normal weathering.
 - d. Failure of insulating glass **[and laminated glass]**.
 - e. **<Insert requirements>**.
 - 2. Warranty Period:
 - a. Sliding Wood-Framed Glass Doors: **[Five][10][20]<Insert number>** years from date of Substantial Completion.
 - b. Insulating Glass: **[10][20]<Insert number>** years from date of Substantial Completion.
 - c. Laminated Glass: **[Five]<Insert number>** years from date of Substantial Completion.
 - d. Exterior Factory-Applied Finishes: **[Five][10][20]<Insert number>** years from date of Substantial Completion.
 - e. Interior Factory-Applied Finishes: **[Five]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain sliding wood-framed glass doors from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Product Certification: WDMA certified with label attached to each door.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: [Class R][Class LC][Class CW][As indicated on Drawings]<Insert requirements>.
 2. Minimum Performance Grade: [Grade 15][Grade 20][Grade 25][Grade 30][Grade 35][Grade 40][Grade 45][Grade 50][As indicated on Drawings]<Insert requirements>.
- C. Thermal Transmittance: NFRC 100 maximum whole-unit U-factor of [0.30 Btu/sq. ft. x h x deg F (1.70 W/sq. m x K)]<Insert value>.
- D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 whole-unit maximum SHGC of [0.40][0.25]<Insert value>.
- E. Sound Transmission Class (STC): Rated for not less than [29][30][31]<Insert rating> STC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E413.
- F. Outside-Inside Transmission Class (OITC): Rated for not less than [23][24][25]<Insert rating> OITC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E1332.
- G. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone [1][2][3][4] for [basic][enhanced] protection.
1. Large-Missile Test: For glazing [located within 30 ft. (9.1 m) of grade]<Insert requirements>.
 2. Small-Missile Test: For glazing located [between 30 ft. (9.1 m) and 60 ft. (18.3 m)][greater than 30 ft. (9.1 m)]<Insert requirements> above grade.

2.3 ALUMINUM-CLAD SLIDING WOOD-FRAMED GLASS DOORS

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
1. [Andersen Windows, Inc.; Andersen Corporation]
 2. [Crestline Windows and Doors]
 3. [JELD-WEN, Inc.]
 4. [Kolbe Windows & Doors]
 5. [Marvin]
 6. [Pella Corporation]
 7. [Ply-Gem]
 8. [Sierra Pacific Windows; Sierra Pacific Industries]
 9. [Weather Shield Mfg., Inc.]
 10. <Insert manufacturer's name>
- B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
1. [Andersen Windows, Inc.; Andersen Corporation]
 2. [Crestline Windows and Doors]
 3. [JELD-WEN, Inc.]
 4. [Kolbe Windows & Doors]
 5. [Marvin]
 6. [Pella Corporation]
 7. [Ply-Gem]
 8. [Sierra Pacific Windows; Sierra Pacific Industries]
 9. [Weather Shield Mfg., Inc.]

10. <Insert manufacturer's name>

C. Exterior Surfaces: **[Manufacturer's standard aluminum cladding]<Insert requirements>**.

1. Baked-Enamel or Powder-Coat Finish: AAMA 2603, except with a minimum dry-film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and curing finish.

a. Color and Gloss: **[As indicated by manufacturer's designation][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.

2. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with **[AAMA 2604][AAMA 2605]** and containing not less than **[50][70]** percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Color and Gloss: **[As indicated by manufacturer's designation][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.

D. Interior Surfaces: **[Manufacturer's standard wood species][Pine][Fir][Alder][Oak][Cherry][Mahogany]<Insert species>**.

1. Visible Finger Joints: **[Allowed][Not allowed]**.

2. Finish: **[Unfinished][Manufacturer's standard factory-applied primer for field painting][Manufacturer's standard factory-applied color-coated finish][Manufacturer's standard factory-applied stain and transparent finish]<Insert finish>**.

a. Color: **[As selected by Architect from manufacturer's full range]<Insert color>**.

2.4 VINYL-CLAD SLIDING WOOD-FRAMED GLASS DOORS

A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

1. **[Andersen Windows, Inc.; Andersen Corporation]**

2. **<Insert manufacturer's name>**

B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

1. **[Andersen Windows, Inc.; Andersen Corporation]**

2. **<Insert manufacturer's name>**

C. Exterior Surfaces: Vinyl-clad frames; vinyl-clad or high-performance color-coated finish on glazed panels.

1. Color: **[As selected by Architect from manufacturer's full range]<Insert color>**.

D. Interior Surfaces: **[Manufacturer's standard wood species][Pine][Oak][Maple]<Insert species>**.

1. Visible Finger Joints: **[Allowed][Not allowed]**.

2. Finish: **[Unfinished][Manufacturer's standard factory-applied color-coated white finish]<Insert finish>**.

2.5 UNCLAD SLIDING WOOD-FRAMED GLASS DOORS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

1. **[JELD-WEN, Inc.]**
2. **[Marvin]**
3. **[Sierra Pacific Windows; Sierra Pacific Industries]**
4. **[Weather Shield Mfg., Inc]**
5. **<Insert manufacturer's name>**

- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

1. **[JELD-WEN, Inc.]**
2. **[Marvin]**
3. **[Sierra Pacific Windows; Sierra Pacific Industries]**
4. **[Weather Shield Mfg., Inc]**
5. **<Insert manufacturer's name>**

- C. Exterior Surfaces: **[Manufacturer's standard paint-grade wood species][Pine]<Insert species>**.

1. Visible Finger Joints: **[Allowed][Not allowed]**.
2. Finish: **[Manufacturer's standard factory-applied primer][Manufacturer's standard factory-applied color-coated finish][Unfinished]<Insert requirements>**.

- a. Color: **[As selected by Architect from manufacturer's full range]<Insert color>**.

- D. Interior Surfaces: **[Manufacturer's standard wood species][Pine][Mahogany][Fir][Alder][Oak][Cherry]<Insert species>**.

1. Visible Finger Joints: **[Allowed][Not allowed]**.
2. Finish: **[Unfinished][Manufacturer's standard factory-applied primer for field painting][Manufacturer's standard factory-applied color-coated finish][Manufacturer's standard factory-applied stain and transparent finish]<Insert finish>**.

- a. Color: **[As selected by Architect from manufacturer's full range]<Insert color>**.

- E. True Divided Lites: Fabricate glazed panels with true muntins resulting in individually glazed lites; provide muntin configuration and profile indicated on Drawings.

2.6 DOOR-ASSEMBLY COMPONENTS

- A. Wood Components: Laminated veneer lumber (LVL) or fine-grained wood lumber complying with AAMA/WDMA/CSA 101/I.S.2/A440; kiln dried to maximum moisture content of 12 percent at time of fabrication; water-repellent preservative treated.
- B. Certified Wood: Wood doors shall be certified as "FSC Pure"[or "FSC Mixed Credit"] according to

FSC STD-01-001 and FSC STD-40-004.

- C. Certified Wood: Wood doors shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
- D. Certified Wood: Wood doors shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
- E. Trim and Glazing Stops: Material and finish to match adjacent door components.
- F. Transoms: Provide manufacturer's fixed transoms from same product line as doors; fabricated and finished to match door frame and panels; in configuration [**indicated on Drawings**]**<Insert requirements>**.
- G. Sidelites: Provide manufacturer's fixed sidelites from same product line as doors; fabricated and finished to match door frame and panels; in configuration [**indicated on Drawings**]**<Insert requirements>**.
- H. Mullions: Provide mullions and mullion casing and cover plates as shown on Drawings, matching door units, complete with anchors for support to structure and installation of sliding wood-framed glass door units. Allow for erection tolerances and provide for movement of door units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design loads of door units.
- I. Integral Nailing Fin: Manufacturer's standard nailing fin for securing frame to structure; with sufficient strength to withstand design pressure indicated.
- J. Drip Caps: Manufacturer's standard; factory-fabricated and -finished to match exterior door frame; designed to direct water away from building when installed horizontally at head of sliding wood-framed glass doors.
- K. Threshold and Sill Cap/Track: [**Manufacturer's standard**]**<Insert requirements>**; of dimensions and profile indicated on Drawings; designed to comply with performance requirements indicated and to drain to exterior.
 - 1. Color: [**Bronze**][**Black**][**Beige**][**Manufacturer's standard**]**<Insert requirements>**.
 - 2. Low-Profile Threshold and Sill Cap/Track: Provide ADA-ABA compliant thresholds and tracks [**where indicated on Drawings**][**where indicated in schedules**]**<Insert requirements>**.
 - 3. Sill Ramps: Provide ADA-ABA compliant sill ramps [**where indicated on Drawings**][**where indicated in schedules**]**<Insert requirements>**.
 - a. Interior Section: [**Maple**][**Oak**][**Aluminum**]**<Insert requirements>**.
 - b. Exterior Section: [**Aluminum**][**Manufacturer's standard**]**<Insert requirements>**.

2.7 GLAZING

- A. Glass and Glazing: Manufacturer's standard glazing system that produces weathertight seal. [**Comply with requirements for windborne-debris impact resistance.**]
 - 1. Glass: ASTM C1036, Type 1, q3, Category II safety glass complying with testing requirements in 16 CFR 1201.
 - 2. Safety Glazing Labeling: Permanently mark safety glazing with [**manufacturer's**][**or**][**SGCC**] certification label indicating manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

3. Tint: **[Clear][Gray][Bronze][Green]<Insert tint>**.
 4. Insulating-Glass Units: ASTM E2190[, **certified through IGCC as complying with requirements of IGCC**].
 - a. Filling: Fill space between glass lites with **[air][argon]**.
 - b. Lites: **[Two][Three]<Insert requirements>**.
 - c. Low-E Coating: **[Manufacturer's standard][Pyrolytic on second surface][Sputtered on second surface][Sputtered on third surface][Sputtered on second or third surface]<Insert coating>**.
 - d. Spacer Color: **[Manufacturer's standard][Silver][Gray][Black]<Inset color>**.
 5. Dual Glazing:
 - a. Interior Glazing: **[Monolithic glass]<Insert requirements>**.
 - b. Exterior Glazing: **[Monolithic glass][Insulating-glass unit]<Insert requirements>**.
- B. Integral Louver Blinds: Manufacturer's standard horizontal louver blinds with aluminum slats and polyester-fiber cords, located in space between **[interior and exterior glazing of dual-glazed units][insulating-glass lites]<Insert requirements>**, and operated by hardware located on inside face of door panel.
1. Operation: **[Tilt only][Tilt, raising, and lowering]**.
 2. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.
- C. Simulated Divided Lites: Provide grilles in configuration indicated on Drawings and as follows:
1. Grilles Between Lites: Provide grilles permanently installed between lites of insulating-glass units in color **[selected by Architect from manufacturer's full range]<Insert color>**.
 2. Exterior Grilles: Provide grilles permanently applied to outside face of glazing units and finished to match door exterior.
 3. Interior Grilles: Provide grilles that are **[removable][permanently applied to inside face of glazing units]**; finished to match door interior.
 4. Profile: **[Flat][Manufacturer's standard contoured profile][As indicated on Drawings]<Insert requirements>**.
 5. Width: **[5/8-inch (16-mm)][7/8-inch (22-mm)][1-1/8 inch (29-mm)][As indicated on Drawings]<Insert requirements>**.

2.8 HARDWARE

- A. General: Manufacturer's **[standard]<Insert requirements>** hardware complying with requirements in AAMA 907; fabricated from corrosion-resistant material compatible with materials with which it comes in contact; designed to smoothly operate, tightly close, and securely lock sliding wood-framed glass doors; and sized to accommodate panel weight and dimensions.
- B. Door Pulls: **[Provide manufacturer's standard pull]<Insert requirements>**.
1. Color and Finish: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and finish>**.
- C. Lock: Manufacturer's keyed cylinder lock and **[multipoint]** locking device to secure each operable panel, lockable from the inside **[only][and outside]**. Adjust locking device to allow unobstructed movement of the panel across adjacent panel in the direction indicated.

1. Keying System: **[All cylinders keyed alike][Keyed to match other building entrances]<Insert requirements>**.
- D. Security Foot Bolt: Foot-operated dead bolt to lock operable panel when fully closed and when partially open to permit ventilation.
- E. Rollers: On each operable panel, dual **[corrosion-resistant][stainless steel]** ball-bearing rollers.
- F. Limit Stops: Resilient rubber.

2.9 INSECT SCREENS

- A. General: Design sliding wood-framed glass doors to accommodate screens in a tight-fitting, removable arrangement fully integrated with door frame. Provide screen for each operable door panel.
- B. Sliding Insect Screens: SMA 1201.
 1. Aluminum Frames: Manufacturer's standard **[extruded][or][roll-formed tubular]** members finished to match door frame; fabricated with mitered or coped joints, concealed fasteners, adjustable rollers, and removable PVC or PE spline/anchor concealing edge of mesh.
 2. Fiberglass Mesh Fabric: ASTM D3656/D3656M, **[manufacturer's standard]<Insert requirements>** mesh of PVC-coated fiberglass.
 - a. Mesh Color: **[Manufacturer's standard][Charcoal gray][Silver gray]<Insert color>**.
 3. Aluminum Wire Fabric: **[Manufacturer's standard]<Insert requirements>** coated aluminum wire.
 - a. Wire-Fabric Finish: **[Manufacturer's standard][Silver][Charcoal gray]<Insert color>**.
 4. Hardware: **[Manufacturer's standard noncorrosive pull and keyless locking device; lockable from inside only; designed to allow unobstructed movement of panels and screen]<Insert requirements>**.
- C. Retractable Insect Screen: **[Manufacturer's standard self-storing screen assembly mounted behind vertical cover at door interlocker]<Insert requirements>**.
 1. Cover Finish: **[Match panel finish]<Insert requirements>**.
 2. Hardware: **[Manufacturer's standard noncorrosive pull and keyless locking device; lockable from inside only]<Insert requirements>**.
 3. Fiberglass Mesh: ASTM D3656/D3656M, **[manufacturer's standard]<Insert requirements>** PVC-coated fiberglass mesh.

2.10 ACCESSORIES

- A. Fasteners: Noncorrosive and compatible with door members, trim, hardware, anchors, and other components.
 1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.
- B. Anchors, Clips, and Accessories: Provide anchors, clips, and accessories of aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron for sliding wood-framed glass doors, complying with ASTM

B456 or ASTM B633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

1. Windborne-Debris Impact Resistance: Provide anchors of same design used in windborne-debris impact-resistance testing.

2.11 FABRICATION

- A. Fabricate sliding wood-framed glass doors in sizes and with stile and rail dimensions indicated on Drawings. Include a complete system for assembling components and anchoring doors.
- B. Fabricate sliding wood-framed glass doors that are reglazable without dismantling panel framing.
- C. Weather Stripping: Provide full-perimeter weather stripping for each door panel.
- D. Factory-machine sliding wood-framed glass doors for openings and hardware that is not surface applied.
- E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.
- F. Factory-Glazed Fabrication: Glaze sliding wood-framed glass doors in the factory.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of threshold/track substrate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight sliding wood-framed glass door installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF SLIDING WOOD-FRAMED GLASS DOORS

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing sliding doors, hardware, accessories, and other components.
- B. Windborne-Debris Impact Resistance: Anchor sliding wood-framed glass doors that have been tested for windborne-debris impact resistance to structure using anchoring method, fastener type, and fastening frequency identical to that used in windborne-debris impact-resistance testing.
- C. Install sliding wood-framed glass doors level, plumb, square, true in line, without distortion, without warp or rack of frames and panels, and without impeding thermal movement; anchored securely in place to

structural support; and in proper relation to wall flashing, vapor retarders, air barriers, water/weather barriers, and other adjacent construction. Comply with requirements in ASTM E2112.

- D. Set sill members in bed of sealant, as indicated on Drawings, to provide weathertight construction.
- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials in accordance with ASTM E2112.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
- B. Testing Services: Test and inspect installed sliding wood-framed glass doors as follows:
 - 1. Testing Methodology: Test sliding wood-framed glass doors for air leakage and water penetration in accordance with AAMA 502.
 - 2. Air-Leakage Resistance Testing:
 - a. Test Pressure: Pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
 - b. Allowable Air-Leakage Rate: **[1.5]<Insert number>** times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
 - 3. Water-Penetration Resistance Testing:
 - a. Test Pressure: **[Two-thirds]<Insert number>** times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
 - b. Allowable Water Infiltration: No water penetration.
 - 4. Testing Extent: **[Three][Three mockup]<Insert number or description>** sliding wood-framed glass doors of each type as selected by Architect and a qualified independent testing and inspecting agency. Conduct tests after perimeter sealants have cured.
 - 5. Test Reports: Prepared in accordance with AAMA 502.
- C. Sliding wood-framed glass door will be considered defective if it does not pass tests and inspections.

3.4 ADJUSTING, CLEANING, AND PROTECTION

- A. Lubricate hardware and moving parts in accordance with manufacturer's written instructions.
- B. Adjust operating panels and screens to provide a tight fit at contact points and weather stripping for smooth operation, without binding, and weathertight closure.
- C. Adjust hardware for proper alignment, smooth operation, and proper latching without requiring unnecessary force or having excessive clearance.
- D. Clean exposed surfaces immediately after installing sliding wood-framed glass doors. Avoid damaging protective coatings and finishes. Remove nonpermanent labels, excess sealants, glazing materials, dirt, and other substances.
- E. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during

construction period.

- F. Protect sliding wood-framed glass door surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances contact sliding wood-framed glass door surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.
- G. Refinish or replace sliding wood-framed glass doors with damaged factory-applied finishes.
- H. Replace damaged components.

END OF SECTION 08 18 16 00B

SECTION 08 18 16 00C - MULTIPANEL SLIDING WOOD-FRAMED GLASS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Multipanel sliding wood-framed glass doors.

B. Related Requirements:

1. Section 081816.23 "Multipanel Folding Wood-Framed Glass Doors" for multipanel wood-framed glass doors that operate by folding.
2. Section 085200 "Wood Windows" for related wood-framed transom and sidelite windows and mullions, and for coordinating combinations and finish among wood fenestration units.
3. **[Section 087100 "Door Hardware"]****[Section 087111 "Door Hardware (Descriptive Specification)"]** for hardware not specified in this Section.
4. Section 099300 "Staining and Transparent Finishing" for on-site finishing of unfinished multipanel sliding wood-framed glass doors.
5. **[Section 099113 "Exterior Painting"]****[and]****[Section 099123 "Interior Painting"]** for on-site finishing of **[unfinished]****[and]****[factory-primed]** multipanel sliding wood-framed glass doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for multipanel sliding wood-framed glass doors.

B. Sustainable Design Submittals:

1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
2. Chain-of-Custody Qualification Data: For manufacturer and vendor.

C. Shop Drawings:

1. Include plans, elevations, sections, and installation details.
2. Indicate dimensions, configuration of panels, and stacking layout.

D. Samples: For each multipanel sliding wood-framed glass door and for each color specified; **12-inch-long (300-mm-long)** section with factory-applied color finish.

E. Samples for Initial Selection: For doors and hardware with factory-applied color finish.

F. Samples for Verification: For multipanel sliding wood-framed glass doors and components required, prepared on Samples of size indicated below:

1. Main Framing Member: **12-inch-long (300-mm-long)** section with weather stripping, glazing bead and factory-applied color finish.
2. Hardware: Full-size units with factory-applied finish.

3. <Insert component>: <Insert description>.

- G. Product Schedule: For multipanel sliding wood-framed glass doors.[**Use same designations indicated on Drawings.**]

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For [Installer][manufacturer][and][testing agency].
- B. Product Test Reports: For each multipanel sliding wood-framed glass door, for tests performed by [manufacturer and witnessed by a qualified testing agency][a qualified testing agency]; and for each class and performance grade indicated, tested at AAMA gateway size.
- C. Field quality-control reports.
- D. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For multipanel sliding wood-framed glass doors to include in maintenance manuals. Include finishes, weather stripping, operable panels, and operating hardware.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.
- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- D. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- E. Installer Qualifications: An installer acceptable to multipanel sliding wood-framed glass door manufacturer for installation of units required for this Project.
- F. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup for multipanel sliding wood-framed glass doors, as shown on Drawings.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace multipanel sliding wood-framed glass doors that fail(s) in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures, including excess deflection.
 - c. Excessive water leakage or air infiltration.
 - d. Faulty operation of movable panels and hardware.
 - e. Deterioration of wood, metals, metal finishes, and other materials beyond normal weathering.
 - f. Failure of insulating glass[**and laminated glass**].
 - g. **<Insert failure modes>**.
 2. Warranty Period:
 - a. Multipanel Sliding Wood-Framed Glass Doors: **[Five][Ten][20]<Insert number>** year(s) from date of Substantial Completion.
 - b. Insulating-Glass Units: **[10][20]<Insert number>** years from date of Substantial Completion.
 - c. Laminated Glass: **[Five]<Insert number>** years from date of Substantial Completion.
 - d. Aluminum Finish: **[Five][10][20]<Insert number>** years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: **[Five][10][20]<Insert number>** years from date of Substantial Completion.
- C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, peeling, or chipping.
 2. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Product Certification: AAMA certified with label attached to each door.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
 - 1. Minimum Performance Class: **[Class R][Class LC][Class CW][Class AW][As indicated on Drawings]<Insert class>**.
 - 2. Minimum Performance Grade: **[Grade 15][Grade 20][Grade 25][Grade 30][Grade 35][Grade 40][Grade 45][Grade 50][As indicated on Drawings]<Insert grade>**.
- C. Thermal Transmittance: NFRC 100 maximum total fenestration product U-factor of **[0.30 Btu/sq. ft. x h x deg F (1.71 W/sq. m x K)][0.32 Btu/sq. ft. x h x deg F (1.83 W/sq. m x K)][0.35 Btu/sq. ft. x h x deg F (2.0 W/sq. m x K)][0.60 Btu/sq. ft. x h x deg F (3.43 W/sq. m x K)]<Insert value>**.
- D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum total fenestration product SHGC of **[0.40][0.30][0.27]<Insert value>**.
- E. Condensation-Resistance Factor (CRF): Provide multipanel sliding wood-framed glass doors tested for thermal performance in accordance with AAMA 1503, showing a CRF of **[45][52]<Insert value>**.
- F. Sound Transmission Class (STC): Rated for not less than **[28][32]<Insert rating>** STC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E413.
- G. Outside-Inside Transmission Class (OITC): Rated for not less than **[23][27][29]<Insert rating>** OITC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E1332.
- H. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone **[1][2][3][4]** for **[basic][enhanced]** protection.
 - 1. Large-Missile Test: For glazing located within **30 feet (9.1 m) <Insert height>** of grade.
 - 2. Small-Missile Test: For glazing located between **30 feet (9.1 m) and [60 feet (18.3 m)]<Insert height>** above grade.
- I. **<Insert requirements>**.

2.2 MULTIPANEL SLIDING WOOD-FRAMED GLASS DOORS

- A. Multipanel Sliding Wood-Framed Glass Doors: Provide multipanel wood-framed sliding glass doors, designed for exterior use, complete with glazing, threshold, flashings, support, and anchorage devices.
 - 1. Stack Storage Configuration: **[Panels open from center to both sides, and are stored within opening][Panels open from one side stack into storage area outside of opening][As shown on Drawings]<Insert configuration>**.

- B. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[Andersen Windows, Inc.; Andersen Corporation]**
 2. **[Centor North America, Inc.]**
 3. **[Dynamic Architectural Windows & Doors, Inc.]**
 4. **[JELD-WEN, Inc.]**
 5. **[LaCantina Doors; a division of JELD-WEN]**
 6. **[Lanai Doors]**
 7. **[Milgard Manufacturing, LLC]**
 8. **[Nana Wall Systems, Inc.]**
 9. **[Panda Windows & Doors]**
 10. **[Sierra Pacific Windows; Sierra Pacific Industries]**
 11. **[Weather Shield Mfg., Inc]**
 12. **<Insert manufacturer's name>**
- C. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Andersen Windows, Inc.; Andersen Corporation]**
 2. **[Centor North America, Inc.]**
 3. **[Dynamic Architectural Windows & Doors, Inc.]**
 4. **[JELD-WEN, Inc.]**
 5. **[LaCantina Doors; a division of JELD-WEN]**
 6. **[Lanai Doors]**
 7. **[Milgard Manufacturing, LLC]**
 8. **[Nana Wall Systems, Inc.]**
 9. **[Panda Windows & Doors]**
 10. **[Sierra Pacific Windows; Sierra Pacific Industries]**
 11. **[Weather Shield Mfg., Inc]**
 12. **<Insert manufacturer's name>**
- D. Frames and Door Panels: Fabricate from wood components complying with AAMA/WDMA/CSA 101/I.S.2/A440 and indicated requirements. Provide factory-assembled door panels that are reglazable without dismantling panel framing and **[factory-assembled][or][field-assembled]** frames.
1. Door Panel Design: **[Narrow-profile][Standard-profile][Wide-profile]<Insert dimensions>** design, **with 10-inch (254-mm) nominal height bottom rail**.
 2. True Divided Lites: Provide glazing with true muntins, resulting in individually glazed lites, in pattern indicated.
 3. Grilles (False Muntins): Provide grilles in designs indicated to each panel lite.
 - a. Type: **[Interior, removable][Exterior and interior, removable][Exterior and interior, adhered to glass][with between-glass grille]**.
 - b. Design: **[Rectangular][Diamond][as indicated on Drawings]<Insert design>**.
 - c. Bar Width: Not less than **[3/4 inch (19 mm)][7/8 inch (22 mm)][1-1/8 inches (28 mm)]<Insert dimension>** wide.
 - d. Bar Profile: **[Beveled][Ovolo][Square]**.
 - e. Color: **[White][Bronze][To match adjacent door finish][As selected by Architect from manufacturer's full range]<Insert color>**.
- E. Aluminum-Clad Exterior Finish: Aluminum cladding with **[manufacturer's standard baked-on enamel finish][manufacturer's standard high-performance organic finish][manufacturer's standard fluoropolymer two-coat system with fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight and complying with AAMA 2605]<Insert finish>**.

1. Color: **[As selected by Architect from manufacturer's full range]**<Insert color>.
- F. Wood Exterior Finish: **[Manufacturer's standard factory-applied primer][Manufacturer's standard factory-applied color finish][Unfinished]**.
1. Wood Species: **[Manufacturer's standard paint-grade species][Pine][Mahogany][Douglas Fir][Western Hemlock][Spruce]**<Insert species>.
 2. Color: **[As selected by Architect from manufacturer's full range]**<Insert color>.
- G. Interior Surfaces: **[Unfinished][Manufacturer's standard factory-applied primer][Manufacturer's standard factory-applied color finish][Manufacturer's standard stain-and varnish-finish]**<Insert finish>.
1. Wood Species: **[Manufacturer's standard species][Pine][Mahogany][Fir][Alder][Oak][Cherry]**<Insert species>.
 2. Color: **[As selected by Architect from manufacturer's full range]**<Insert color>.
- H. Wood Components: Manufacturer's standard LVL or fine-grained wood lumber complying with AAMA/WDMA/CSA 101/I.S.2/A440; kiln dried to a moisture content of not more than 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch (0.8 mm) deep by 2 inches (51 mm) wide; water-repellent preservative treated.
- I. Certified Wood: Wood doors shall be certified as "FSC Pure"[or "FSC Mixed Credit"] according to FSC STD-01-00 and FSC STD-40-004.
- J. Certified Wood: Wood doors shall be certified as "FSC Pure"[or "FSC Mixed Credit"] according to FSC STD-01-001 and FSC STD-40-004.
- K. Certified Wood: Wood doors shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
- L. Certified Wood: Wood doors shall **[contain not less than 60 percent][be made from]** certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "Technical Barriers to Trade."
- M. Certified Wood: Wood doors shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.

2.3 GLAZING

- A. Glass and Glazing: Manufacturer's standard glazing system that produces weathertight seal. **[Comply with requirements for windborne-debris resistance][Comply with requirements indicated in Section 088000 "Glazing"]**<Insert glazing requirements>.
1. Glass: ASTM C1036, Type 1, q3; Category II safety glass complying with testing requirements in 16 CFR 1201.
 2. Safety Glazing Labeling: Permanently mark safety glazing with certification label of **[the SGCC][the SGCC or another certification agency acceptable to authorities having jurisdiction][or][the manufacturer]**. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
 3. Tint: **[Clear][Gray][Bronze][Green]**<Insert tint>.

4. Insulating-Glass Units: ASTM E2190[, **certified through IGCC as complying with requirements of IGCC**].
 - a. Filling: Fill space between glass lites with [air][argon].
 - b. Lites: [Two][Three].
 - c. Low-E Coating: [Manufacturer's standard][Pyrolytic on second surface][Sputtered on second surface][Sputtered on third surface][Sputtered on second or third surface]<Insert coating>.

2.4 HARDWARE

- A. Provide manufacturer's standard hardware, fabricated from a corrosion-resistant material compatible with door panels and other components, and complying with AAMA 907. Provide hardware designed to smoothly operate, tightly close, and securely lock multipanel sliding wood-framed glass doors. Size hardware to accommodate panel weights and dimensions. Provide full-perimeter weatherstripping for each door panel.
- B. Bottom-Supported Panel System: Provide panel support system designed for size, weight, and performance requirements of multipanel sliding wood-framed glass doors indicated, capable of being adjusted for smooth operation and clearances without needing to remove panels from tracks.
 1. Bottom Carriers: Provide carrier system designed to roll on track within threshold, with overhead wheeled guide that engages upper track. Provide carriers with sealed ball bearings.
 2. Lock: Provide manufacturer's standard multipoint locking device on primary door panel, lockable from the inside. Provide exterior cylinder lock on primary panel. Provide manufacturer's standard lock mechanism on each secondary door panel operable from the inside. Adjust locking devices to allow unobstructed movement of the panel across adjacent panel in the direction indicated.
 - a. Trim Design: [As selected from manufacturer's full range]<Insert design>.
 - b. Trim Finish: [As selected from manufacturer's full range of finishes][Polished brass][Antique brass][Satin chrome][Oil-rubbed bronze][Dark bronze][Painted white]<Insert finish>.
 - c. Cylinders: [Manufacturer's standard.][ANSI/BHMA A156.5, Grade 1.][As specified in Section 087100 "Door Hardware."][As specified in Section 087111 "Door Hardware (Descriptive Specification)."]
 3. Threshold Configuration: Extruded-aluminum [, **thermally broken,**] multitrack threshold with [raised, weather-resistant profile][low profile, compliant with United States Access Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines"]<Insert finish>[recessed flush profile][with concealed drainage system].
 - a. Aluminum Finish: [To match panel][Clear anodized][Dark bronze anodized].
- C. Lift-and-Slide Panel System: Provide panel support system designed for size, weight and performance requirements of multipanel sliding wood-framed glass doors indicated, capable of being adjusted for smooth operation and clearances without needing to remove panels from tracks.
 1. Bottom Carriers: Provide carrier system designed to roll on track within threshold, with overhead wheeled guide that engages upper track. Provide carriers with sealed ball bearings incorporating lift-and-slide mechanism operated by locking handle.
 2. Lock: Provide multipoint locking system on each door panel designed to unlock and raise panel from track, and engage bottom carrier. Provide exterior cylinder lock on primary panel. Provide [interior][and][exterior] finger pulls on each panel. Adjust locking device to allow unobstructed movement of the panel across adjacent panel in the direction indicated.

- a. Trim Design: **[As selected from manufacturer's full range]<Insert design>.**
 - b. Trim Finish: **[As selected from manufacturer's full range of finishes][Polished brass][Antique brass][Satin chrome][Oil-rubbed bronze][Dark bronze][Painted white]<Insert finish>.**
 - c. Cylinders: **[Manufacturer's standard.][ANSI/BHMA A156.5, Grade 1.][As specified in Section 087100 "Door Hardware."][As specified in Section 087111 "Door Hardware (Descriptive Specification)."]**
3. Threshold Configuration: Extruded aluminum [, **thermally broken,**] multitrack threshold with **[raised, weather-resistant profile][low profile, compliant with the United States Access Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines"]**[recessed flush] profile[with concealed drainage system].
 - a. Aluminum Finish: **[To match panel][Clear anodized][Dark bronze anodized].**
- D. Multitrack Top-Supported Panel System: Provide panel support system designed for size, weight, and performance requirements of multipanel sliding wood-framed glass doors indicated, capable of being adjusted for smooth operation and clearances without needing to remove panels from tracks.
 1. Overhead Carriers: Provide multiwheeled overhead carriers suspended from steel or aluminum track, with lower guide system engaged in threshold for smooth operation. Limit track deflection to no more than **[0.10 inch (2.54 mm)]<Insert dimension>** between supports when fully loaded. Provide carriers with sealed ball bearings.
 2. Lock: Provide manufacturer's standard keyed cylinder lock and multipoint locking device on primary door panel, lockable from the inside. Provide exterior cylinder lock on primary panel. Provide manufacturer's standard lock mechanism on each secondary door panel operable from the inside. Adjust locking device to allow unobstructed movement of the panel across adjacent panel in the direction indicated.
 - a. Trim Design: **[As selected from manufacturer's full range]<Insert design>.**
 - b. Trim Finish: **[As selected from manufacturer's full range of finishes][Polished brass][Antique brass][Satin chrome][Oil-rubbed bronze][Dark bronze][Painted white]<Insert finish>.**
 - c. Cylinders: **[Manufacturer's standard.][ANSI/BHMA A156.5, Grade 1.][As specified in Section 087100 "Door Hardware."][As specified in Section 087111 "Door Hardware (Descriptive Specification)."]**
 3. Threshold Configuration: Extruded-aluminum [, **thermally broken,**] threshold with **[raised, weather-resistant profile][low profile, compliant with the United States Access Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines"]**[recessed flush profile][with concealed drainage system].
 - a. Aluminum Finish: **[To match panel][Clear anodized][Dark bronze anodized].**
- E. Single-Track Top-Supported Panel System: Provide panel support system designed for size, weight and performance requirements of multipanel sliding wood-framed glass doors indicated, capable of being adjusted for smooth operation and clearances without needing to remove panels from tracks.
 1. Overhead Carriers: Provide overhead carriers suspended from steel or aluminum track, with lower guide system engaged in threshold for smooth operation. Limit track deflection to no more than **[0.10 inch (2.54 mm)]<Insert dimension>** between supports when fully loaded. Provide carriers with sealed ball bearings.
 2. Stacking Track System: Provide intersections, switches, and accessories required for operation, storage, track configuration, and layout indicated for multipanel sliding wood-framed glass doors. Fabricate track intersections and switches from steel or aluminum.

3. Lock: Provide manufacturer's standard multipoint locking device on each movable panel, lockable from the inside. Provide exterior cylinder lock on primary panel. Adjust locking device to allow unobstructed movement of the panel across adjacent panel in the direction indicated.
 - a. Trim Design: **[As selected from manufacturer's full range]<Insert design>.**
 - b. Trim Finish: **[As selected from manufacturer's full range of finishes][Polished brass][Antique brass][Satin chrome][Oil-rubbed bronze][Dark bronze][Painted white]<Insert finish>.**
 - c. Cylinders: **[Manufacturer's standard.][ANSI/BHMA A156.5, Grade 1.][As specified in Section 087100 "Door Hardware."][As specified in Section 087111 "Door Hardware (Descriptive Specification)."]**
4. Threshold Configuration: Extruded-aluminum [, **thermally broken,**] threshold with [**raised, weather-resistant profile**][**low profile, compliant with the United States Access Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines"**][**recessed flush**][**with concealed drainage system**].
 - a. Aluminum Finish: **[To match panel][Clear anodized][Dark bronze anodized].**

2.5 ACCESSORIES

- A. Trim: Provide interior and exterior casings, jamb extensions, and other components in material and finish to match door frames.
- B. Fasteners: Noncorrosive and compatible with door members, trim, hardware, anchors, and other components.
 1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.
- C. Anchors, Clips, and Accessories: Provide anchors, clips, and accessories of aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron for multipanel sliding wood-framed glass doors, complying with ASTM B456 or ASTM B633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
 1. Windborne-Debris Resistance: Provide anchors of same design used in windborne-debris resistance testing.

2.6 INSECT SCREENS

- A. Screen Fabric: Provide screen mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration; and complying with ASTM D3656/D3656M.
 1. Fabric Color: **[Manufacturer's standard][Charcoal gray][Silver gray]<Insert color>.**
- B. Pleated Insect Screen: Screen suspended from the top, with bottom guide, and finish **[to match exterior door face][as selected from manufactures' standard colors]**. Provide single- or two-function operation with screen meeting rails at same location as primary entrance of door.
- C. Coiling Insect Screen: Coiling screen housed in jamb-mounted cartridge, guided by upper and lower tracks. Finish **[to match exterior door face][as selected from manufactures' standard colors]**. Provide single- or two-function operation with screen meeting rails at same location as primary entrance of door.

2.7 FABRICATION

- A. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.
- B. Factory-Glazed Fabrication: Glaze sliding wood-framed glass doors in the factory.

2.8 GENERAL FINISH REQUIREMENTS

- A. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - 1. Color: **[Light bronze][Medium bronze][Dark bronze][Champagne][Black][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603, except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- D. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with **[AAMA 2604][AAMA 2605]** and containing not less than **[50][70]** percent PVDF resin by weight in color coat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- E. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- F. Superior-Performance Organic Finish, Four-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.

- G. Superior Performance Organic Finish, Single-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- H. Superior Performance Organic Finish, Two-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

2.10 WOOD FINISHES

- A. Factory-Applied Primer: Provide manufacturer's standard factory-applied prime coat complying with WDMA T.M. 11. **<Insert specific requirements for factory-applied prime coat if any>** on exposed **[exterior][and][interior]** wood surfaces.
- B. Factory-Applied Color Finish: Provide manufacturer's standard factory-applied finish **[complying with WDMA T.M. 12]<Insert manufacturer's standard finish>**. Apply finish to exposed **[exterior][and][interior]** wood surfaces.
 - 1. Color: **[White][Brown][Gray][As selected by Architect from manufacturer's full range]<Insert color>.**

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of Work.
- B. Verify rough opening dimensions, levelness of threshold substrate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight hinged door installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing multipanel sliding wood-framed glass doors, hardware, accessories, and other components.
- B. Windborne-Debris Resistance: Anchor multipanel sliding wood-framed glass doors that have been tested for windborne-debris resistance to structure, using anchoring method, fastener type, and

fastening frequency identical to that used in windborne-debris resistance testing.

- C. Install multipanel sliding wood-framed glass doors level, plumb, square, true to line; without distortion, warp, or rack of frames and panels, and without impeding thermal movement; anchored securely in place to structural support; and in proper relation to wall flashing, vapor retarders, air barriers, water/weather barriers, and other adjacent construction.
- D. Set threshold members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.
- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
 - 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing Services: Test and inspect installed multipanel sliding wood-framed glass doors as follows:
 - 1. Testing Methodology: Test multipanel sliding wood-framed glass doors for air infiltration and water resistance in accordance with AAMA 502.
 - 2. Air-Infiltration Testing:
 - a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
 - b. Allowable Air-Leakage Rate: **[1.5]<Insert number>** times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
 - 3. Water-Resistance Testing:
 - a. Test Pressure: **[Two-thirds]<Insert number>** times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
 - b. Allowable Water Infiltration: No water penetration.
 - 4. Testing Extent: **[Three][Three mockup]<Insert number or description>** multipanel sliding wood-framed glass doors of each type as selected by Architect and a qualified independent testing and inspecting agency. Conduct tests after perimeter sealants have cured.
 - 5. Test Reports: Prepared in accordance with AAMA 502.
- C. Multipanel sliding wood-framed glass door will be considered defective if it does not pass tests and inspections.

3.4 ADJUSTING

- A. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.

- B. Adjust hardware and operable panels to function smoothly, and lubricate as recommended by manufacturer.

3.5 CLEANING

- A. Clean exposed surfaces immediately after installation. Avoid damaging protective coatings and finishes. Remove nonpermanent labels, excess sealants, glazing materials, dirt, and other substances.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

3.6 PROTECTION

- A. Protect multipanel sliding wood-framed glass door surfaces from contact with contaminating substances resulting from construction operations. Remove contaminants immediately in accordance with manufacturer's written instructions.
- B. Refinish or replace sliding wood-framed glass doors with damaged finishes.

END OF SECTION 08 18 16 00C

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SECTION 08 31 13 00 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flush access doors with exposed flanges.
2. Flush access doors with concealed flanges.
3. Recessed access doors with exposed flanges.
4. Recessed access doors with concealed flanges.
5. Aluminum flush access doors.
6. Lightweight flush access doors.
7. Exterior flush access doors.
8. Interior flush GFRG access doors with concealed flanges.
9. Exterior flush GFRG access doors with concealed flanges.
10. Fire-rated access doors with exposed flanges.
11. Fire-rated access doors with concealed flanges.

B. Related Requirements:

1. Section 077200 "Roof Accessories" for roof hatches.
2. Section 083113.53 "Security Access Doors and Frames" for access doors and frames for security applications.
3. Section 083123 "Floor Doors" for doors installed in floors.
4. Section 233300 "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.2 ALLOWANCES

- A. See Section 012100 "Allowances" for description of allowances affecting items specified in this Section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, [**fire ratings,**] material descriptions, dimensions of individual components and profiles, and finishes.

- B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum **6 by 6 inches (150 by 150 mm)** in size.

- C. Product Schedule: For access doors and frames. [**Use same designations indicated on Drawings.**]

1.4 INFORMATIONAL SUBMITTALS

- A. Field Quality Control Reports: For fire-rated door inspections.
- B. Qualification Statements: For testing and inspecting agency.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
2. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

1.5 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

1.6 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies complies with the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection [**and temperature-rise limit**] ratings indicated, in accordance with NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Exposed Flanges :
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :**
 - a. **[ACUDOR Products, Inc]**
 - b. **[Babcock-Davis]**
 - c. **[Best Access Doors]**
 - d. **[Cendrex Inc.]**
 - e. **[Elmdor; Morris Group International, Inc.]**
 - f. **[JL Industries; Activar Construction Products Group, Inc.]**
 - g. **[Karp Associates, Inc]**
 - h. **[Lane-Aire Manufacturing Corp.]**
 - i. **[Larsen's Manufacturing Company]**
 - j. **[Maxam Metal Products Limited]**
 - k. **[Metropolitan Door Industries Corp.]**
 - l. **[MIFAB, Inc]**
 - m. **[Milcor by Duravent; Duravent Group.]**
 - n. **[Nystrom, Inc.]**
 - o. **[Williams Brothers Corporation of America]**
 - p. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ACUDOR Products, Inc]**
 - b. **[Babcock-Davis]**
 - c. **[Best Access Doors]**
 - d. **[Cendrex Inc.]**
 - e. **[Elmdor; Morris Group International, Inc.]**
 - f. **[JL Industries; Activar Construction Products Group, Inc.]**
 - g. **[Karp Associates, Inc]**
 - h. **[Lane-Aire Manufacturing Corp.]**
 - i. **[Larsen's Manufacturing Company]**
 - j. **[Maxam Metal Products Limited]**
 - k. **[Metropolitan Door Industries Corp.]**
 - l. **[MIFAB, Inc]**
 - m. **[Milcor by Duravent; Duravent Group.]**
 - n. **[Nystrom, Inc.]**
 - o. **[Williams Brothers Corporation of America]**
 - p. **<Insert manufacturer's name>**
3. Description: Face of door flush with frame, with exposed flange and concealed hinge.
4. Optional Features: **[Gasketing][Double-leaf doors][Piano hinges][Louvers][Masonry anchors][Removable doors]<Insert feature>** .
5. Locations: **[Wall][Ceiling][Wall and ceiling]<Insert location or substrate>** .
6. Door Size: **<Insert door size>** .
7. Uncoated Steel Sheet for Door: **[Nominal 0.060 inch (1.52 mm), 16 gage]<Insert thickness>** , factory **[primed][finished]** .
8. Metallic-Coated Steel Sheet for Door: **[Nominal 0.064 inch (1.63 mm), 16 gage]<Insert thickness>** , factory **[primed][finished]** .
9. Stainless Steel Sheet for Door: **[Nominal 0.062 inch (1.59 mm), 16 gage]<Insert thickness>** , ASTM A480/A480M No. 4 finish.
10. Frame Material: **[Same material, thickness, and finish as door]<Insert material, thickness, and finish>** .
11. Latch and Lock: **[Cam latch, screwdriver operated][Cam latch, key operated][Cam latch, hex-head wrench operated][Cam latch, pinned-hex-head wrench operated][Cam latch, spanner-head wrench operated][Latch bolt, knurled-knob operated][Latch bolt, key operated][Prepared for mortise cylinder][As indicated on Drawings][As indicated in schedule]<Insert operator>[; with interior release]** .

B. Flush Access Doors with Concealed Flanges :

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
 - a. **[ACUDOR Products, Inc]**
 - b. **[Babcock-Davis]**
 - c. **[Bauco Access Panel Solutions Inc.]**
 - d. **[Best Access Doors]**
 - e. **[Cendrex Inc.]**
 - f. **[Elmdor; Morris Group International, Inc.]**
 - g. **[JL Industries; Activar Construction Products Group, Inc.]**
 - h. **[Karp Associates, Inc]**
 - i. **[Lane-Aire Manufacturing Corp.]**

- j. [Larsen's Manufacturing Company]
 - k. [Maxam Metal Products Limited]
 - l. [Metropolitan Door Industries Corp.]
 - m. [MIFAB, Inc]
 - n. [Milcor by Duravent; Duravent Group.]
 - o. [Nystrom, Inc.]
 - p. [Williams Brothers Corporation of America]
 - q. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [ACUDOR Products, Inc]
 - b. [Babcock-Davis]
 - c. [Bauco Access Panel Solutions Inc.]
 - d. [Best Access Doors]
 - e. [Cendrex Inc.]
 - f. [Elmdor; Morris Group International, Inc.]
 - g. [JL Industries; Activar Construction Products Group, Inc.]
 - h. [Karp Associates, Inc]
 - i. [Lane-Aire Manufacturing Corp.]
 - j. [Larsen's Manufacturing Company]
 - k. [Maxam Metal Products Limited]
 - l. [Metropolitan Door Industries Corp.]
 - m. [MIFAB, Inc]
 - n. [Milcor by Duravent; Duravent Group.]
 - o. [Nystrom, Inc.]
 - p. [Williams Brothers Corporation of America]
 - q. <Insert manufacturer's name>
3. Description: Face of door flush with frame; with concealed flange for [gypsum board][plaster] installation and concealed hinge.
4. Optional Features: [Gasketing][Double-leaf doors][Piano hinges][Louvers][Masonry anchors][Removable doors]<Insert feature> .
5. Locations: [Wall][Ceiling][Wall and ceiling]<Insert location or substrate> .
6. Door Size: <Insert door size> .
7. Uncoated Steel Sheet for Door: [Nominal 0.060 inch (1.52 mm), 16 gage]<Insert thickness> , factory [primed][finished] .
8. Metallic-Coated Steel Sheet for Door: [Nominal 0.064 inch (1.63 mm), 16 gage]<Insert thickness> factory [primed][finished] .
9. Stainless Steel Sheet for Door: [Nominal 0.062 inch (1.59 mm), 16 gage]<Insert thickness> , ASTM A480/A480M No. 4 finish.
10. Frame Material: [Same material and thickness as door]<Insert material, thickness, and finish> .
11. Latch and Lock: [Cam latch, screwdriver operated][Cam latch, key operated][Cam latch, hex-head wrench operated][Cam latch, pinned-hex-head wrench operated][Cam latch, spanner-head wrench operated][Latch bolt, knurled-knob operated][Latch bolt, key operated][Prepared for mortise cylinder][As indicated on Drawings][As indicated in schedule]<Insert operator>; with interior release] .
- C. Recessed Access Doors with Exposed Flanges :
- 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering

products that may be incorporated into the Work include, but are not limited to, the following] :

- a. [ACUDOR Products, Inc]
 - b. [Babcock-Davis]
 - c. [Cendrex Inc.]
 - d. [Elmdor; Morris Group International, Inc.]
 - e. [JL Industries; Activar Construction Products Group, Inc.]
 - f. [Karp Associates, Inc]
 - g. [Lane-Aire Manufacturing Corp.]
 - h. [Larsen's Manufacturing Company]
 - i. [Maxam Metal Products Limited]
 - j. [Metropolitan Door Industries Corp.]
 - k. [MIFAB, Inc]
 - l. [Nystrom, Inc.]
 - m. [Williams Brothers Corporation of America]
 - n. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [ACUDOR Products, Inc]
 - b. [Babcock-Davis]
 - c. [Cendrex Inc.]
 - d. [Elmdor; Morris Group International, Inc.]
 - e. [JL Industries; Activar Construction Products Group, Inc.]
 - f. [Karp Associates, Inc]
 - g. [Lane-Aire Manufacturing Corp.]
 - h. [Larsen's Manufacturing Company]
 - i. [Maxam Metal Products Limited]
 - j. [Metropolitan Door Industries Corp.]
 - k. [MIFAB, Inc]
 - l. [Nystrom, Inc.]
 - m. [Williams Brothers Corporation of America]
 - n. <Insert manufacturer's name>
3. Description: Door face recessed [1/2 inch (13 mm)][5/8 inch (16 mm)][1 inch (25 mm)] for [gypsum board][plaster][acoustical tile]<Insert material> infill, with exposed flange and concealed hinge.
4. Optional Features: [Gasketing][Double-leaf doors][Piano hinges][Louvers][Masonry anchors][Removable doors]<Insert feature> .
5. Locations: [Wall][Ceiling][Wall and ceiling]<Insert location or substrate> .
6. Door Size: <Insert door size> .
7. Uncoated Steel Sheet for Door: [Nominal 0.060 inch (1.52 mm), 16 gage]<Insert thickness> , factory [primed][finished] .
8. Metallic-Coated Steel Sheet for Door: [Nominal 0.064 inch (1.63 mm), 16 gage]<Insert thickness> , factory [primed][finished] .
9. Stainless Steel Sheet for Door: [Nominal 0.062 inch (1.59 mm), 16 gage]<Insert thickness> , ASTM A480/A480M No. 4 finish.
10. Frame Material: [Same material and thickness as door]<Insert material, thickness, and finish> .
11. Latch and Lock: [Cam latch, screwdriver operated][Cam latch, key operated][Cam latch, hex-head wrench operated][Cam latch, pinned-hex-head wrench operated][Cam latch, spanner-head wrench operated][Latch bolt, knurled-knob operated][Latch bolt, key operated][Prepared for mortise cylinder][As indicated on Drawings][As indicated in

schedule]<Insert operator>[; with interior release] .

D. Recessed Access Doors with Concealed Flanges :

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :**
 - a. **[ACUDOR Products, Inc]**
 - b. **[Babcock-Davis]**
 - c. **[Bauco Access Panel Solutions Inc.]**
 - d. **[Best Access Doors]**
 - e. **[Cendrex Inc.]**
 - f. **[Elmdor; Morris Group International, Inc.]**
 - g. **[JL Industries; Activar Construction Products Group, Inc.]**
 - h. **[Karp Associates, Inc]**
 - i. **[Lane-Aire Manufacturing Corp.]**
 - j. **[Larsen's Manufacturing Company]**
 - k. **[Maxam Metal Products Limited]**
 - l. **[Metropolitan Door Industries Corp.]**
 - m. **[MIFAB, Inc]**
 - n. **[Milcor by Duravent; Duravent Group.]**
 - o. **[Nystrom, Inc.]**
 - p. **[Williams Brothers Corporation of America]**
 - q. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ACUDOR Products, Inc]**
 - b. **[Babcock-Davis]**
 - c. **[Bauco Access Panel Solutions Inc.]**
 - d. **[Best Access Doors]**
 - e. **[Cendrex Inc.]**
 - f. **[Elmdor; Morris Group International, Inc.]**
 - g. **[JL Industries; Activar Construction Products Group, Inc.]**
 - h. **[Karp Associates, Inc]**
 - i. **[Lane-Aire Manufacturing Corp.]**
 - j. **[Larsen's Manufacturing Company]**
 - k. **[Maxam Metal Products Limited]**
 - l. **[Metropolitan Door Industries Corp.]**
 - m. **[MIFAB, Inc]**
 - n. **[Milcor by Duravent; Duravent Group.]**
 - o. **[Nystrom, Inc.]**
 - p. **[Williams Brothers Corporation of America]**
 - q. **<Insert manufacturer's name>**
3. Description: Door face recessed **[1/2 inch (13 mm)][5/8 inch (16 mm)][1 inch (25 mm)]** for **[gypsum board][plaster][acoustical tile]<Insert material>** infill; with concealed flange for **[gypsum board][plaster][no bead for acoustical tile]** installation and concealed hinge.
4. Optional Features: **[Gasketing][Double-leaf doors][Piano hinges][Louvers][Masonry anchors][Removable door]<Insert feature>** .
5. Locations: **[Wall][Ceiling][Wall and ceiling]<Insert location or substrate>** .

6. Door Size: <Insert door size> .
7. Uncoated Steel Sheet for Door: [Nominal 0.060 inch (1.52 mm), 16 gage]<Insert thickness> , factory [primed][finished] .
8. Metallic-Coated Steel Sheet for Door: [Nominal 0.064 inch (1.63 mm), 16 gage]<Insert thickness> , factory [primed][finished] .
9. Stainless Steel Sheet for Door: [Nominal 0.062 inch (1.59 mm), 16 gage]<Insert thickness> , [ASTM A480/A480M No. 4][ASTM A480/A480M No. 2b] finish.
10. Latch and Lock: [Cam latch, screwdriver operated][Cam latch, key operated][Cam latch, hex-head wrench operated][Cam latch, pinned-hex-head wrench operated][Cam latch, spanner-head wrench operated][Latch bolt, knurled-knob operated][Latch bolt, key operated][Prepared for mortise cylinder][As indicated on Drawings][As indicated in schedule]<Insert operator>[; with interior release] .

E. Aluminum Flush Access Doors :

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [ACUDOR Products, Inc]
 - b. [Babcock-Davis]
 - c. [Best Access Doors]
 - d. [Cendrex Inc.]
 - e. [Lane-Aire Manufacturing Corp.]
 - f. [Metropolitan Door Industries Corp.]
 - g. [MIFAB, Inc]
 - h. [Milcor by Duravent; Duravent Group.]
 - i. [Williams Brothers Corporation of America]
 - j. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [ACUDOR Products, Inc]
 - b. [Babcock-Davis]
 - c. [Best Access Doors]
 - d. [Cendrex Inc.]
 - e. [Lane-Aire Manufacturing Corp.]
 - f. [Metropolitan Door Industries Corp.]
 - g. [MIFAB, Inc]
 - h. [Milcor by Duravent; Duravent Group.]
 - i. [Williams Brothers Corporation of America]
 - j. <Insert manufacturer's name>
3. Description: Face of door flush with frame, with exposed flange and concealed hinge.
4. Optional Features: [Gasketing][Double-leaf doors][Piano hinges][Louvers][Masonry anchors][Removable doors]<Insert feature> .
5. Locations: [Wall][Ceiling][Wall and ceiling]<Insert location or substrate> .
6. Door Size: <Insert door size> .
7. Aluminum Sheet for Door: [Nominal 0.045 inch (1.15 mm)]<Insert thickness> , with [mill][manufacturer's standard baked-enamel or powder-coat] finish.
8. Frame Material: [Same material, thickness, and finish as door]<Insert material, thickness, and finish> .
9. Latch and Lock: [Cam latch, screwdriver operated][Cam latch, key operated][Cam latch, hex-

head wrench operated][Cam latch, pinned-hex-head wrench operated][Cam latch, spanner-head wrench operated][Latch bolt, knurled-knob operated][Latch bolt, key operated][Prepared for mortise cylinder][As indicated on Drawings][As indicated in schedule]<Insert operator>[; with interior release] .

F. Lightweight Flush Access Doors :

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [ACUDOR Products, Inc]
 - b. [Babcock-Davis]
 - c. [Cendrex Inc.]
 - d. [JL Industries; Activar Construction Products Group, Inc.]
 - e. [Karp Associates, Inc]
 - f. [Larsen's Manufacturing Company]
 - g. [Maxam Metal Products Limited]
 - h. [Metropolitan Door Industries Corp.]
 - i. [MIFAB, Inc]
 - j. [Nystrom, Inc.]
 - k. [Williams Brothers Corporation of America]
 - l. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [ACUDOR Products, Inc]
 - b. [Babcock-Davis]
 - c. [Cendrex Inc.]
 - d. [JL Industries; Activar Construction Products Group, Inc.]
 - e. [Karp Associates, Inc]
 - f. [Larsen's Manufacturing Company]
 - g. [Maxam Metal Products Limited]
 - h. [Metropolitan Door Industries Corp.]
 - i. [MIFAB, Inc]
 - j. [Nystrom, Inc.]
 - k. [Williams Brothers Corporation of America]
 - l. <Insert manufacturer's name>
3. Description: Face of door flush with exposed flange, with exposed piano hinge; frameless for surface installation.
4. Optional Features: [Gasketing][Double-leaf doors][Piano hinges][Louvers][Masonry anchors][Removable door]<Insert feature> .
5. Locations: [Wall][Ceiling][Wall and ceiling]<Insert location or substrate> .
6. Door Size: <Insert door size> .
7. Uncoated Steel Sheet for Door: [Nominal 0.018 inch (0.46 mm), 26 gage]<Insert thickness> , factory [primed][finished] .
8. Metallic-Coated Steel Sheet for Door: [Nominal 0.022 inch (0.56 mm), 26 gage]<Insert thickness> , factory [primed][finished] .
9. Frame Material: [Aluminum, nominal 0.045 inch (1.15 mm), mill finish]<Insert material, thickness, and finish> .
10. Latch and Lock: [Cam latch, screwdriver operated][Cam latch, key operated][Cam latch, hex-

head wrench operated][Cam latch, pinned-hex-head wrench operated][Cam latch, spanner-head wrench operated][Latch bolt, knurled-knob operated][Latch bolt, key operated][Prepared for mortise cylinder][As indicated on Drawings][As indicated in schedule]<Insert operator>[; with interior release] .

G. Exterior Flush Access Doors :

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [Babcock-Davis]
 - b. [JL Industries; Activar Construction Products Group, Inc.]
 - c. [Karp Associates, Inc]
 - d. [Larsen's Manufacturing Company]
 - e. [Maxam Metal Products Limited]
 - f. [MIFAB, Inc]
 - g. [Nystrom, Inc.]
 - h. [Williams Brothers Corporation of America]
 - i. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Babcock-Davis]
 - b. [JL Industries; Activar Construction Products Group, Inc.]
 - c. [Karp Associates, Inc]
 - d. [Larsen's Manufacturing Company]
 - e. [Maxam Metal Products Limited]
 - f. [MIFAB, Inc]
 - g. [Nystrom, Inc.]
 - h. [Williams Brothers Corporation of America]
 - i. <Insert manufacturer's name>
3. Description: Weatherproof assembly, with face of door fit flush with frame and with exposed frame. Include extruded door gaskets and minimum **2-inch- (50-mm-)** thick fiberglass insulation.
4. Optional Features: [Piano hinges][Removable doors]<Insert feature> .
5. Locations: [Wall]<Insert location or substrate> .
6. Door Size: <Insert door size> .
7. Metallic-Coated Steel Sheet for Door: [Nominal 0.064 inch (1.63 mm), 16 gage]<Insert thickness> , factory [primed][finished] .
8. Aluminum Sheet for Door: [Nominal 0.045 inch (1.15 mm)]<Insert thickness> , with [mill][manufacturer's standard baked-enamel or powder-coat] finish.
9. Stainless Steel Sheet for Door: [Nominal 0.062 inch (1.59 mm), 16 gage]<Insert thickness> , [ASTM A480/A480M No. 4][ASTM A480/A480M No. 2b] finish.
10. Frame Material: [Same material, thickness, and finish as door]<Insert material, thickness, and finish> .
11. Latch and Lock: Cam latch operated by handle, [without lock][with keyed lock in handle][with separate mortise lock][with preparation for mortise lock][as indicated on Drawings][as indicated in schedule]<Insert operator>[; with interior release] .

H. Interior Flush GFRG Access Doors with Concealed Flanges :

1. Manufacturers: Subject to compliance with requirements, [provide products by the

following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :

- a. [ACUDOR Products, Inc]
- b. [Babcock-Davis]
- c. [Best Access Doors]
- d. [Cendrex Inc.]
- e. [Elmdor; Morris Group International, Inc.]
- f. [JL Industries; Activar Construction Products Group, Inc.]
- g. [Karp Associates, Inc]
- h. [MIFAB, Inc]
- i. [Milcor by Duravent; Duravent Group.]
- j. [Williams Brothers Corporation of America]
- k. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [ACUDOR Products, Inc]
- b. [Babcock-Davis]
- c. [Best Access Doors]
- d. [Cendrex Inc.]
- e. [Elmdor; Morris Group International, Inc.]
- f. [JL Industries; Activar Construction Products Group, Inc.]
- g. [Karp Associates, Inc]
- h. [MIFAB, Inc]
- i. [Milcor by Duravent; Duravent Group.]
- j. [Williams Brothers Corporation of America]
- k. <Insert manufacturer's name>

- 3. Description: Face of [drop-in][concealed-hinge] door flush with frame, with concealed flange for gypsum board installation.
- 4. Optional Features: [Gasketing][Piano hinges]<Insert feature> .
- 5. Locations: [Wall][Ceiling][Wall and ceiling]<Insert location or substrate> .
- 6. Door Size: <Insert door size> .
- 7. Door Type [Drop in, radius corner][Drop in, square corner][Concealed-hinge, radius corner][Concealed-hinge, square corner] .
- 8. Door and Frame Material: Unpainted glass-fiber-reinforced gypsum, with frames reinforced for hardware and fastenings.
- 9. Latch and Lock: [Cam latch, screwdriver operated][Cam latch, key operated][As indicated on Drawings][As indicated in schedule]<Insert operator> .

I. Exterior Flush GFRC Access Doors with Concealed Flanges :

- 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following] :
 - a. [ACUDOR Products, Inc]
 - b. [JL Industries; Activar Construction Products Group, Inc.]
 - c. [Karp Associates, Inc]
 - d. [MIFAB, Inc]

- e. **[Milcor by Duravent; Duravent Group.]**
 - f. **[Williams Brothers Corporation of America]**
 - g. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[ACUDOR Products, Inc]**
 - b. **[JL Industries; Activar Construction Products Group, Inc.]**
 - c. **[Karp Associates, Inc]**
 - d. **[MIFAB, Inc]**
 - e. **[Milcor by Duravent; Duravent Group.]**
 - f. **[Williams Brothers Corporation of America]**
 - g. **<Insert manufacturer's name>**
3. Description: Face of door flush with frame, neoprene gasketed, with concealed flange for gypsum board installation.
4. Optional Features: **[Piano hinges]<Insert feature>** .
5. Locations: **[Wall][Ceiling][Wall and ceiling]<Insert location or substrate>** .
6. Door Size: **<Insert door size>** .
7. Door Type: **[Drop in, radius corner][Drop in, square corner][Concealed-hinge, radius corner][Concealed-hinge, square corner]** .
8. Door and Frame Material: Unpainted glass-fiber-reinforced cement, with frames reinforced for hardware and fastenings.
9. Latch and Lock: **[Cam latch, screwdriver operated][Cam latch, key operated][Cam latch, hex-head wrench operated][Cam latch, pinned-hex-head wrench operated][As indicated on Drawings][As indicated in schedule]<Insert operator>** .

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

A. Fire-Rated Access Doors with Exposed Flanges :

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]** :
- a. **[ACUDOR Products, Inc]**
 - b. **[Babcock-Davis]**
 - c. **[Best Access Doors]**
 - d. **[Cendrex Inc.]**
 - e. **[Elmdor; Morris Group International, Inc.]**
 - f. **[JL Industries; Activar Construction Products Group, Inc.]**
 - g. **[Karp Associates, Inc]**
 - h. **[Lane-Aire Manufacturing Corp.]**
 - i. **[Larsen's Manufacturing Company]**
 - j. **[Maxam Metal Products Limited]**
 - k. **[Metropolitan Door Industries Corp.]**
 - l. **[MIFAB, Inc]**
 - m. **[Milcor by Duravent; Duravent Group.]**
 - n. **[Nystrom, Inc.]**
 - o. **[Williams Brothers Corporation of America]**
 - p. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ACUDOR Products, Inc]**
 - b. **[Babcock-Davis]**
 - c. **[Best Access Doors]**
 - d. **[Cendrex Inc.]**
 - e. **[Elmdor; Morris Group International, Inc.]**
 - f. **[JL Industries; Activar Construction Products Group, Inc.]**
 - g. **[Karp Associates, Inc]**
 - h. **[Lane-Aire Manufacturing Corp.]**
 - i. **[Larsen's Manufacturing Company]**
 - j. **[Maxam Metal Products Limited]**
 - k. **[Metropolitan Door Industries Corp.]**
 - l. **[MIFAB, Inc]**
 - m. **[Milcor by Duravent; Duravent Group.]**
 - n. **[Nystrom, Inc.]**
 - o. **[Williams Brothers Corporation of America]**
 - p. **<Insert manufacturer's name>**
 3. Description: Door flush with frame [, **with a core of mineral-fiber insulation enclosed in sheet metal**][, **uninsulated**] ; with exposed flange, self-closing door, and concealed hinge.
 4. Door Type:
 - a. Flush.
 - b. Recessed [**1/2 inch (13 mm)**][**5/8 inch (16 mm)**][**1 inch (25 mm)**] for [**gypsum board**][**plaster**][**acoustical tile**]**<Insert material>** .
 5. Optional Features: [**Upward-opening doors for ceilings**][**Gasketing**][**Double-leaf doors**][**Piano hinges**][**Masonry anchors**]**<Insert feature>** .
 6. Locations: [**Wall**][**Ceiling**][**Wall and ceiling**]**<Insert location or substrate>** .
 7. Door Size: **<Insert door size>** .
 8. Fire-Resistance Rating: Not less than [**that indicated**][**that of adjacent construction**][**45 minutes**][**1 hour**][**1-1/2 hours**][**2 hours**][**3 hours**]**<Insert requirement>** .
 9. Temperature-Rise Rating: [**450 deg F (250 deg C)**][**250 deg F (139 deg C)**] at the end of 30 minutes.
 10. Uncoated Steel Sheet for Door: [**Nominal 0.036 inch (0.91 mm), 20 gage**]**<Insert thickness>** , factory [**primed**][**finished**] .
 11. Metallic-Coated Steel Sheet for Door: [**Nominal 0.040 inch (1.02 mm), 20 gage**]**<Insert thickness>** , factory [**primed**][**finished**] .
 12. Stainless Steel Sheet for Door: [**Nominal 0.038 inch (0.95 mm), 20 gage**]**<Insert thickness>** , ASTM A480/A480M No. 4 finish.
 13. Frame Material: [**Same material, thickness, and finish as door**]**<Insert material, thickness, and finish>** .
 14. Latch and Lock: Self-latching door hardware, [**operated by knurled-knob**][**operated by key**][**prepared for mortise cylinder**][**as indicated on Drawings**][**as indicated in schedule**]**<Insert operator>**[; with interior release] .
- B. Fire-Rated Access Doors with Concealed Flanges :
1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**] :

- a. **[ACUDOR Products, Inc]**
 - b. **[Babcock-Davis]**
 - c. **[Best Access Doors]**
 - d. **[Cendrex Inc.]**
 - e. **[JL Industries; Activar Construction Products Group, Inc.]**
 - f. **[Karp Associates, Inc]**
 - g. **[Maxam Metal Products Limited]**
 - h. **[Metropolitan Door Industries Corp.]**
 - i. **[MIFAB, Inc]**
 - j. **[Milcor by Duravent; Duravent Group.]**
 - k. **[Nystrom, Inc.]**
 - l. **[Williams Brothers Corporation of America]**
 - m. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ACUDOR Products, Inc]**
 - b. **[Babcock-Davis]**
 - c. **[Best Access Doors]**
 - d. **[Cendrex Inc.]**
 - e. **[JL Industries; Activar Construction Products Group, Inc.]**
 - f. **[Karp Associates, Inc]**
 - g. **[Maxam Metal Products Limited]**
 - h. **[Metropolitan Door Industries Corp.]**
 - i. **[MIFAB, Inc]**
 - j. **[Milcor by Duravent; Duravent Group.]**
 - k. **[Nystrom, Inc.]**
 - l. **[Williams Brothers Corporation of America]**
 - m. **<Insert manufacturer's name>**
3. Description: Door flush with frame, **[with a core of mineral-fiber insulation enclosed in sheet metal][uninsulated]** ; with concealed flange for **[gypsum board][plaster]** installation, self-closing door, and concealed hinge.
4. Door Type:
 - a. Flush.
 - b. Recessed **[1/2 inch (13 mm)][5/8 inch (16 mm)][1 inch (25 mm)]** for **[gypsum board][plaster][acoustical tile]<Insert material>** .
5. Optional Features: **[Upward-opening doors for ceilings][Gasketing][Double-leaf doors][Piano hinges][Masonry anchors]<Insert feature>** .
6. Locations: **[Wall][Ceiling][Wall and ceiling]<Insert location or substrate>** .
7. Door Size: **<Insert door size>** .
8. Fire-Resistance Rating: Not less than **[that indicated][that of adjacent construction][45 minutes][1 hour][1-1/2 hours][2 hours][3hours]<Insert requirement>** .
9. Temperature-Rise Rating: **[450 deg F (250 deg C)][250 deg F (139 deg C)]** at the end of 30 minutes.
10. Uncoated Steel Sheet for Door: **[Nominal 0.036 inch (0.91 mm), 20 gage]<Insert thickness>** , factory **[primed][finished]** .
11. Metallic-Coated Steel Sheet for Door: **[Nominal 0.040 inch (1.02 mm), 20 gage]<Insert thickness>** , factory **[primed][finished]** .
12. Stainless Steel Sheet for Door: **[Nominal 0.038 inch (0.95 mm), 20 gage]<Insert thickness>** , ASTM A480/A480M No. 4 finish.
13. Frame Material: **[Same material, thickness, and finish as door]<Insert material, thickness,**

and finish> .

14. Latch and Lock: Self-closing, self-latching door hardware, **[operated by knurled-knob][operated by key][prepared for mortise cylinder][as indicated on Drawings][as indicated in schedule]<Insert operator>[; with interior release] .**

2.4 Recessed Access Doors with Concealed Flanges, Aluminum

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

1. **<Insert manufacturer's name>**

2.5 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum **G60 (Z180)** or **A60 (ZF180)** metallic coating.
- D. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, **[Type 304][Type 316]** . Remove tool and die marks and stretch lines, or blend into finish.
- E. Stainless Steel Flat Bars: ASTM A666, **[Type 304][Type 316]** . Remove tool and die marks and stretch lines, or blend into finish.
- F. Aluminum Extrusions: **ASTM B221 (ASTM B221M)**, Alloy 6063.
- G. Aluminum Sheet: ASTM B209/B209M, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- H. Frame Anchors: Same material as door face.
- I. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.

2.6 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices, and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
 2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.
1. For recessed doors with plaster infill, provide self-furring expanded-metal lath attached to door panel.
- E. Latch and Lock Hardware:
1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
 2. Keys: Furnish two keys per lock and key all locks alike.
 3. Mortise Cylinder Preparation: Where indicated, prepare door panel to accept cylinder specified in **[Section 087100 "Door Hardware."][Section 087111 "Door Hardware (Descriptive Specification)."]**
- F. Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

2.7 FINISHES

- A. Comply with NAAMM/NOMMA AMP 500 for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
 2. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of **1 mil (0.025 mm)** for topcoat.
 - a. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from full range of industry colors]<Insert color> .**
- E. Stainless Steel Finishes:
1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 2. Polished Finish: ASTM A480/A480M No. 4 finish. Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

3. Bright, Cold-Rolled, Unpolished Finish: ASTM A480/A480M No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ACCESS DOORS AND FRAMES

- A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: **[Owner will engage][Engage]** a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, Section 5.2.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in **[NFPA 80][and][NFPA 101]** .

3.4 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 31 13 00

SECTION 08 33 13 00 - COILING COUNTER DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Counter door assemblies.
2. Fire-rated counter door assemblies.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for door-opening framing and corner guards.
2. Section 099123 "Interior Painting" for finish painting of factory-primed doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of coiling counter door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
3. Include description of automatic closing device and testing and resetting instructions.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Show locations of controls, locking devices[, **detectors or replaceable fusible links**], and other accessories.
5. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1. Curtain slats[, **including full vision window secured to slat**].
2. Bottom bar[**with sensor edge**].
3. Guides.
4. Brackets.
5. Hood.

6. Laminate-clad counter panel product for each type, color, pattern, and surface finish; laminated to core.
7. Locking device(s).
8. Include similar Samples of accessories involving color selection.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[Installer][and][testing and inspecting agency]**.
 1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, section 5.2.3.1.
 2. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.
- B. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For coiling counter doors to include in maintenance manuals.
- B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
 1. Maintenance Proximity: Not more than **[two]<Insert number>** hours' normal travel time from Installer's place of business to Project site.
- B. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies is to meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:
 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain coiling counter doors from single source from single manufacturer.
 1. Obtain operators and controls from coiling counter door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Complying with NFPA 80; listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to **[NFPA 252][or][UL 10B]**.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 2. Temperature-Rise Limit: **[Where indicated][At exit enclosures and exit passageways]**, provide doors that have a maximum transmitted temperature end point of not more than **450 deg F (250 deg C)** above ambient after 30 minutes of standard fire-test exposure.
 3. Smoke Control: **[Where indicated][In corridors and smoke barriers]**, provide doors that are listed and labeled with the letter "S" on the fire-rating label by a qualified testing agency for smoke- and draft-control based on testing according to UL 1784; with maximum air-leakage rate of **3.0 cfm/sq. ft. (0.01524 cu. m/s x sq. m)** of door opening at **0.10 inch wg (24.9 Pa)** for both ambient and elevated temperature tests.
- B. Sound-Control Doors: Assemblies tested in a laboratory for sound-transmission-loss performance according to ASTM E90, calculated according to ASTM E413, and rated for not less than the STC value indicated.

2.3 COUNTER DOOR ASSEMBLY

- A. Counter Door: Coiling counter door formed with curtain of interlocking metal slats.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ACME Rolling Doors]**
 - b. **[Alpine Overhead Doors, Inc]**
 - c. **[Alumatec Pacific Products]**
 - d. **[Amarr Company]**
 - e. **[ASTA America; Janus International Group]**
 - f. **[C.H.I. Overhead Doors, Inc.]**
 - g. **[City Gates USA]**
 - h. **[Clopay Building Products]**
 - i. **[Cookson; a CornellCookson company]**
 - j. **[Cornell; a CornellCookson company]**
 - k. **[Lawrence Roll-Up Doors, Inc.]**
 - l. **[McKeon Door Company]**
 - m. **[Metro Door LLC]**
 - n. **[Overhead Door Corporation]**
 - o. **[Wayne Dalton; a division of Overhead Door Corporation]**
 - p. **[Woodfold Manufacturing, Inc.]**
 - q. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ACME Rolling Doors]**
 - b. **[Alpine Overhead Doors, Inc]**
 - c. **[Alumatec Pacific Products]**
 - d. **[Amarr Company]**
 - e. **[ASTA America; Janus International Group]**
 - f. **[C.H.I. Overhead Doors, Inc.]**
 - g. **[City Gates USA]**
 - h. **[Clopay Building Products]**

- i. [Cookson; a CornellCookson company]
 - j. [Cornell; a CornellCookson company]
 - k. [Lawrence Roll-Up Doors, Inc.]
 - l. [McKeon Door Company]
 - m. [Metro Door LLC]
 - n. [Overhead Door Corporation]
 - o. [Wayne Dalton; a division of Overhead Door Corporation]
 - p. [Woodfold Manufacturing, Inc.]
 - q. <Insert manufacturer's name>
- B. Operation Cycles: Door components and operators capable of operating for not less than [10,000][20,000][50,000][100,000][200,000]<Insert number>. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- 1. Include tamperproof cycle counter.
- C. STC Rating: [26]<Insert value>.
- D. Curtain R-Value: [4.5 deg F x h x sq. ft./Btu (0.792 K x sq. m/W)][5.0 deg F x h x sq. ft./Btu (0.881 K x sq. m/W)][6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W)]<Insert value>.
- E. Door Curtain Material: [Galvanized steel][Stainless steel][Aluminum].
- F. Door Curtain Slats: [Curved][Flat] profile slats of [1-1/4-inch (32-mm)][1-1/2-inch (38-mm)]<Insert dimension> center-to-center height.
- 1. Perforated Slats: Approximately [1/16-inch (1.6-mm) pinholes][3/32-inch (2.4-mm) pinholes][7/8-inch- (22-mm-) wide by 3/8-inch- (10-mm-) high slots]<Insert dimensions>.
 - 2. Fenestrated Slats: Approximately [3- by 5/8-inch (76- by 16-mm)][4- by 5/8-inch (102- by 16-mm)][10- by 1-5/8-inch (254- by 41-mm)]<Insert dimensions> openings spaced approximately [1-1/2 inches (38 mm)]<Insert dimension> apart and beginning 12 inches (305 mm) from jamb guides.
 - 3. Vision Panels: Approximately 10- by 1-5/8-inch (254- by 41-mm) openings spaced approximately 2 inches (51 mm) apart and beginning 12 inches (305 mm) from end guides; in [two][three]<Insert number> rows of slats at height indicated on Drawings; installed with [insulated] vision-panel glazing.
 - 4. Insulated-Slat Interior Facing: [Metal][Plastic].
 - 5. Gasket Seal. Manufacturer's standard continuous gaskets between slats.
- G. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, fabricated [hot-dip galvanized steel][stainless steel][or][aluminum extrusion] and finished [to match door]<Insert requirement>.
- H. Curtain Jamb Guides: [Galvanized steel][Stainless steel][Aluminum] with exposed finish matching curtain slats.[Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.][Provide removable post(s) and jamb guides where indicated on Drawings.]
- I. Hood: [Match curtain material and finish][Galvanized steel][Stainless steel][Aluminum].
- 1. Shape: [Round][Square][As indicated on Drawings]<Insert shape>.
 - 2. Mounting: [Face of wall][Between jambs][As indicated on Drawings].
- J. Integral Frame, Hood, and Fascia: [Galvanized][Stainless] steel.

1. Mounting: **[Face of wall][Between jambs][As indicated on Drawings]**.
- K. Sill Configuration: **[No sill][Integral metal sill]**.
- L. Locking Devices: Equip door with **[slide bolt for padlock][locking device assembly][and][chain lock keeper]**.
1. Locking Device Assembly: **[Single-jamb side][Cremone-type, both jamb sides]** locking bars, operable from **[inside with thumbturn][outside with cylinder][outside only, with cylinder][inside and outside with cylinders]<Insert requirement>**.
- M. Manual Door Operator: **[Push-up operation][Chain-hoist operator][Manufacturer's standard crank operator][Awning-crank operator]**.
1. Provide operator with through-wall shaft operation.
 2. Provide operator with manufacturer's standard removable operating arm.
- N. Electric Door Operator:
1. Usage Classification: **[Heavy duty, 25 or more cycles per hour and more than 90 cycles per day][Standard duty, up to 25 cycles per hour and up to 90 cycles per day][Medium duty, up to 12 cycles per hour and up to 50 cycles per day][Light duty, up to 10 cycles per hour]<Insert classification>**.
 2. Operator Location: **[Top of hood][Front of hood][Wall][Bench][Through wall][As indicated on Drawings]**.
 3. Motor Exposure: **[Interior][Exterior, wet, and humid]**.
 4. Motor Electrical Characteristics:
 - a. Horsepower: **[1/2][1][2][3]<Insert value>** hp.
 - b. Voltage:
 - 1) **[115-V ac][208-V ac][230-V ac]**, single phase, 60 Hz.
 - 2) **[208-V ac][230-V ac][460-V ac]**, three phase, 60 Hz.
 5. Emergency Manual Operation: **[Push-up][Chain][Crank]** type.
 6. Obstruction-Detection Device: Automatic **[photoelectric sensor][electric sensor edge on bottom bar][pneumatic sensor edge on bottom bar][; self-monitoring type]<Insert type>**.
 - a. Sensor Edge Bulb Color: **[Black][As selected by Architect from manufacturer's full range]<Insert color>**.
 7. Control Station(s): **[Interior-side mounted][Exterior-side mounted][Where indicated on Drawings]<Insert location>**.
 8. Other Equipment: **<Insert device>**.
- O. Curtain Accessories: Equip door with **[smoke seals][weatherseals][astragal][push/pull handles][pull-down strap][pole hook][and][automatic closing device]<Insert item>**.
- P. Door Finish:
1. Aluminum Finish: **[Mill][Clear anodized][Light bronze anodized][Medium bronze anodized][Dark bronze anodized][Black anodized][Anodized color matching Architect's sample][Anodized color as selected by Architect from full range of industry colors and color densities]<Insert color>**.
 2. Baked-Enamel or Powder-Coated Finish: **[Color as indicated by manufacturer's designations][Color matching Architect's sample][Color as selected by Architect from**

3. **manufacturer's full range]<Insert color>.**
4. **Factory Prime Finish: Manufacturer's standard color.**
4. **Stainless Steel Finish: [ASTM A480/A480M No. 2B (bright, cold rolled)][ASTM A480/A480M No. 4 (polished directional satin)]<Insert finish>.**
5. **Interior Curtain-Slat Facing: [Match finish of exterior curtain-slat face][PVC plastic]<Insert finish>.**

2.4 FIRE-RATED COUNTER DOOR ASSEMBLY

- A. **Fire-Rated Counter Door: Overhead fire-rated coiling door formed with curtain of interlocking metal slats.**
 1. **Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[ACME Rolling Doors]**
 - b. **[Alpine Overhead Doors, Inc]**
 - c. **[Amarr Company]**
 - d. **[ASTA America; Janus International Group]**
 - e. **[C.H.I. Overhead Doors, Inc.]**
 - f. **[City Gates USA]**
 - g. **[Clopay Building Products]**
 - h. **[Cookson; a CornellCookson company]**
 - i. **[Cornell; a CornellCookson company]**
 - j. **[Lawrence Roll-Up Doors, Inc.]**
 - k. **[McKeon Door Company]**
 - l. **[Overhead Door Corporation]**
 - m. **[Wayne Dalton; a division of Overhead Door Corporation]**
 - n. **<Insert manufacturer's name>**
 2. **Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:**
 - a. **[ACME Rolling Doors]**
 - b. **[Alpine Overhead Doors, Inc]**
 - c. **[Amarr Company]**
 - d. **[ASTA America; Janus International Group]**
 - e. **[C.H.I. Overhead Doors, Inc.]**
 - f. **[City Gates USA]**
 - g. **[Clopay Building Products]**
 - h. **[Cookson; a CornellCookson company]**
 - i. **[Cornell; a CornellCookson company]**
 - j. **[Lawrence Roll-Up Doors, Inc.]**
 - k. **[McKeon Door Company]**
 - l. **[Overhead Door Corporation]**
 - m. **[Wayne Dalton; a division of Overhead Door Corporation]**
 - n. **<Insert manufacturer's name>**
- B. **Operation Cycles: Door components and operators capable of operating for not less than [10,000][20,000][50,000][100,000][200,000]<Insert number>. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.**

1. Include tamperproof cycle counter.
- C. Fire Rating: **[3/4 hour][1 hour][1-1/2 hours][3 hours][4 hours][with temperature-rise limit][and][with smoke control]**.
- D. STC Rating: **[27]<Insert value>**.
- E. Curtain R-Value: **[4.5 deg F x h x sq. ft./Btu (0.792 K x sq. m/W)][5.0 deg F x h x sq. ft./Btu (0.881 K x sq. m/W)][6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W)]<Insert value>**.
- F. Door Curtain Material: **[Galvanized][Stainless]** steel.
- G. Door Curtain Slats: **[Curved][Flat]** profile slats of **[1-1/4-inch (32-mm)][1-1/2-inch (38-mm)]<Insert dimension>** center-to-center height.
1. Vision Panels: Approximately **10- by 1-5/8-inch (254- by 41-mm)** openings spaced approximately **2 inches (51 mm)** apart and beginning **12 inches (305 mm)** from end guides; in **[two][three]<Insert number>** rows of slats at height indicated on Drawings; installed with fire-rated vision-panel glazing.
 2. Insulated-Slat Interior Facing: Metal.
- H. Curtain Jamb Guides: **[Galvanized][Stainless]** steel with exposed finish matching curtain slats.
- I. Hood: **[Match curtain material and finish][Galvanized steel][Stainless steel]**.
1. Shape: **[Round][Square][As indicated on Drawings]<Insert shape>**.
 2. Mounting: **[Face of wall][Between jambs][As indicated on Drawings]**.
- J. Integral Frame, Hood, and Fascia: **[Galvanized][Stainless]** steel.
1. Mounting: **[Face of wall][Between jambs][As indicated on Drawings]**.
- K. Sill Configuration: **[No sill][Integral metal sill][Fire-rated, laminate counter]**.
1. High-Pressure Decorative Laminate: Match color, pattern, and finish **[as indicated by manufacturer's designations][of Architect's sample][as selected by Architect from manufacturer's full range]<Insert requirement>**.
- L. Locking Devices: Equip door with **[slide bolt for padlock][locking device assembly][and][chain lock keeper]**.
1. Locking Device Assembly: **[Single-jamb side][Cremone-type, both jamb sides]** locking bars, operable from **[inside with thumbturn][outside with cylinder][outside only, with cylinder][inside and outside with cylinders]<Insert requirement>**.
- M. Manual Door Operator: **[Push-up operation][Chain-hoist operator][Manufacturer's standard crank operator][Awning-crank operator]**.
1. Provide operator with through-wall shaft operation.
 2. Provide operator with manufacturer's standard removable operating arm.
- N. Electric Door Operator:
1. Usage Classification: **[Heavy duty, 25 or more cycles per hour and more than 90 cycles per day][Standard duty, up to 25 cycles per hour and up to 90 cycles per day][Medium duty, up to 10 cycles per hour and up to 30 cycles per day]<Insert requirement>**.

to 12 cycles per hour and up to 50 cycles per day][Light duty, up to 10 cycles per hour]<Insert classification>.

2. Operator Location: [Top of hood][Front of hood][Wall][Bench][Through wall][As indicated on Drawings].
 3. Motor Exposure: [Interior][Exterior, wet, and humid].
 4. Motor Electrical Characteristics:
 - a. Horsepower: [1/2][1][2][3]<Insert value> hp.
 - b. Voltage:
 - 1) [115-V ac][208-V ac][230-V ac], single phase, 60 Hz.
 - 2) [208-V ac][230-V ac][460-V ac], three phase, 60 Hz.
 5. Emergency Manual Operation: [Push-up][Chain][Crank] type.
 6. Obstruction-Detection Device: Automatic [photoelectric sensor][electric sensor edge on bottom bar][pneumatic sensor edge on bottom bar][; self-monitoring type]<Insert type>.
 - a. Sensor Edge Bulb Color: [Black][As selected by Architect from manufacturer's full range]<Insert color>.
 7. Control Station(s): [Interior-side mounted][Exterior-side mounted][Where indicated on Drawings]<Insert location>.
 8. Other Equipment: <Insert device>.
- O. Curtain Accessories: Equip door with smoke seals, automatic closing device, [astragal][push/pull handles][pull-down strap][pole hook][and]<Insert item>.
- P. Door Finish:
1. Baked-Enamel or Powder-Coated Finish: [Color as indicated by manufacturer's designations][Color matching Architect's sample][Color as selected by Architect from manufacturer's full range]<Insert color>.
 2. Factory Prime Finish: Manufacturer's standard color.
 3. Stainless Steel Finish: [ASTM A480/A480M No. 2B (bright, cold rolled)][ASTM A480/A480M No. 4 (polished directional satin)]<Insert finish>.
 4. Interior Curtain-Slat Facing: [Match finish of exterior curtain-slat face]<Insert finish>.

2.5 MATERIALS, GENERAL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 DOOR CURTAIN MATERIALS AND FABRICATION

- A. Door Curtains: Fabricate coiling counter door curtain of interlocking metal slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A653/A653M, with **G90 (Z275)** zinc coating; nominal sheet thickness (coated) of **0.028 inch (0.71 mm)**; and as required.
 2. Stainless Steel Door Curtain Slats: ASTM A240/A240M or ASTM A666, Type 304; sheet

- thickness of **0.025 inch (0.64 mm)**; and as required.
 3. Aluminum Door Curtain Slats: **ASTM B209 (ASTM B209M)** sheet or **ASTM B221 (ASTM B221M)** extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; thickness of **0.050 inch (1.27 mm)**; and as required.
 4. Vision-Panel Glazing: Manufacturer's standard clear glazing, fabricated from transparent acrylic sheet or fire-protection-rated glass as required for type of door; set in glazing channel secured to curtain slats.
 5. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84 or UL 723. Enclose insulation completely within slat faces.
 6. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
 7. Plastic Interior Curtain-Slat Facing: Extruded PVC plastic with maximum flame-spread index of **[25][75][200]** and smoke-developed index of 450, according to ASTM E84 or UL 723.
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.
1. Removable Posts and Jamb Guides: Manufacturer's standard.

2.7 HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
1. Galvanized Steel: Nominal **0.028-inch- (0.71-mm-)** thick, hot-dip galvanized-steel sheet with **G90 (Z275)** zinc coating, complying with ASTM A653/A653M.
 2. Stainless Steel: **0.025-inch- (0.64-mm-)** thick, stainless steel sheet, Type 304, complying with ASTM A240/A240M or ASTM A666.
 3. Aluminum: **0.040-inch- (1.02-mm-)** thick aluminum sheet complying with **ASTM B209 (ASTM B209M)**, of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.
 4. Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.
- B. Integral Frame, Hood, and Fascia: Welded sheet metal assembly of the following sheet metal(s):
1. Galvanized Steel: Hot-dip galvanized-steel sheet with **G90 (Z275)** zinc coating, complying with ASTM A653/A653M.
 2. Stainless Steel: Type 304, complying with ASTM A240/A240M or ASTM A666.
- C. Removable Metal Soffit: Formed or extruded from same metal and with same finish as curtain if hood is mounted above ceiling unless otherwise indicated.

2.8 LOCKING DEVICES

- A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
- B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

1. Lock Cylinders: As [specified in Section 087100 "Door Hardware"] [specified in Section 087111 "Door Hardware (Descriptive Specification)"] [standard with manufacturer] [and keyed to building keying system].
2. Keys: [Two] [Three] <Insert number> for each cylinder.

- C. Chain Lock Keeper: Suitable for padlock.
- D. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.9 CURTAIN ACCESSORIES

- A. Smoke Seals: Equip each fire-rated door with replaceable smoke-seal perimeter gaskets or brushes for smoke and draft control as required for door listing and labeling by a qualified testing agency.
- B. Weatherseals: Equip door with weather-stripping gaskets fitted to entire perimeter of door for air-resistant installation unless otherwise indicated.
1. At door head, use **1/8-inch- (3-mm-)** thick, replaceable, continuous-sheet baffle secured to inside of hood or field-installed on the header.
 2. At door jambs, use replaceable, adjustable, continuous, **[flexible, 1/8-inch- (3-mm-) thick seals of flexible vinyl, rubber, or neoprene] [nylon brushes] <Insert material>**.
- C. Astragal: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
- D. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.
- E. Pull-Down Strap: Provide pull-down straps for doors more than **84 inches (2130 mm)** high.
- F. Pole Hooks: Provide pole hooks and poles for doors more than **84 inches (2130 mm)** high.
- G. Automatic-Closing Device: Equip each fire-rated door with an automatic-closing device or holder-release mechanism and governor unit complying with NFPA 80 and an easily tested and reset release mechanism. **[Testing for manually operated doors allows resetting by opening the door without retensioning the counterbalance mechanism.] [Release mechanism for motor-operated doors allows testing without mechanical release of the door.]** Automatic-closing device is to be designed for activation by the following:
1. Replaceable fusible links with temperature rise and melting point of **[165 deg F (74 deg C)] <Insert temperature>** interconnected and mounted on both sides of door opening.
 2. Manufacturer's standard UL-labeled smoke detector and door-holder-release devices.
 3. Manufacturer's standard UL-labeled heat detector and door-holder-release devices.
 4. Building fire-detection, smoke-detection, and -alarm systems.
- H. **<Insert requirements>**.

2.10 COUNTER DOOR ACCESSORIES

- A. Integral Metal Sill: Fabricate sills as integral part of frame assembly of Type 304 stainless steel in manufacturer's standard thickness with **[ASTM A480/A480M No. 4] <Insert finish>** finish.

- B. Fire-Rated, Laminate Counter: Fire-door manufacturer's high-pressure, decorative laminate-covered countertop; UL or ITS tested and labeled for 1-1/2-hour fire rating for approved use with fire-door assembly.
- C. **<Insert requirements>**.

2.11 COUNTERBALANCE MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, **[seamless][or][welded]** carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than **0.03 in./ft. (2.5 mm/m)** of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
 - 1. Fire-Rated Doors: Equip with auxiliary counterbalance spring and prevent tension release from main counterbalance spring when automatic closing device operates.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.12 MANUAL DOOR OPERATORS

- A. General: Equip door with manual door operator by door manufacturer.
- B. Push-up Door Operation: Design counterbalance mechanism so that required lift or pull for door operation does not exceed **[25 lbf (111 N)][30-lbf (133-N)]<Insert value>**.
- C. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum **[25-lbf (111-N)][30-lbf (133-N)]<Insert value>** force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.
- D. Crank Operator: Consisting of crank and crank gearbox, steel crank drive shaft, and gear-reduction unit, of type indicated. Size gears to require not more than **[25-lbf (111-N)][30-lbf (133-N)]<Insert value>** force to turn crank. Fabricate gearbox to be oiltight and to completely enclose operating mechanism. Provide manufacturer's standard crank-locking device.

2.13 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door Operator Location(s): Operator location indicated for each door.
1. Top-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on top of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.
 2. Front-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on coil side of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.
 3. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall-mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.
 4. Bench Mounted: Operator is mounted to the right or left door head plate and connected to the door drive shaft with drive chain and sprockets. Side room is required for this type of mounting.
 5. Through-Wall Mounted: Operator is mounted on other side of wall from coil side of door.
- D. Motors: Reversible-type motor[**with controller (disconnect switch)**] for motor exposure indicated for each door assembly.
1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than **8 in./sec. (203 mm/s)** and not more than **12 in./sec. (305 mm/s)**, without exceeding nameplate ratings or service factor.
 2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening.[**For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.**][**For fire-rated doors, activation delays closing.**]
1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
 - a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained or constant pressure on close button.
 2. Electric Sensor Edge: Automatic safety sensor edge, located within astragal mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
 - a. Self-Monitoring Type: Four-wire-configured device designed to interface with door operator

control circuit to detect damage to or disconnection of sensor edge.

3. Pneumatic Sensor Edge: Automatic safety sensor edge, located within astragal mounted to bottom bar. Contact with sensor activates device.
- G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
 1. Type: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed **[25 lbf (111 N)][30 lbf (133 N)]<Insert value>**.
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- K. **<Insert requirements>**.

2.14 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.15 ALUMINUM FINISHES

- A. Mill Finish: Manufacturer's standard.
- B. Clear Anodic Finish: AAMA 611, **[AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm]** or thicker.
- C. Color Anodic Finish: AAMA 611, **[AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm]** or thicker.
- D. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.16 STEEL AND GALVANIZED-STEEL FINISHES

- A. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film

thickness.

- B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
- C. **<Insert requirements>**.

2.17 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3. Directional Satin Finish: ASTM A480/A480M No. 4.
- C. Bright, Cold-Rolled, Unpolished Finish: ASTM A480/A480M No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install coiling counter doors, hoods, controls, and operators at the mounting locations indicated for each door.
- C. Fire-Rated Doors: Install according to NFPA 80.
- D. Smoke-Control Doors: Install according to NFPA 80 and NFPA 105.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections and to furnish reports to Architect.

- B. Perform the following tests and inspections[**with the assistance of a factory-authorized service representative**]:
 - 1. Test door release, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed door. Reset door-closing mechanism after successful test.
 - 2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, section 5.2.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in [NFPA 80][and][NFPA 101].

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
 - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.5 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service is to include [three][six][nine][12] months' full maintenance by skilled employees of coiling-door Installer. Include [monthly][quarterly] preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies are to be manufacturer's authorized replacement parts and supplies.
 - 1. Perform maintenance, including emergency callback service, during normal working hours.
 - 2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust,



08 - Openings

operate, and maintain coiling counter doors.

END OF SECTION 08 33 13 00



Task	Specification	Specification Description
08 33 16 00	08 33 26 00	Overhead Coiling Grilles



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SECTION 08 33 23 00 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Service doors.
2. Insulated service doors.
3. Fire-rated service doors.
4. Fire-rated, insulated service doors.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports, door-opening framing, corner guards, and bollards.
2. **[Section 099113 "Exterior Painting"]**[and]**[Section 099123 "Interior Painting"]** for finish painting of factory-primed doors.
3. Section 111200 "Parking Control Equipment" for parking control equipment interlocked to overhead coiling doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
3. Include description of automatic-closing device and testing and resetting instructions.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
5. Show locations of controls, locking devices[, **detectors or replaceable fusible links**], and other accessories.
6. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

- D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1. Curtain slats[, **including full vision window secured to slat**].
2. Bottom bar[**with sensor edge**].
3. Guides.
4. Brackets.
5. Hood.
6. Locking device(s).
7. Include similar Samples of accessories involving color selection.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[Installer][and][testing and inspecting agency]**.
1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
 2. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.
- B. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.
- C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Special warranty.
- B. Maintenance Data: For overhead coiling doors to include in maintenance manuals.
- C. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
1. Maintenance Proximity: Not more than **[two]<Insert number>** hours' normal travel time from Installer's place of business to Project site.
- B. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies is to meet the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain overhead coiling doors from single source from single manufacturer.
 1. Obtain operators and controls from overhead coiling-door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Complying with NFPA 80; listed and labeled by qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to **[NFPA 252][or][UL 10B]**.
 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 2. Temperature-Rise Limit: **[Where indicated][At exit enclosures and exit passageways]**, provide doors that have a maximum transmitted temperature end point of not more than **450 deg F (250 deg C)** above ambient after 30 minutes of standard fire-test exposure.
 3. Smoke Control: **[Where indicated][In corridors and smoke barriers]**, provide doors that are listed and labeled with the letter "S" on the fire-rating label by a qualified testing agency for smoke- and draft-control based on testing according to UL 1784; with maximum air-leakage rate of **3.0 cfm/sq. ft. (0.01524 cu. m/s x sq. m)** of door opening at **0.10 inch wg (24.9 Pa)** for both ambient and elevated temperature tests.
- B. Sound-Control Doors: Assemblies tested in a laboratory for sound-transmission-loss performance according to ASTM E90, calculated according to ASTM E413, and rated for not less than the STC value indicated.
- C. Accessibility Standard: Comply with applicable provisions in **[the USDOJ's "2010 ADA Standards for Accessible Design"]****[the ABA standards of the Federal agency having jurisdiction]****[and][ICC A117.1]<Insert requirement>**.
- D. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:
 1. Design Wind Load: **[As indicated on Drawings][Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward]<Insert loads>**.
 2. Testing: According to ASTM E330/E330M **[or DASMA 108 for garage doors and complying with acceptance criteria of DASMA 108]<Insert requirement>**.
 3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
 4. Operability under Wind Load: Design overhead coiling doors to remain operable under **[design][uniform pressure (velocity pressure) of 20-lbf/sq. ft. (960-Pa)]<Insert load>** wind load, acting inward and outward.
- E. Windborne-Debris Impact Resistance: Provide **[glazed][and][impact-protective]** overhead coiling doors that pass ASTM E1886 missile-impact and cyclic-pressure tests according to **[ASTM E1996 for Wind Zone 1][ASTM E1996 for Wind Zone 2][ASTM E1996 for Wind Zone 3][ASTM E1996 for Wind Zone 4][or DASMA 115]** for **[basic][enhanced]** protection.

1. Large-Missile Test: For overhead coiling doors located within [30 ft. (9.1 m)]<Insert dimension> of grade.
2. Small-Missile Test: For overhead coiling doors located between 30 ft. (9.1 m) and [60 ft. (18.3 m)]<Insert dimension> above grade.

F. Seismic Performance: Overhead coiling doors are to withstand the effects of earthquake motions determined according to [ASCE/SEI 7]<Insert requirement>.

1. Component Importance Factor: [1.5][1.0].

2.3 DOOR ASSEMBLY

A. Overhead Coiling Door: [Service][Insulated service] overhead coiling door formed with curtain of interlocking metal slats.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [ACME Rolling Doors]
 - b. [Advanced Door Technologies]
 - c. [Alpine Overhead Doors, Inc]
 - d. [Alumatec Pacific Products]
 - e. [Amarr Company]
 - f. [ASTA America; Janus International Group]
 - g. [C.H.I. Overhead Doors, Inc.]
 - h. [City Gates USA]
 - i. [Clopay Building Products]
 - j. [Cookson; a CornellCookson company]
 - k. [Cornell; a CornellCookson company]
 - l. [Dynamic Closures Corporation]
 - m. [Hormann High Performance Doors]
 - n. [Lawrence Roll-Up Doors, Inc.]
 - o. [McKeon Door Company]
 - p. [Metro Door LLC]
 - q. [Overhead Door Corporation]
 - r. [Raynor Garage Doors]
 - s. [Southwestern Rolling Steel Door Co]
 - t. [Wayne Dalton; a division of Overhead Door Corporation]
 - u. [Windsor Door]
 - v. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [ACME Rolling Doors]
 - b. [Advanced Door Technologies]
 - c. [Alpine Overhead Doors, Inc]
 - d. [Alumatec Pacific Products]
 - e. [Amarr Company]
 - f. [ASTA America; Janus International Group]
 - g. [C.H.I. Overhead Doors, Inc.]

- h. **[City Gates USA]**
 - i. **[Clopay Building Products]**
 - j. **[Cookson; a CornellCookson company]**
 - k. **[Cornell; a CornellCookson company]**
 - l. **[Dynamic Closures Corporation]**
 - m. **[Hormann High Performance Doors]**
 - n. **[Lawrence Roll-Up Doors, Inc.]**
 - o. **[McKeon Door Company]**
 - p. **[Metro Door LLC]**
 - q. **[Overhead Door Corporation]**
 - r. **[Raynor Garage Doors]**
 - s. **[Southwestern Rolling Steel Door Co]**
 - t. **[Wayne Dalton; a division of Overhead Door Corporation]**
 - u. **[Windsor Door]**
 - v. **<Insert manufacturer's name>**
- B. Operation Cycles: Door components and operators capable of operating for not less than **[10,000][20,000][50,000][100,000][200,000]<Insert number>** cycles. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- 1. Include tamperproof cycle counter.
- C. Air Infiltration: Maximum rate of **[0.4 cfm/sq. ft. (2.03 L/s per sq. m)][1.0 cfm/sq. ft. (5.1 L/s per sq. m)]<Insert rate>** at **15 and 25 mph (24.1 and 40.2 km/h)** when tested according to **[ASTM E283][or][DASMA 105]**.
- D. STC Rating: **[26]<Insert value>**.
- E. Insulated Door Curtain R-Value: **[4.5 deg F x h x sq. ft./Btu (0.792 K x sq. m/W)]<Insert value>**.
- F. Insulated Door Assembly U-Factor: **[0.90 Btu/deg F x h x sq. ft. (5.1 W/K x sq. m)]<Insert value>**.
- G. Door Curtain Material: **[Galvanized steel][Stainless steel][Aluminum]**.
- H. Door Curtain Slats: **[Curved][Flat]** profile slats of **[1-7/8-inch (48-mm)][2-5/8-inch (67-mm)][3-1/4-inch (83-mm)]<Insert dimension>** center-to-center height.
- 1. Perforated Slats: Approximately **[1/16-inch (1.6-mm) pinholes][3/32-inch (2.4-mm) pinholes][7/8-inch- (22-mm-) wide by 3/8-inch- (10-mm-) high slots]<Insert dimensions>**.
 - 2. Fenestrated Slats: Approximately **[3- by 5/8-inch (76- by 16-mm)][4- by 5/8-inch (102- by 16-mm)][10- by 1-5/8-inch (254- by 41-mm)]<Insert dimensions>** openings spaced approximately **[1-1/2 inches (38 mm)]<Insert dimension>** apart and beginning **12 inches (305 mm)** from jamb guides.
 - 3. Vision Panels: Approximately **10- by 1-5/8-inch (254- by 41-mm)** openings spaced approximately **2 inches (51 mm)** apart and beginning **12 inches (305 mm)** from end guides; in **[two][three]<Insert number>** rows of slats at height indicated on Drawings; installed with **[insulated]** vision-panel glazing.
 - 4. Insulated-Slat Interior Facing: **[Metal][Plastic]**.
 - 5. Gasket Seal. Manufacturer's standard continuous gaskets between slats.
- I. Bottom Bar: Two angles, each not less than **[1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick]<Insert dimensions>**; fabricated from **[hot-dip galvanized steel][stainless steel][or][aluminum extrusions]** and finished **[to match door]<Insert requirement>**.
- J. Curtain Jamb Guides: **[Galvanized steel][Stainless steel][Aluminum]** with exposed finish matching

curtain slats.

- K. Pass Door(s): **[Hinged][Rigid]** frame with **[lockset][exit hardware]**.
- L. Hood: **[Match curtain material and finish][Galvanized steel][Stainless steel][Aluminum]**.
1. Shape: **[Round][Square][As indicated on Drawings]<Insert shape>**.
 2. Mounting: **[Face of wall][Between jambs][As indicated on Drawings]**.
- M. Locking Devices: Equip door with **[slide bolt for padlock][locking device assembly][and][chain lock keeper]**.
1. Locking Device Assembly: **[Single-jamb side][Cremone-type, both jamb sides]** locking bars, operable from **[inside with thumbturn][outside with cylinder][outside only, with cylinder][inside and outside with cylinders]<Insert requirement>**.
- N. Manual Door Operator: **[Push-up operation][Chain-hoist operator][Manufacturer's standard crank operator][Awning-crank operator][Wall-crank operator]**.
1. Provide operator with through-wall shaft operation.
 2. Provide operator with manufacturer's standard removable operating arm.
- O. Electric Door Operator:
1. Usage Classification: **[Heavy duty, 25 or more cycles per hour and more than 90 cycles per day][Standard duty, up to 25 cycles per hour and up to 90 cycles per day][Medium duty, up to 12 cycles per hour and up to 50 cycles per day][Light duty, up to 10 cycles per hour]<Insert classification>**.
 2. Operator Location: **[Top of hood][Front of hood][Wall][Bench][Through wall][As indicated on Drawings]**.
 3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; **moving parts of operator enclosed or guarded if exposed and mounted at 8 ft. (2.44 m) or lower**.
 4. Motor Exposure: **[Interior][Exterior, wet, and humid]**.
 5. Motor Electrical Characteristics:
 - a. Horsepower: **[1/2][1][2][3]<Insert value>** hp.
 - b. Voltage: **[115 V ac, single phase, 60 Hz][208 V ac, single phase, 60 Hz][230 V ac, single phase, 60 Hz][208 V ac, three phase, 60 Hz][230 V ac, three phase, 60 Hz][460 V ac, three phase, 60 Hz]**.
 6. Emergency Manual Operation: **[Push-up][Chain][Crank]** type.
 7. Obstruction-Detection Device: Automatic **[photoelectric sensor][electric sensor edge on bottom bar][pneumatic sensor edge on bottom bar][; self-monitoring type]<Insert type>**.
 - a. Sensor Edge Bulb Color: **[Black][As selected by Architect from manufacturer's full range]<Insert color>**.
 8. Control Station(s): **[Interior mounted][Exterior mounted][Where indicated on Drawings]<Insert location>**.
 9. Other Equipment: **[Audible and visual signals][Portable radio-control system]<Insert device>**.
- P. Curtain Accessories: Equip door with **[smoke seals][weatherseals][astragal][push/pull handles][pull-down strap][pole hook][and][automatic-closing device]<Insert item>**.

Q. Door Finish:

1. Aluminum Finish: [Mill][Clear anodized][Light bronze anodized][Medium bronze anodized][Dark bronze anodized][Black anodized][Anodized color matching Architect's sample][Anodized color as selected by Architect from full range of industry colors and color densities]<Insert color>.
2. Baked-Enamel or Powder-Coated Finish: [Color as indicated by manufacturer's designations][Color matching Architect's sample][Color as selected by Architect from manufacturer's full range]<Insert color>.
3. Factory Prime Finish: Manufacturer's standard color.
4. Stainless Steel Finish: [ASTM A480/A480M No. 2B (bright, cold rolled)][ASTM A480/A480M No. 4 (polished directional satin)]<Insert finish>.
5. Interior Curtain-Slat Facing: [Match finish of exterior curtain-slat face][Finish as indicated by manufacturer's designations][Finish matching Architect's sample][Finish as selected by Architect from manufacturer's full range]<Insert finish>.

2.4 FIRE-RATED DOOR ASSEMBLY

A. Fire-Rated Overhead Coiling Door: [Service][Insulated service] overhead fire-rated coiling door formed with curtain of interlocking metal slats.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [ACME Rolling Doors]
 - b. [Advanced Door Technologies]
 - c. [Alpine Overhead Doors, Inc]
 - d. [Amarr Company]
 - e. [ASTA America; Janus International Group]
 - f. [C.H.I. Overhead Doors, Inc.]
 - g. [City Gates USA]
 - h. [Clopay Building Products]
 - i. [Cookson; a CornellCookson company]
 - j. [Cornell; a CornellCookson company]
 - k. [Lawrence Roll-Up Doors, Inc.]
 - l. [McKeon Door Company]
 - m. [Overhead Door Corporation]
 - n. [Raynor Garage Doors]
 - o. [Southwestern Rolling Steel Door Co]
 - p. [Wayne Dalton; a division of Overhead Door Corporation]
 - q. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [ACME Rolling Doors]
 - b. [Advanced Door Technologies]
 - c. [Alpine Overhead Doors, Inc]
 - d. [Amarr Company]
 - e. [ASTA America; Janus International Group]
 - f. [C.H.I. Overhead Doors, Inc.]
 - g. [City Gates USA]

- h. [Clipay Building Products]
 - i. [Cookson; a CornellCookson company]
 - j. [Cornell; a CornellCookson company]
 - k. [Lawrence Roll-Up Doors, Inc.]
 - l. [McKeon Door Company]
 - m. [Overhead Door Corporation]
 - n. [Raynor Garage Doors]
 - o. [Southwestern Rolling Steel Door Co]
 - p. [Wayne Dalton; a division of Overhead Door Corporation]
 - q. <Insert manufacturer's name>
- B. Operation Cycles: Door components and operators capable of operating for not less than [10,000][20,000][50,000][100,000][200,000]<Insert number> cycles. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- 1. Include tamperproof cycle counter.
- C. Fire Rating: [3/4 hour][1 hour][1-1/2 hours][3 hours][4 hours][with temperature-rise limit][and][with smoke control].
- D. Air Infiltration: Maximum rate of [0.4 cfm/sq. ft. (2.03 L/s per sq. m)][1.0 cfm/sq. ft. (5.1 L/s per sq. m)]<Insert rate> at 15 and 25 mph (24.1 and 40.2 km/h) when tested according to [ASTM E283][or][DASMA 105].
- E. STC Rating: [27]<Insert value>.
- F. Insulated Door Curtain R-Value: [4.5 deg F x h x sq. ft./Btu (0.792 K x sq. m/W)]<Insert value>.
- G. Insulated Door Assembly U-Factor: [0.90 Btu/deg F x h x sq. ft. (5.1 W/K x sq. m)]<Insert value>.
- H. Door Curtain Material: [Galvanized][Stainless] steel.
- I. Door Curtain Slats: [Curved][Flat] profile slats of [1-7/8-inch (48-mm)][2-5/8-inch (67-mm)][3-1/4-inch (83-mm)]<Insert dimension> center-to-center height.
- 1. Vision Panels: Approximately 10- by 1-5/8-inch (254- by 41-mm) openings spaced approximately 2 inches (51 mm) apart and beginning 12 inches (305 mm) from end guides; in [two][three]<Insert number> rows of slats at height indicated on Drawings; installed with fire-rated vision-panel glazing.
 - 2. Insulated-Slat Interior Facing: Metal.
- J. Bottom Bar: Two angles, each not less than [1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick]<Insert dimensions>; fabricated from [hot-dip galvanized steel][stainless steel][or][aluminum extrusions] and finished [to match door]<Insert requirement>.
- K. Curtain Jamb Guides: [Galvanized][Stainless] steel with exposed finish matching curtain slats.
- L. Pass Door(s): [Hinged][Rigid] frame with [lockset][exit hardware].
- M. Hood: [Match curtain material and finish][Galvanized steel][Stainless steel].
- 1. Shape: [Round][Square][As indicated on Drawings]<Insert shape>.
 - 2. Mounting: [Face of wall][Between jambs][As indicated on Drawings].

- N. Locking Devices: Equip door with **[slide bolt for padlock][locking device assembly][and][chain lock keeper]**.
1. Locking Device Assembly: **[Single-jamb side][Cremone-type, both jamb sides]** locking bars, operable from **[inside with thumbturn][outside with cylinder][outside only, with cylinder][inside and outside with cylinders]<Insert requirement>**.
- O. Manual Door Operator: **[Push-up operation][Chain-hoist operator][Manufacturer's standard crank operator][Awning-crank operator][Wall-crank operator]**.
1. Provide operator with through-wall shaft operation.
 2. Provide operator with manufacturer's standard removable operating arm.
- P. Electric Door Operator:
1. Usage Classification: **[Heavy duty, 25 or more cycles per hour and more than 90 cycles per day][Standard duty, up to 25 cycles per hour and up to 90 cycles per day][Medium duty, up to 12 cycles per hour and up to 50 cycles per day][Light duty, up to 10 cycles per hour]<Insert classification>**.
 2. Operator Location: **[Top of hood][Front of hood][Wall][Bench][Through wall][As indicated on Drawings]**.
 3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; **moving parts of operator enclosed or guarded if exposed and mounted at 8 ft. (2.44 m) or lower**.
 4. Motor Exposure: **[Interior][Exterior, wet, and humid]**.
 5. Motor Electrical Characteristics:
 - a. Horsepower: **[1/2][1][2][3]<Insert value>** hp.
 - b. Voltage: **[115 V ac, single phase, 60 Hz][208 V ac, single phase, 60 Hz][230 V ac, single phase, 60 Hz][208 V ac, three phase, 60 Hz][230 V ac, three phase, 60 Hz][460 V ac, three phase, 60 Hz]**.
 6. Emergency Manual Operation: **[Push-up][Chain][Crank]** type.
 7. Obstruction-Detection Device: Automatic **[photoelectric sensor][electric sensor edge on bottom bar][pneumatic sensor edge on bottom bar]; self-monitoring type<Insert type>**.
 - a. Sensor Edge Bulb Color: **[Black][As selected by Architect from manufacturer's full range]<Insert color>**.
 8. Control Station(s): **[Interior mounted][Exterior mounted][Where indicated on Drawings]<Insert location>**.
 9. Other Equipment: **[Audible and visual signals][Portable radio-control system]<Insert device>**.
- Q. Curtain Accessories: Equip door with smoke seals, automatic-closing device, **[astragal][push/pull handles][pull-down strap][pole hook][and]<Insert item>**.
- R. Door Finish:
1. Baked-Enamel or Powder-Coated Finish: **[Color as indicated by manufacturer's designations][Color matching Architect's sample][Color as selected by Architect from manufacturer's full range]<Insert color>**.
 2. Factory Prime Finish: Manufacturer's standard color.
 3. Stainless Steel Finish: **[ASTM A480/A480M No. 2B (bright, cold rolled)][ASTM A480/A480M No. 4 (polished directional satin)]<Insert finish>**.
 4. Interior Curtain-Slat Facing: **[Match finish of exterior curtain-slat face][Finish as indicated by**

manufacturer's designations][Finish matching Architect's sample][Finish as selected by Architect from manufacturer's full range]<Insert finish>.

2.5 MATERIALS, GENERAL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A653/A653M, with **G90 (Z275)** zinc coating; nominal sheet thickness (coated) of **0.028 inch (0.71 mm)**; and as required.
 2. Stainless Steel Door Curtain Slats: ASTM A240/A240M or ASTM A666, Type 304; sheet thickness of **0.025 inch (0.64 mm)**; and as required.
 3. Aluminum Door Curtain Slats: **ASTM B209 (ASTM B209M)** sheet or **ASTM B221 (ASTM B221M)** extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; thickness of **0.050 inch (1.27 mm)**; and as required.
 4. Vision-Panel Glazing: Manufacturer's standard clear glazing, fabricated from transparent acrylic sheet or fire-protection-rated glass as required for type of door; set in glazing channel secured to curtain slats.
 5. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84 or UL 723. Enclose insulation completely within slat faces.
 6. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with **[minimum steel thickness of 0.010 inch (0.25 mm)][and][minimum aluminum thickness of 0.032 inch (0.80 mm)]**.
 7. Plastic Interior Curtain-Slat Facing: Extruded PVC plastic with maximum flame-spread index of **[25][75][200]** and smoke-developed index of 450, according to ASTM E84 or UL 723.
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain[, **and a continuous bar for holding windlocks**].
- C. Pass Door(s): Swinging-door and frame assembly constructed integrally with the coiling-door assembly[**and bearing the same fire rating**]. Comply with the accessibility standard of authorities having jurisdiction.
1. Door Frame and Integral Jamb Guide: Fabricate of angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading.
 2. Hinged Frame: Hinged pass door and frame that swings out of the way, as a unit, to allow use of the full coiling-door opening width. One jamb of the pass-door frame is hinged and the other jamb includes a guide for the lower, narrower part of the coiling-door curtain.
 3. Rigid Frame: Rigid pass door and frame that are built into the rigid, lower part of the door curtain and that raise with the curtain.

4. Locking Hardware:
 - a. **[Lockset][Exit Hardware]: [As specified in Section 087100 "Door Hardware."][As specified in Section 087111 "Door Hardware (Descriptive Specification)."] [As selected by Architect from manufacturer's full range.]<Insert requirement.>**
 - b. Lock Cylinders: As **[specified in Section 087100 "Door Hardware"] [specified in Section 087111 "Door Hardware (Descriptive Specification)"] [standard with manufacturer] [and keyed to building keying system].**
 - c. Keys: **[Two][Three]<Insert number>** for each cylinder.
5. Thresholds: Equip pass doors with integral thresholds that comply with the accessibility standard of authorities having jurisdiction.

2.7 HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
 1. Galvanized Steel: Nominal **0.028-inch- (0.71-mm-)** thick, hot-dip galvanized-steel sheet with **G90 (Z275)** zinc coating, complying with ASTM A653/A653M.
 2. Stainless Steel: **0.025-inch- (0.64-mm-)** thick, stainless steel sheet, Type 304, complying with ASTM A240/A240M or ASTM A666.
 3. Aluminum: **0.040-inch- (1.02-mm-)** thick aluminum sheet complying with **ASTM B209 (ASTM B209M)**, of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.
 4. Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.
 5. Exterior-Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.
- B. Removable Metal Soffit: Formed or extruded from same metal and with same finish as curtain if hood is mounted above ceiling unless otherwise indicated.

2.8 LOCKING DEVICES

- A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
- B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 1. Lock Cylinders: As **[specified in Section 087100 "Door Hardware"] [specified in Section 087111 "Door Hardware (Descriptive Specification)"] [standard with manufacturer] [and keyed to building keying system].**
 2. Keys: **[Two][Three]<Insert number>** for each cylinder.
- C. Chain Lock Keeper: Suitable for padlock.
- D. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.9 CURTAIN ACCESSORIES

- A. Smoke Seals: Equip each fire-rated door with replaceable smoke-seal perimeter gaskets or brushes for smoke and draft control as required for door listing and labeling by a qualified testing agency.
- B. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
 - 1. At door head, use **1/8-inch- (3-mm-)** thick, replaceable, continuous-sheet baffle secured to inside of hood or field-installed on the header.
 - 2. At door jambs, use replaceable, adjustable, continuous, **[flexible, 1/8-inch- (3-mm-) thick seals of flexible vinyl, rubber, or neoprene][nylon brushes]<Insert material>**.
- C. Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
- D. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.
- E. Pull-Down Strap: Provide pull-down straps for doors more than **84 inches (2130 mm)** high.
- F. Pole Hooks: Provide pole hooks and poles for doors more than **84 inches (2130 mm)** high.
- G. Automatic-Closing Device: Equip each fire-rated door with an automatic-closing device or holder-release mechanism and governor unit complying with NFPA 80 and an easily tested and reset release mechanism. **[Testing for manually operated doors allows resetting by opening the door without retensioning the counterbalance mechanism][Release mechanism for motor-operated doors allows testing without mechanical release of the door.]** Automatic-closing device is to be designed for activation by the following:
 - 1. Replaceable fusible links with temperature rise and melting point of **[165 deg F (74)]<Insert temperature>** interconnected and mounted on both sides of door opening.
 - 2. Manufacturer's standard UL-labeled smoke detector and door-holder-release devices.
 - 3. Manufacturer's standard UL-labeled heat detector and door-holder-release devices.
 - 4. Building fire-detection, smoke-detection, and -alarm systems.

2.10 COUNTERBALANCE MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, **[seamless][or][welded]** carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than **0.03 in./ft. (2.5 mm/m)** of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
 - 1. Fire-Rated Doors: Equip with auxiliary counterbalance spring and prevent tension release from main counterbalance spring when automatic-closing device operates.

- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.11 MANUAL DOOR OPERATORS

- A. General: Equip door with manual door operator by door manufacturer.
- B. Push-up Door Operation: Lift handles and pull rope for raising and lowering doors, with counterbalance mechanism designed so that required lift or pull for door operation does not exceed **[25 lbf (111 N)]<Insert value>**.
- C. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum **[25-lbf (111-N)][30-lbf (133-N)]<Insert value>** force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.
- D. Crank Operator: Consisting of crank and crank gearbox, steel crank drive shaft, and gear-reduction unit, of type indicated. Size gears to require not more than **[25-lbf (111-N)][30-lbf (133-N)]<Insert value>** force to turn crank. Fabricate gearbox to be oiltight and to completely enclose operating mechanism. Provide manufacturer's standard crank-locking device.

2.12 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door Operator Location(s): Operator location indicated for each door.
 - 1. Top-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on top of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.
 - 2. Front-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on coil side of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.
 - 3. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall-mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.
 - 4. Bench Mounted: Operator is mounted to the right or left door head plate and connected to the door drive shaft with drive chain and sprockets. Side room is required for this type of mounting.
 - 5. Through-Wall Mounted: Operator is mounted on other side of wall from coil side of door.
- D. Motors: Reversible-type motor[**with controller (disconnect switch)**] for motor exposure indicated for each door assembly.

1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than **8 in./sec. (203 mm/s)** and not more than **12 in./sec. (305 mm/s)**, without exceeding nameplate ratings or service factor.
 2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. **[For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.][For fire-rated doors, activation delays closing.]**
1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
 - a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained or constant pressure on close button.
 2. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
 - a. Self-Monitoring Type: Four-wire-configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.
 3. Pneumatic Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device.
- G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
 2. Exterior-Mounted Units: Full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
- H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed **[25 lbf (111 N)][30 lbf (133 N)]<Insert value>**.
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

- K. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with the accessibility standard.
- L. Portable Radio-Control System: Consisting of **[one][two]<Insert number>** of the following per door operator:
 - 1. Three-channel universal coaxial receiver to open, close, and stop door.
 - 2. Portable control device to open and stop door may be momentary-contact type; control to close door is to be sustained- or constant-pressure type.
 - 3. Remote-antenna mounting kit.

2.13 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.14 ALUMINUM FINISHES

- A. Mill Finish: Manufacturer's standard.
- B. Clear Anodic Finish: AAMA 611, **[AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm]** or thicker.
- C. Color Anodic Finish: AAMA 611, **[AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm]** or thicker.
- D. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.15 STEEL AND GALVANIZED-STEEL FINISHES

- A. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
- B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

2.16 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

3. Directional Satin Finish: ASTM A480/A480M No. 4.

C. Bright, Cold-Rolled, Unpolished Finish: ASTM A480/A480M No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.
- D. Fire-Rated Doors: Install according to NFPA 80.
- E. Smoke-Control Doors: Install according to NFPA 80 and NFPA 105.
- F. Power-Operated Doors: Install[**automatic garage doors openers**] according to UL 325.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: [**Owner will engage**][**Engage**] a qualified testing agency to perform tests and inspections and to furnish reports to Architect.
- B. Perform the following tests and inspections[**with the assistance of a factory-authorized service representative**]:
 - 1. Test door release, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed door. Reset door-closing mechanism after successful test.
 - 2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in **[NFPA 80][and][NFPA 101]**.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
 - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.5 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 - 1. Adjust exterior doors and components to be weather resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service includes **[three][six][nine][12]** months' full maintenance by skilled employees of coiling-door Installer. Include **[monthly][quarterly]** preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies are to be manufacturer's authorized replacement parts and supplies.
 - 1. Perform maintenance, including emergency callback service, during normal working hours.
 - 2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 08 33 23 00

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Task	Specification	Specification Description
08 33 23 11	08 33 23 00	Overhead Coiling Doors
08 33 23 11	08 33 26 00	Overhead Coiling Grilles
08 33 23 13	01 11 19 00	No Specification Required
08 33 23 13	08 33 23 00	Overhead Coiling Doors



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SECTION 08 33 26 00 - OVERHEAD COILING GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Open-curtain overhead coiling grilles.
2. Closed-curtain overhead coiling grilles.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports, angle-framing of grille opening, corner guards, and bollards.
2. **[Section 099113 "Exterior Painting"]****[and]****[Section 099123 "Interior Painting"]** for finish painting of factory-primed grilles.
3. Section 111200 "Parking Control Equipment" for parking control equipment interlocked to overhead coiling grilles.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling grille and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for curtain components, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. For exterior components, include details of provisions for assembly expansion and contraction.
5. Show locations of controls, locking devices, and other accessories.
6. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:

1. Open-curtain grille with full-size components consisting of rods, spacers, and links as required to illustrate each assembly[, **including glazed inserts**].

2. Closed-curtain grille with full-size components consisting of ribs and infill as required to illustrate each assembly.
3. Bottom bar[**with sensor edge**].
4. Guides.
5. Mounting frame.
6. Brackets.
7. Hood.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For overhead coiling grilles to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
- B. Accessibility Standard: Comply with applicable provisions in [the USDOJ's "2010 ADA Standards for Accessible Design"] [the ABA standards of the Federal agency having jurisdiction] [and] [ICC A117.1] <Insert requirement>.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of grilles that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: [Two] <Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain overhead coiling grilles from single source from single manufacturer.
 1. Obtain operators and controls from overhead coiling-grille manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Overhead coiling grilles withstand the effects of earthquake motions determined according to [ASCE/SEI 7] <Insert requirement>.

1. Component Importance Factor: **[1.5][1.0]**.

2.3 OPEN-CURTAIN GRILLE ASSEMBLY

- A. Open-Curtain Grille: Overhead coiling[, **countertop**] grille with a curtain having a network of horizontal rods that interconnect with vertical links.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ACME Rolling Doors]**
 - b. **[Advanced Door Technologies]**
 - c. **[Alpine Overhead Doors, Inc]**
 - d. **[Alumatec Pacific Products]**
 - e. **[Amarr Company]**
 - f. **[C.H.I. Overhead Doors, Inc.]**
 - g. **[City Gates USA]**
 - h. **[Clopay Building Products]**
 - i. **[Cookson; a CornellCookson company]**
 - j. **[Cornell; a CornellCookson company]**
 - k. **[Dynaflair Corporation]**
 - l. **[Dynamic Closures Corporation]**
 - m. **[Lawrence Roll-Up Doors, Inc.]**
 - n. **[McKeon Door Company]**
 - o. **[Metro Door LLC]**
 - p. **[Overhead Door Corporation]**
 - q. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ACME Rolling Doors]**
 - b. **[Advanced Door Technologies]**
 - c. **[Alpine Overhead Doors, Inc]**
 - d. **[Alumatec Pacific Products]**
 - e. **[Amarr Company]**
 - f. **[C.H.I. Overhead Doors, Inc.]**
 - g. **[City Gates USA]**
 - h. **[Clopay Building Products]**
 - i. **[Cookson; a CornellCookson company]**
 - j. **[Cornell; a CornellCookson company]**
 - k. **[Dynaflair Corporation]**
 - l. **[Dynamic Closures Corporation]**
 - m. **[Lawrence Roll-Up Doors, Inc.]**
 - n. **[McKeon Door Company]**
 - o. **[Metro Door LLC]**
 - p. **[Overhead Door Corporation]**
 - q. **<Insert manufacturer's name>**
- B. Operation Cycles: Grille components and operators capable of operating for not less than **[10,000][20,000][50,000][100,000][200,000]<Insert number>**. One operation cycle is complete when a grille is opened from the closed position to the fully open position and returned to the closed position.

1. Include tamperproof cycle counter.
- C. Grille Curtain Material: **[Aluminum][Stainless steel][Galvanized steel]**.
1. Rod Spacing: Approximately **[1-1/2 inches (38 mm)][2 inches (51 mm)][3 inches (76 mm)]<Insert dimension>** o.c.
 2. Link Spacing: Approximately **[3 inches (76 mm)][6 inches (152 mm)][9 inches (228 mm)]<Insert dimension>** apart in a **[straight in-line][brick (staggered)]<Insert pattern>** pattern.
 3. Glazing Inserts: **[Manufacturer's standard]<Insert description>**.
 4. Spacers: **[Metal tubes matching curtain material][PVC]<Insert description>**.
- D. Bottom Bar: Continuous **[tubular shape][channel][or][doubled angles]**, fabricated from **[aluminum extrusion][hot-dip galvanized steel][or][stainless steel]** and finished **[to match grille]<Insert requirement>**.
- E. Curtain Jamb Guides: **[Aluminum][Stainless steel][Galvanized steel]** with exposed finish **[matching curtain slats]<Insert requirement>**. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise. **[Provide removable post(s) and jamb guides where indicated on Drawings.]**
- F. Hood: **[Match curtain material and finish][Aluminum][Stainless steel][Galvanized steel]**.
1. Shape: **[Round][Square][As indicated on Drawings]<Insert shape>**.
 2. Mounting: **[Face of wall][Between jambs][On mounting frame][As indicated on Drawings]**.
- G. Locking Devices: Equip grille with **[slide bolt for padlock][locking device assembly][and][chain lock keeper]**.
1. Locking Device Assembly: **[Single-jamb side][Cremone-type, both jamb sides]** locking bars, operable from **[inside with thumbturn][outside with cylinder][outside only, with cylinder][inside and outside with cylinders]<Insert requirement>**.
- H. Manual Grille Operator: **[Push-up operation][Chain-hoist operator][Manufacturer's standard crank operator][Awning-crank operator][Wall-crank operator]**.
1. Provide operator with through-wall shaft operation.
 2. Provide operator with manufacturer's standard removable operating arm.
- I. Electric Grille Operator:
1. Usage Classification: **[Heavy duty, 25 or more cycles per hour and more than 90 cycles per day][Standard duty, up to 25 cycles per hour and up to 90 cycles per day][Medium duty, up to 12 cycles per hour and up to 50 cycles per day][Light duty, up to 10 cycles per hour]<Insert classification>**.
 2. Operator Location: **[Top of hood][Front of hood][Wall][Bench][Through wall][As indicated on Drawings]**.
 3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; **moving parts of operator enclosed or guarded if exposed and mounted at 8 feet (2.4 m) or lower**.
 4. Motor Exposure: **[Interior][Exterior, wet, and humid]**.
 5. Motor Electrical Characteristics:
 - a. Horsepower: **[1/2][1][2][3]<Insert value>** hp.
 - b. Voltage, Single Phase, 60 Hz: **[115-V ac][208-V ac][230-V ac]**.

- c. Voltage, Three Phase, 60 Hz: **[208-V ac][230-V ac][460-V ac]**.
- 6. Emergency Manual Operation: **[Push-up][Chain][Crank]** type.
- 7. Obstruction-Detection Device: Automatic **[photoelectric sensor][electric sensor edge on bottom bar][pneumatic sensor edge on bottom bar]; self-monitoring type]<Insert type>**.
 - a. Sensor Edge Bulb Color: **[Black][As selected by Architect from manufacturer's full range]<Insert color>**.
- 8. Control Station: **[Interior mounted][Exterior mounted][Where indicated on Drawings]<Insert location>**.
- 9. Other Equipment: **[Audible and visual signals][Emergency-egress release][Self-opening mechanism]<Insert device>**.
- J. Curtain Accessories: Equip grille with **[astragal][push/pull handles][and][pole hook]<Insert item>**.
- K. Grille Finish:
 - 1. Aluminum Finish: **[Mill][Clear anodized][Light bronze anodized][Medium bronze anodized][Dark bronze anodized][Black anodized][Anodized color matching Architect's sample][Anodized color as selected by Architect from full range of industry colors and color densities]<Insert color>**.
 - 2. Baked-Enamel or Powder-Coat Finish: **[Color as indicated by manufacturer's designations][Color matching Architect's sample][Color as selected by Architect from manufacturer's full range]<Insert color and gloss>**.
 - 3. Factory Prime Finish: Manufacturer's standard color.
 - 4. Stainless Steel Finish: **[No. 2B (bright, cold rolled)][No. 4 (polished directional satin)]<Insert finish>**.
 - 5. PVC Spacers: **[Color as indicated by manufacturer's designations][Color as selected by Architect from manufacturer's full range]<Insert color>**.

2.4 CLOSED-CURTAIN GRILLE ASSEMBLY

- A. Closed-Curtain Grille: Overhead coiling[, **countertop**] grille with a curtain having a series of horizontal ribs alternating with continuous horizontal infill panels secured by the ribs.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Alumatec Pacific Products]**
 - b. **[Dynaflair Corporation]**
 - c. **[Dynamic Closures Corporation]**
 - d. **[Metro Door LLC]**
 - e. **[QMI Security Solutions]**
 - f. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Alumatec Pacific Products]**
 - b. **[Dynaflair Corporation]**
 - c. **[Dynamic Closures Corporation]**

- d. **[Metro Door LLC]**
 - e. **[QMI Security Solutions]**
 - f. **<Insert manufacturer's name>**
- B. Operation Cycles: Grille components and operators capable of operating for not less than **[10,000][20,000][50,000][100,000][200,000]<Insert number>**. One operation cycle is complete when a grille is opened from the closed position to the fully open position and returned to the closed position.
- 1. Include tamperproof cycle counter.
- C. Grille Curtain Material: Aluminum ribs with continuous inserts indicated.
- 1. Rib Spacing: Approximately **[3 inches (76 mm)]<Insert dimension>** o.c.
 - 2. Inserts: **[Glass panels][Clear, transparent plastic panels][Translucent plastic panels][Solid aluminum panels][Perforated aluminum panels]**.
- D. Bottom Bar: Continuous **[tubular shape][channel][or][doubled angles]**, fabricated from **[aluminum extrusion][hot-dip galvanized steel][or][stainless steel]** and finished **[to match grille]<Insert requirement>**.
- E. Curtain Jamb Guides: Aluminum with exposed finish **[matching curtain slats]<Insert requirement>**. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise. **[Provide removable post(s) and jamb guides where indicated on Drawings.]**
- F. Hood: **[Match curtain material and finish][Aluminum][Stainless steel][Galvanized steel]**.
- 1. Shape: **[Round][Square][As indicated on Drawings]<Insert shape>**.
 - 2. Mounting: **[Face of wall][Between jambs][On mounting frame][As indicated on Drawings]**.
- G. Locking Devices: Equip grille with **[slide bolt for padlock][locking device assembly][and][chain lock keeper]**.
- 1. Locking Device Assembly: **[Single-jamb side][Cremone-type, both jamb sides]** locking bars, operable from **[inside with thumbturn][outside with cylinder][outside only, with cylinder][inside and outside with cylinders]<Insert requirement>**.
- H. Manual Grille Operator: **[Push-up operation][Chain-hoist operator][Manufacturer's standard crank operator][Awning-crank operator][Wall-crank operator]**.
- 1. Provide operator with through-wall shaft operation.
 - 2. Provide operator with manufacturer's standard removable operating arm.
- I. Electric Grille Operator:
- 1. Usage Classification: **[Heavy duty, 25 or more cycles per hour and more than 90 cycles per day][Standard duty, up to 25 cycles per hour and up to 90 cycles per day][Medium duty, up to 12 cycles per hour and up to 50 cycles per day][Light duty, up to 10 cycles per hour]<Insert classification>**.
 - 2. Operator Location: **[Top of hood][Front of hood][Wall][Bench][Through wall][As indicated on Drawings]**.
 - 3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; **moving parts of operator enclosed or guarded if exposed and mounted at 8 feet (2.4 m) or lower**.
 - 4. Motor Exposure: **[Interior][Exterior, wet, and humid]**.
 - 5. Motor Electrical Characteristics:

- a. Horsepower: [1/2][1][2][3]<Insert value> hp.
- b. Voltage, Single Phase, 60 Hz: [115-V ac][208-V ac][230-V ac].
- c. Voltage, Three Phase, 60 Hz: [208-V ac][230-V ac][460-V ac].
- 6. Emergency Manual Operation: [Push-up][Chain][Crank] type.
- 7. Obstruction-Detection Device: Automatic [photoelectric sensor][electric sensor edge on bottom bar][pneumatic sensor edge on bottom bar]; self-monitoring type<Insert type>.
 - a. Sensor Edge Bulb Color: [Black][As selected by Architect from manufacturer's full range]<Insert color>.
- 8. Control Station: [Interior mounted][Exterior mounted][Where indicated on Drawings]<Insert location>.
- 9. Other Equipment: [Audible and visual signals][Emergency-egress release][Self-opening mechanism]<Insert device>.

J. Grille Finish:

- 1. Aluminum Finish: [Mill][Clear anodized][Light bronze anodized][Medium bronze anodized][Dark bronze anodized][Black anodized][Anodized color matching Architect's sample][Anodized color as selected by Architect from full range of industry colors and color densities]<Insert color>.
- 2. Baked-Enamel or Powder-Coat Finish: [Color as indicated by manufacturer's designations][Color matching Architect's sample][Color as selected by Architect from manufacturer's full range]<Insert color and gloss>.
- 3. Factory Prime Finish: Manufacturer's standard color.
- 4. Stainless Steel Finish: [No. 2B (bright, cold rolled)][No. 4 (polished directional satin)]<Insert finish>.

2.5 MATERIALS, GENERAL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 GRILLE CURTAIN MATERIALS AND CONSTRUCTION

- A. Open-Curtain Grilles: Fabricate metal grille curtain as an open network of horizontal rods, spaced at regular intervals, that are interconnected with vertical links, which are formed and spaced as indicated and are free to rotate on the rods.
 - 1. Aluminum Grille Curtain: **ASTM B221 (ASTM B221M)**, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
 - 2. Stainless Steel Grille Curtain: ASTM A666 or ASTM A240/A240M, Type 300 series.
 - 3. Steel Grille Curtain: Hot-dip zinc coated (galvanized) complying with ASTM A123/A123M, or electrogalvanized complying with ASTM 653/A653M, and phosphatized before fabrication.
 - 4. Glazing Insert: Manufacturer's standard glazing of clear polycarbonate sheet secured by the curtain links.
- B. Closed-Curtain Grilles: Fabricate curtain as a series of horizontal double-C ribs, spaced at regular intervals, that alternate with continuous horizontal infill panels secured by the ribs.
 - 1. Aluminum Horizontal Ribs: **ASTM B221 (ASTM B221M)**, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
 - 2. Glass Panels: Uncoated, clear, heat-treated, fully tempered float glass; complying with ASTM

C1048, Condition A, Type I, Class I, Quality q3, Kind FT; manufacturer's standard panel dimensions and thickness.

3. Plastic Panels: Fire-retardant polycarbonate sheet manufactured by the extrusion process; UV resistant; manufacturer's standard panel dimensions and thickness.
4. Aluminum Panels: **ASTM B209 (ASTM B209M)**, alloy and temper standard with manufacturer for type of use and finish indicated; manufacturer's standard panel dimensions and thickness; finished to match ribs.

a. Perforations: [**Manufacturer's standard pinholes**]<Insert description>.

- C. Bottom Bar: Manufacturer's standard continuous shape unless otherwise indicated, finished to match grille.

1. Astragal: Equip grille bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
2. Provide motor-operated grilles with combination bottom astragal and sensor edge.

- D. Grille Curtain Jamb Guides: Manufacturer's standard shape having curtain groove with return lips or bars to retain curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise; with removable stops on guides to prevent overtravel of curtain.

1. Removable Posts and Jamb Guides: Manufacturer's standard.

2.7 HOODS AND ACCESSORIES

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Galvanized Steel: Nominal **0.028-inch- (0.71-mm-)** thick, hot-dip galvanized-steel sheet with **G90 (Z275)** zinc coating, complying with ASTM A653/A653M.
2. Stainless Steel: **0.025-inch- (0.64-mm-)** thick, stainless steel sheet, Type 304, complying with ASTM A666 or ASTM A240/A240M.
3. Aluminum: **0.040-inch- (1.02-mm-)** thick aluminum sheet, complying with **ASTM B209 (ASTM B209M)**, of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.

- B. Removable Metal Soffit: Formed or extruded from same metal and with same finish as curtain if hood is mounted above ceiling unless otherwise indicated.

- C. Mounting Frame: Manufacturer's standard mounting frame designed to support grille; factory fabricated from ASTM A36/A36M structural-steel [**tubes**][**or**][**shapes**], hot-dip galvanized per ASTM A123/A123M; fastened to floor and structure above grille; to be built into wall construction; and complete with anchors, connections, and fasteners.

- D. Push/Pull Handles: Equip push-up-operated or emergency-operated grille with lifting handles on each side of grille, finished to match grille.

- E. Pull-Down Strap: Provide pull-down straps for grilles more than **84 inches (2130 mm)** high.

- F. Pole Hooks: Provide pole hooks and poles for grilles more than **84 inches (2130 mm)** high.

2.8 LOCKING DEVICES

- A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.
- B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 - 1. Lock Cylinders: As **[specified in Section 087100 "Door Hardware"]****[specified in Section 087111 "Door Hardware (Descriptive Specification)"]****[standard with manufacturer]****[and keyed to building keying system]**.
 - 2. Keys: **[Two]****[Three]****<Insert number>** for each cylinder.
- C. Chain Lock Keeper: Suitable for padlock.
- D. Safety Interlock Switch: Equip power-operated grilles with safety interlock switch to disengage power supply when grille is locked.

2.9 COUNTERBALANCE MECHANISM

- A. General: Counterbalance grilles by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, **[seamless]****[or]****[welded]** carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of parts and to limit barrel deflection to not more than **0.03 in./ft. (2.5 mm/m)** of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.10 MANUAL GRILLE OPERATORS

- A. General: Equip grille with manual grille operator by grille manufacturer.
- B. Push-up Grille Operation: Lift handles and pull rope for raising and lowering grille, with counterbalance mechanism designed so that required lift or pull for grille operation does not exceed **[25 lbf (111 N)]****<Insert value>**.
- C. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum **[25-lbf (111-N)]****[30-lbf (133-N)]****<Insert value>** force for grille operation. Provide alloy-steel hand chain with chain holder secured to operator guide.
- D. Crank Operator: Consisting of crank and crank gearbox, steel crank drive shaft, and gear-reduction unit, of type indicated. Size gears to require not more than **[25-lbf (111-N)]****[30-lbf (133-N)]****<Insert value>**

force to turn crank. Fabricate gearbox to be oiltight and to completely enclose operating mechanism. Provide manufacturer's standard crank-locking device.

2.11 ELECTRIC GRILLE OPERATORS

- A. General: Electric grille operator assembly of size and capacity recommended and provided by grille manufacturer for grille and operation cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking grille, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each grille.
- C. Grille Operator Location(s): Operator location indicated for each grille.
 - 1. Top-of-Hood Mounted: Operator is mounted to the right or left grille head plate, with the operator on top of the grille-hood assembly and connected to the grille drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.
 - 2. Front-of-Hood Mounted: Operator is mounted to the right or left grille head plate, with the operator on coil side of the grille-hood assembly and connected to the grille drive shaft with drive chain and sprockets. Front clearance is required for this type of mounting.
 - 3. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of grille and connected to grille drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall-mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.
 - 4. Bench Mounted: Operator is mounted to the right or left grille head plate and connected to the grille drive shaft with drive chain and sprockets. Side room is required for this type of mounting.
 - 5. Through-Wall Mounted: Operator is mounted on other side of wall from coil side of grille.
- D. Motors: Reversible-type motor[**with controller (disconnect switch)**] for motor exposure indicated for each grille assembly.
 - 1. Electrical Characteristics: Minimum as indicated for each grille assembly. If not indicated, large enough to start, accelerate, and operate grille in either direction from any position, at a speed not less than **8 in./sec. (203 mm/s)** and not more than **12 in./sec. (305 mm/s)**, without exceeding nameplate ratings or service factor.
 - 2. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 - 3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- E. Limit Switches: Equip each motorized grille with adjustable switches interlocked with motor controls and set to automatically stop grille at fully opened and fully closed positions.
- F. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of grille opening. Activation of sensor immediately stops and reverses downward grille travel.
 - 1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in grille opening without contact between grille and obstruction.

- a. Self-Monitoring Type: Designed to interface with grille operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, grille closes only with sustained or constant pressure on close button.
- 2. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
 - a. Self-Monitoring Type: Four-wire-configured device designed to interface with grille operator control circuit to detect damage to or disconnection of sensor edge.
- 3. Pneumatic Sensor Edge: Automatic safety sensor edge, located within astragal mounted to bottom bar. Contact with sensor activates device.
- G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
 - 1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
 - 2. Exterior-Mounted Units: Full-guarded, standard-duty, surface-mounted, weatherproof type; NEMA ICS 6, Type 4 enclosure, key operated.
- H. Emergency Manual Operation: Equip electrically powered grille with capability for emergency manual operation. Design manual mechanism so required force for grille operation does not exceed **[25 lbf (111 N)][30 lbf (133 N)]<Insert value>**.
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- K. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with the accessibility standard.
- L. Emergency-Egress Release: Flush, wall-mounted handle mechanism, for accessibility-code-compliant egress feature, not dependent on electric power. The release allows an unlocked grille to partially open without affecting limit switches to permit passage, and it automatically resets motor drive on return of handle to original position.
- M. Self-Opening Mechanism: Automatic release mechanism triggered by **[smoke detector,][emergency push-button station,]** fire alarm or power failure. When activated, the grille self-opens by means of a fail-safe operator to the fully open position without the need for power operation or battery backup systems. When the **[emergency push-button is reset, and the]** alarm is cleared and power is restored, the grille will operate normally.

2.12 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in

appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.13 ALUMINUM FINISHES

- A. Mill Finish: Manufacturer's standard.
- B. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**][**AA-M12C22A31, Class II, 0.010 mm**] or thicker.
- C. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**][**AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.
- D. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.14 STEEL AND GALVANIZED-STEEL FINISHES

- A. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
- B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

2.15 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3. Directional Satin Finish: No. 4.
- C. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install overhead coiling grilles and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports, according to manufacturer's written instructions and as specified.
- B. Install overhead coiling grilles, hoods, controls, and operators at the mounting locations indicated for each grille.
- C. Accessibility: Install overhead coiling grilles, switches, and controls along accessible routes in compliance with the accessibility standard.
- D. Power-Operated Grilles: Install[**automatic garage grille openers**] according to UL 325.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
 - 3. Test grille opening when activated by detector, fire-alarm system, emergency-egress release, or self-opening mechanism as required. Reset grille-opening mechanism after successful test.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly, so that grilles operate easily, free of warp, twist, or distortion.
 - 1. Adjust exterior components to be weather resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.5 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service is to include **[three][six][nine][12]** months' full maintenance by skilled employees of coiling-grille Installer. Include **[monthly][quarterly]** preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper grille operation. Parts and supplies are to be manufacturer's authorized replacement parts and supplies.
 - 1. Perform maintenance, including emergency callback service, during normal working hours.
 - 2. Include 24-hour-per-day, 7-day-per-week, emergency callback service.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling grilles.

END OF SECTION 08 33 26 00



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SECTION 08 33 43 00 - OVERHEAD COILING SMOKE CURTAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Smoke-protective curtain assemblies for elevator entrances.
2. Smoke- and fire-protective curtain assemblies for elevator entrances.
3. Deployable draft curtains.
4. Fixed draft curtains.

B. Related Requirements:

1. Section 083344 "Overhead Coiling Fire Curtains" for overhead coiling fire-protective curtain assemblies.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.3 COORDINATION

- A. Coordinate smoke curtain assemblies with power, signal, fire-alarm, and smoke-detection systems specified in Division 26 and Division 28.
- B. Coordinate elevator smoke-protective curtain assemblies with elevator hoistway door frames specified in Division 14.
- C. Coordinate smoke-protective curtain assemblies with ceilings for operational clearances and maintenance access requirements.
- D. Coordinate smoke-protective curtain assemblies with walls for support requirements, rating continuity above ceilings, and recessed wall switches.
- E. Coordinate requirements for metal supports required for smoke-protective curtain assemblies.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of smoke-protective curtain assembly and draft curtain.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for smoke curtains.
 2. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 3. Include ratings, operating components, electrical characteristics, control systems, and furnished specialties and accessories.

- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of smoke curtain assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - 4. Detail fabrication and assembly of fire-protective curtain assemblies.
 - 5. Show locations of controls, detectors, and other accessories.
 - 6. Include diagrams for power, signal, and control wiring.
- C. Samples: For each exposed product and for each color and texture specified, **6 inches (152 mm)** in length.
- D. Samples for Initial Selection: Manufacturer's finish charts showing full range of material and finish options available for units with factory-applied finishes.
 - 1. Curtain guide.
 - 2. Bottom bar.
- E. Samples for Verification: For each type of exposed finish, in manufacturer's standard sizes.
 - 1. Curtain guide
 - 2. Bottom bar.
- F. Product Schedule: For smoke curtain assemblies. [**Use same designations indicated on Drawings.**]

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturer, testing agency, and factory-authorized service representative.
- B. Evaluation Reports: For curtain assemblies, from ICC-ES or another qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For smoke curtain assemblies to include in emergency, operation, and maintenance manuals.
- B. Field quality-control reports for required testing.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: An entity experienced in manufacturing smoke-and-draft-control curtain assemblies that have been successfully installed in compliance with requirements of authorities having jurisdiction.

- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
- C. Smoke-Protective Curtain Assembly Inspector Qualifications: Inspector for field quality control inspections of smoke-protective curtain assemblies complying with NFPA 105.

1.8 FIELD CONDITIONS

- A. Field Measurements: Field-verify and coordinate dimensions and indicate measurements on Shop Drawings.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of curtain assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain smoke-protective curtains from single source from single manufacturer.
 - 1. Obtain operators and controls from smoke-protective curtain manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Smoke Protective Curtain Assemblies: Provide smoke-protective curtains that are listed and labeled with the letter "S" on the rating label by a qualified testing agency for smoke- and draft-control based on testing in accordance with UL 1784; with maximum air-leakage rate of **3.0 cfm/sq. ft. (0.01524 cu. m/s x sq. m)** of opening at **0.10 inch wg (24.9 Pa)** for both ambient and elevated temperature tests.
- B. Smoke- and Fire-Protective Curtain Assemblies: Complying with NFPA 80; listed and labeled by qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible in accordance with UL 10D.
 - 1. Oversize Rated Curtain Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that curtain assemblies comply with standard construction requirements for tested and labeled fire-rated curtain assemblies, except for size.
 - 2. Smoke Control: Provide smoke-protective curtains that are listed and labeled with the letter "S" on the rating label by a qualified testing agency for smoke- and draft-control based on testing in accordance with UL 1784; with maximum air-leakage rate of **3.0 cfm/sq. ft. (0.01524 cu. m/s x sq. m)** of opening at **0.10 inch wg (24.9 Pa)** for both ambient and elevated temperature tests.
- C. Curtain Fabric Fire-Test-Response Characteristics: Provide products that pass NFPA 701, as determined by testing of fabrics that were treated using treatment-application method intended for use for this Project by a testing and inspecting agency acceptable to authorities having jurisdiction.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a

qualified testing agency, and marked for intended location and application.

- E. Seismic Performance: Smoke-protective curtain assembly shall withstand the effects of earthquake motions determined according to **[ASCE/SEI 7]<Insert requirement>**.

1. Component Importance Factor: **[1.5][1.0]<Insert requirements>**.

2.3 SMOKE-PROTECTIVE CURTAIN ASSEMBLIES FOR ELEVATOR ENTRANCES

- A. Alarm-activated transparent-film smoke curtain assembly complying with ICC-ES AC77.
- B. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[Cookson; a CornellCookson company]**
 2. **[Cornell; a CornellCookson company]**
 3. **[Door Systems]**
 4. **[Smoke Guard, a CSW Industrials Company]**
 5. **<Insert manufacturer's name>**
- C. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Cookson; a CornellCookson company]**
 2. **[Cornell; a CornellCookson company]**
 3. **[Door Systems]**
 4. **[Smoke Guard, a CSW Industrials Company]**
 5. **<Insert manufacturer's name>**
- D. Smoke Containment: Assemblies complying with UL 1784 for air leakage and requirements of ASME 17.1/CSA B44.
- E. Transparent-Film Curtain: Manufacturer's standard transparent film with flame-spread and smoke-developed indexes of 25 and 450, respectively, when tested in accordance with ASTM E84.
- F. Operation: Controlled descent automatically by fail-safe **[gravity][motor-driven]** deployment and motorized rewind.
- G. Curtain Attachment: Curtain shall form a pressure-resisting seal by one of the following methods:
1. Magnetic Adhesion: With Type 430 ferritic stainless steel elevator door frames, use magnets for closure with door frame.
 2. Auxiliary Rails: With magnetic closure of curtain with incompatible elevator door frame material, provide magnetic stainless steel cladding for door frame, formed from ASTM A240/A240M, Type 430 ferritic stainless steel.
 - a. Finish: Match stainless steel elevator door frame.
 3. Captured Side Guides: Formed from galvanized-steel sheet complying with ASTM A653/A653M with integral pressure-retaining tabs.
- H. Control System: Provide factory-assembled control unit as required for assembly specified.

1. Fail-safe[, **gravity-closing**] device[**with battery backup**] deploys on activation of local smoke detector[**and building fire alarm**] or testing key switch in compliance with UL 864.
 2. Curtain Rewind Switch: Include switch to rewind screen into housing.
 3. Motor Operator: Provide factory-assembled electric operation system of size and capacity recommended in writing by curtain manufacturer for assembly specified, with electric motors and factory-prewired motor controls, control devices, and accessories required for proper operation.
 4. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by a qualified testing agency, and marked for intended location and application.
- I. Housing Type: Sheet metal housings containing support rollers and associated electronics.
1. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

2.4 SMOKE- AND FIRE-PROTECTIVE CURTAIN ASSEMBLIES FOR ELEVATOR ENTRANCES

- A. Alarm-activated flame-resistant fabric smoke curtain assembly complying with ICC-ES AC77.
- B. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[Door Systems]**
 2. **[McKeon Door Company]**
 3. **[U.S. Smoke & Fire]**
 4. **<Insert manufacturer's name>**
- C. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Door Systems]**
 2. **[McKeon Door Company]**
 3. **[U.S. Smoke & Fire]**
 4. **<Insert manufacturer's name>**
- D. Smoke Containment: Assemblies complying with UL 1784 for air leakage and requirements of ASME 17.1/CSA B44.
- E. Fire-Resistance Rating of Fabric: Comply with UL 10D; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Rating: 1-hour **[As indicated in door schedule]**.
- F. Operation: Motorized automatic operation with controlled descent.
- G. Automatic-Closing Device: Equip each deployable curtain assembly with fail-safe, gravity-closing device or holder-release mechanism and governor unit complying with UL 864 and NFPA 105, and an easily tested and reset release mechanism. Automatic-closing device shall be designed for activation by the following:
1. Manufacturer's standard UL-labeled smoke detector and holder-release devices.
 2. Manufacturer's standard UL-labeled heat detector and holder-release devices.
 3. Building fire-detection, smoke-detection, and fire-alarm systems.

- H. Hood/Head Box: Manufactured from galvanized steel in accordance with ASTM A653/A653M; rated at

the same temperature as the curtain fabric.

- I. Curtain: Manufacturer's standard multilayer glass-fiber fabric woven-coated on one or both sides **[with egress][and][vision panel]**.
 - 1. Fire Rating: UL-listed fabric tested in accordance with UL 10D and ASTM E119 for **[1-hour]<Insert rating>** fire resistance.
- J. Roller: Manufacturer's standard curtain roller assembly to contain motor.
- K. Weighted Bottom Bar: Provide weighted bottom bar to ensure smooth operation and hold curtain taut.
- L. Curtain Guides: As selected by Architect from manufacturer's available standard materials and finishes.
- M. Motor Operator: Provide factory-assembled electric operation system of size and capacity recommended by curtain manufacturer for assembly specified, with electric motors and factory-prewired motor controls, control devices, and accessories required for proper operation.
 - 1. Include wiring from control stations to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
 - 2. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 3. Battery Backup: Manufacturer's standard battery backup sized for motor power requirements.

2.5 DEPLOYABLE DRAFT CURTAINS

- A. Alarm-activated fabric smoke curtain assembly.
- B. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **[Door Systems]**
 - 2. **[McKeon Door Company]**
 - 3. **[Smoke Guard, a CSW Industrials Company]**
 - 4. **[U.S. Smoke & Fire]**
 - 5. **<Insert manufacturer's name>**
- C. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1. **[Door Systems]**
 - 2. **[McKeon Door Company]**
 - 3. **[Smoke Guard, a CSW Industrials Company]**
 - 4. **[U.S. Smoke & Fire]**
 - 5. **<Insert manufacturer's name>**
- D. Smoke Containment: Assemblies complying with UL 1784 for air leakage.
- E. Operation: Motorized automatic operation with controlled descent.
- F. Automatic-Closing Device: Equip each deployable curtain assembly with fail-safe, gravity-closing device or holder-release mechanism and governor unit complying with UL 864 and NFPA 105, and an easily

tested and reset release mechanism. Automatic-closing device shall be designed for activation by the following:

1. Manufacturer's standard UL-labeled smoke detector and holder-release devices.
 2. Manufacturer's standard UL-labeled heat detector and holder-release devices.
 3. Building fire-detection, smoke-detection, and fire-alarm systems.
- G. Hood/Head Box: Manufactured from galvanized steel in accordance with ASTM A653/A653M; rated at the same temperature as the curtain fabric.
- H. Curtain: Manufacturer's standard multilayer glass-fiber fabric coated on one or both sides.
1. Fabric Egress Slot: Outlined by stenciling.
 - a. Curtain fabric to include an overlap with magnets at center.
 - b. Fabric Pull Strap: Mounted on pull side of egress slot at **42 inches (1067 mm) AFF**.
- I. Roller: Manufacturer's standard curtain roller assembly to contain motor.
- J. Weighted Bottom Bar: Provide weighted bottom bar to ensure smooth operation, hold curtain taut, and prevent deflection from air movement.
- K. Motor Operator: Provide factory-assembled electric operation system of size and capacity recommended by curtain manufacturer for assembly specified, with electric motors and factory-prewired motor controls, control devices, and accessories required for proper operation.
1. Include wiring from control stations to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
 2. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by a qualified testing agency, and marked for intended location and application.
 3. Battery Backup: Manufacturer's standard battery backup sized for motor power requirements.

2.6 FIXED DRAFT CURTAINS

- A. Fixed fabric smoke curtain assembly.
- B. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[Door Systems]**
 2. **[McKeon Door Company]**
 3. **[Smoke Guard, a CSW Industrials Company]**
 4. **[U.S. Smoke & Fire]**
 5. **<Insert manufacturer's name>**
- C. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Door Systems]**
 2. **[McKeon Door Company]**
 3. **[Smoke Guard, a CSW Industrials Company]**
 4. **[U.S. Smoke & Fire]**
 5. **<Insert manufacturer's name>**

- D. Operation: Fixed.
- E. Curtain: Manufacturer's standard multilayer glass-fiber fabric coated on one or both sides.
- F. Top and Bottom Bar: Provide top bar for suspending curtain and weighted bottom bar to hold curtain taut and prevent deflection from air movement.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Smoke- and Fire-Protective Curtains: Install in accordance with manufacturer's written installation instructions, NFPA 80, and NFPA 105.
- B. Smoke-Protective Curtains: Install smoke-protective curtain assemblies in accordance with manufacturer's written installation instructions and NFPA 105.
 - 1. Install smoke-protective curtain assemblies for elevator entrances in accordance with ASME 17.1/CSA B44.
- C. Power-Operated Curtains: Install in accordance with UL 864.
- D. Install anchorage devices to securely fasten assembly to substrate and building framing without distortion or stress.
- E. Securely brace components suspended from structure.
- F. Fit and align assembly, including vertical guides, level and plumb, to provide smooth operation.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified opening protective assembly inspector to perform tests and inspections and to furnish reports to Architect.
- B. Perform the following tests and inspections **[with the assistance of a factory-authorized service representative]**:
 - 1. Test release mechanism, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed curtain. Reset closing mechanism after successful test.
 - 2. Inspections: Inspect each smoke-protective curtain assembly in accordance with NFPA 105.

- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each smoke-protective curtain assembly indicating compliance with each item listed in NFPA 105.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling smoke curtains.

3.5 MAINTENANCE

- A. Engage a manufacturer's authorized service representative to test, adjust, and maintain the smoke-protective assemblies once per year, as required by NFPA 105.

END OF SECTION 08 33 43 00

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Task	Specification	Specification Description
08 34 00 00	02 41 16 00	Structure Demolition
08 34 13 00	01 11 19 00	No Specification Required
08 34 23 00	08 31 13 00	Access Doors And Frames
08 34 49 13	13 49 00 00	Radiation Protection
08 34 56 00	11 98 12 00a	Detention Doors And Frames



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SECTION 08 34 73 13 - METAL SOUND CONTROL DOOR ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Side-hinged, steel sound control door assemblies.

B. Related Requirements:

1. Section 08473.16 "Wood Sound Control Door Assemblies" for sound control assemblies with wood doors in hollow metal frames.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Include information indicating compliance with assembly performance requirements, construction details, material descriptions, and finishes.

B. Shop Drawings:

1. Elevations of each type and style of door; details of doors, frames, anchorages, wall-opening conditions, sound control seals, door bottoms, and thresholds; and locations of reinforcements and preparations for hardware.
2. **<Insert requirements>**.

- C. Samples for Initial Selection: For units with factory-applied finishes, manufacturer's standard finish sheets, showing full range of available finishes.

- D. Samples for Verification: For each type of exposed finish not less than **3 by 5 inches (76 by 127 mm)**.

1. Doors and Frames: Samples approximately **12 by 12 inches (305 by 305 mm)**.

- a. Doors: Include section of vertical-edge, top, and bottom construction; automatic door bottom or gasket; core construction; **[glazing];** and hinge and other applied hardware reinforcement.
- b. Frames: Include profile, corner joint, anchors, and seals.

- E. Product Schedule: For sound control door assemblies. Use same designations indicated on Drawings.

F. Sustainable Design Submittals:

1. Environmental Product Declaration: For each product.

2. Health Product Declaration: For each product.
3. Environmental Product Declaration: For each product.
4. Environmental Product Declaration: For each product.
5. Environmental Product Declaration: For each product.
6. Third-Party Certifications: For each product.
7. Third-Party Certified Life Cycle Assessment: For each product.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each sound control door assembly, for tests performed by **[a qualified testing agency][or][manufacturer and witnessed by a qualified testing agency]**.
- B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.
- C. Field Quality-Control Reports: For sound control door assemblies.
- D. Qualification Statements: For **[manufacturer][Installer][and][field testing and inspecting agency]<Insert entity or specialist>**.
- E. Sample Warranties: For sound control door assemblies.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sound control door assemblies.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating sound control door assemblies that meet or exceed assembly performance requirements indicated and of documenting this performance by test reports and calculations.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- C. Acoustical Testing Agency Qualifications: An independent agency accredited as an acoustical laboratory in accordance with NIST's National Voluntary Laboratory Accreditation Program.
- D. Fire-Rated Door Inspector Qualifications: Documented as complying with requirements in NFPA 80 **[and having Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification]<Insert requirements>**.
- E. Egress Door Inspector Qualifications: Documented as complying with requirements in NFPA 101 **[and having Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification]<Insert requirements>**.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage.

1. Welded Frames: Deliver with two temporary shipping spreader bars each, tack welded across bottom of frames.
- B. Upon delivery, remove cardboard and wrappings from doors and frames to promote air circulation.
- C. Do not use nonvented plastic or canvas to cover doors and frames to prevent entrapping moisture.
- D. Store doors and frames vertically under cover at Project site, spaced with blocking that provides a minimum **1/4-inch (6-mm)** space between each stacked unit to permit air circulation between components. Stand doors on top end on minimum **4-inch- (102-mm-)** high wood blocking, to avoid damage to bottom end, unless otherwise indicated in manufacturer's written instructions.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of sound control door assemblies that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Failure of product materials and workmanship.
 - b. Failures of assemblies to have NIC ratings within 5 dB of laboratory STC ratings specified when tested in accordance with ASTM E336, with results calculated in accordance with ASTM E413.
 - c. Faulty operation of sound seals.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal use or weathering.
 2. Warranty Period: **[Five]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain sound control door assemblies from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Acoustic Performance: Provide sound control door assemblies with minimum STC **[ratings indicated on Drawings][ratings indicated in schedules]<Insert STC rating>** for the entire assembly, calculated in accordance with ASTM E413 when tested in an operable condition in accordance with ASTM E90.
- B. Fire-Rated Assemblies: Complying with requirements in NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated **[on Drawings][in schedules]**, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
 1. Temperature-Rise Limit: Where indicated **[on Drawings][in schedules]**, provide doors that have a maximum transmitted temperature end point of not more than **450 deg F (250 deg C)** above ambient after 30 minutes of standard fire-test exposure.
- C. Smoke- and Draft-Control Assemblies: Listed and labeled for smoke and draft control based on testing

in accordance with UL 1784 by a qualified testing agency acceptable to authorities having jurisdiction.

2.3 SIDE-HINGED, STEEL SOUND CONTROL DOOR ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

1. **[Allmark Door]**
2. **[AMBICO Limited]**
3. **[Ceco Door; AADG, Inc.; ASSA ABLOY]**
4. **[Curries, AADG, Inc.; ASSA ABLOY Group]**
5. **[IAC Acoustics]**
6. **[Krieger Specialty Products Company]**
7. **[Noise Barriers, LLC.]**
8. **[Overly Door Company]**
9. **[Pioneer Industries; AADG, Inc.; ASSA ABLOY]**
10. **[Protective Door Industries]**
11. **<Insert manufacturer's name>**

- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

1. **[Allmark Door]**
2. **[AMBICO Limited]**
3. **[Ceco Door; AADG, Inc.; ASSA ABLOY]**
4. **[Curries, AADG, Inc.; ASSA ABLOY Group]**
5. **[IAC Acoustics]**
6. **[Krieger Specialty Products Company]**
7. **[Noise Barriers, LLC.]**
8. **[Overly Door Company]**
9. **[Pioneer Industries; AADG, Inc.; ASSA ABLOY]**
10. **[Protective Door Industries]**
11. **<Insert manufacturer's name>**

- C. Assemblies: Comply with requirements in NAAMM-HMMA 865 unless otherwise specified or indicated on Drawings. Provide complete assemblies with steel doors, hollow-metal frames, sound seals, and specified hardware and accessories.

1. Manufacturer's Nameplate: Affix permanent nameplate to assembly indicating manufacturer's name and STC rating.

- D. Steel Doors:

1. Face Design: **[As indicated in door schedule]<Insert requirements>**.
2. Thickness: **[1-3/4 inches (44 mm)][2 inches (51 mm)][2-1/4 inches (57 mm)][As required to comply with assembly performance requirements][As indicated in door schedule]<Insert requirements>**.
3. Exterior Doors Faces: Metallic-coated steel sheet in thickness required to comply with assembly performance requirements but not less than minimum **[0.064-inch (1.63-mm)]<Insert dimension>** nominal thickness.
4. Interior Doors Faces:
 - a. Commercial-Quality Steel Sheet: **[Hot][Cold]** rolled, in thickness required to comply with

- assembly performance requirements but not less than **[0.048-inch (1.21-mm)]<Insert dimension>** nominal thickness.
 - b. Metallic-Coated Steel Sheet: In thickness required to comply with assembly performance requirements but not less than **[0.052-inch (1.32-mm)]<Insert dimension>** nominal thickness.
5. Core: **[Manufacturer's standard sound control core as required to comply with assembly performance requirements]<Insert requirements>**.
 6. Loose Stops for Glazed Lites in Doors: Same material as face sheets, prepared for countersunk **[tamper-resistant]** flat- or oval-head machine screws.
 7. Top and Bottom Channels: Closed with continuous channels of same material as face sheets, spot welded to face sheets not more than **6 inches (152 mm)** o.c.
 8. Hardware Reinforcement: Comply with requirements in BHMA A156.115 for preparing doors for hardware.
- E. Hollow-Metal Frames: **[NAAMM-HMMA 820, continuously welded][Two-piece slip-on][Manufacturer's standard]** frames with corners mitered and reinforced.
1. Exterior Frames: Fabricated from metallic-coated steel sheet in thickness required to support door and comply with assembly performance requirements but not less than **[0.079-inch (2.01-mm)]<Insert requirements>** nominal thickness.
 2. Interior Frames: Provide **[straight][back bend, gypsum board]** returns.
 - a. Commercial-Quality Steel Sheet: **[Hot][Cold]** rolled, in thickness required to support door and comply with assembly performance requirements but not less than **[0.075-inch (1.90-mm)]<Insert dimension>** nominal thickness.
 - b. Metallic-Coated Steel Sheet: In thickness required to support door and comply with assembly performance requirements but not less than **[0.079-inch (2.01-mm)]<Insert dimension>** nominal thickness.
 3. Hardware Reinforcement: Comply with requirements in BHMA A156.115 for preparing frames for hardware.
 4. Grouted-Frame Head Reinforcement for Welded Frames: Metallic-coated steel channel or angle stiffener, not less than **0.108-inch (2.74-mm)** nominal thickness.
 5. Grout Guards for Welded Frames: Metallic-coated steel sheet, not less than **0.026 inch (0.66 mm)** thick.
- F. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls in accordance with ASTM A153/A153M, Class B.
1. Jamb Anchors: Anchors of minimum size and type required by wall construction and assembly performance requirements.
 - a. Postinstalled Expansion Anchors: Minimum **3/8-inch- (9.5-mm-)** diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
 2. Floor Anchors for Welded Frames: Metallic-coated steel in thickness matching frame but not less than **[0.079-inch (2.01-mm)]<Insert dimension>** nominal thickness.
 - a. Monolithic Concrete Slabs: Provide clip-type anchors, with two holes to receive fasteners.
 - b. Separate Topping Concrete Slabs: Provide adjustable-type anchors with extension clips, allowing not less than **2-inch (51-mm)** height adjustment. Terminate bottom of frames at finish floor surface.
 3. Ceiling Struts: Not less than **3/8-inch-thick by 2-inch- (9.5-mm-thick by 51-mm-)** wide uncoated steel unless otherwise indicated **[on Drawings][in schedules]**.

- G. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized in accordance with ASTM A153/A153M or ASTM F2329/F2329M.
- H. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching frames of type indicated.
- I. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers.
- J. Materials:
 - 1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
 - 2. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
 - 3. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B metallic coated by the hot-dip process.
 - a. Exterior-Door and Frame Coating: [A40 (ZF120) zinc-iron alloy (galvannealed)][G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron alloy (galvannealed)][G60 (Z180) zinc (galvanized)]<Insert requirements>.
 - b. Interior-Door and Frame Coating: [A25 (ZF75) zinc-iron alloy (galvannealed)][A40 (ZF120) zinc-iron alloy (galvannealed)][G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron alloy (galvannealed)][G60 (Z180) zinc (galvanized)]<Insert requirements>.
- K. Finishes:
 - 1. Prime Finish: Apply manufacturer's standard rust-inhibitive primer immediately after cleaning and pretreating metal.
 - a. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with requirements in SDI A250.10 for acceptance criteria; recommended in writing by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
 - 2. Factory-Applied Paint Finish: Manufacturer's standard primer and finish coats, complying with requirements in SDI A250.3 for performance and acceptance criteria.
 - a. Color and Gloss: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert requirements>.

2.4 HARDWARE

- A. Sound Control Door Hardware: Manufacturer's standard sound control system required to comply with assembly performance requirements.
 - 1. Head and Jamb Seals: [Provide one of the following:]
 - a. Neoprene Compression Seals: One-piece units consisting of closed-cell sponge neoprene seal held in place by metal retainer, with retainer cover of same material as door frame; attached to door frame with concealed screws.
 - b. Silicone Compression Seals: One-piece units consisting of silicone compression bulb and stabilizer flange; attached to door frame adhesively.

- c. Magnetic Seals: One-piece units consisting of closed-cell sponge neoprene seal and resiliently mounted magnet held in place by metal retainer, with retainer cover of same material as door frame; attached to door frame with concealed screws.
 - 2. Automatic Door Bottoms: Neoprene or silicone gasket, held in place by metal housing, that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.
 - a. Mounting: **[Mortised or semimortised into bottom of door][or][surface mounted on face of door]** as required to comply with assembly performance requirements.
 - 3. Door Bottoms: Neoprene or silicone gasket held in place by metal housing; mortised into bottom edge of door.
 - 4. Cam-Lift Hinges: **[Manufacturer's standard full-mortise type as required to support weight of door]<Insert requirements>**.
 - 5. Thresholds: Flat, smooth, unfluted type recommended in writing by manufacturer; fabricated from **[aluminum][stainless steel]**.
 - a. Finish: **[Clear][Color]** anodic finish.
 - b. Color: **[Light bronze][Medium bronze][Dark bronze][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert requirements>**.
- B. Astragals for Double Doors: **[Manufacturer's standard metal acoustic astragals with integral acoustic seals]<Insert requirements>**.
- C. Other Hardware: Comply with requirements in **[Section 087100 "Door Hardware."][Section 087111 "Door Hardware (Descriptive Specification)."]**

2.5 SOUND CONTROL ACCESSORIES

- A. Glass and Glazing: **[Manufacturer's glazing system complying with assembly performance requirements.][Comply with requirements in Section 088000 "Glazing."][Comply with requirements in Section 088813 "Fire-Rated Glazing."]<Insert glazing requirements.>**
 - 1. Glass: **[ASTM C1036, Type 1, q3, safety glass complying with testing requirements in 16 CFR 1201 for category based on lite size]<Insert requirements>**.
- B. Grout: ASTM C476, with a slump of not more than **4 inches (102 mm)** as measured in accordance with ASTM C143/C143M.
- C. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for **15-mil (0.4-mm)** dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 FABRICATION

- A. Fabrication Standard: Comply with requirements in NAAMM-HMMA 865 unless otherwise specified or indicated on Drawings.
- B. Hardware Preparation: Factory prepare frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping.

1. Reinforce doors and frames to receive nontemplated mortised and surface-mounted hardware.
 2. Locate hardware as indicated [**on Drawings**][**in accordance with NAAMM-HMMA 831**][**<Insert requirements>**].
- C. Steel Doors: Fabricate to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.
1. Seamless Edge Construction: Fabricate doors with faces joined at vertical edges by welding; grind, fill, and dress welds to make them invisible and to provide a smooth, flush surface.
 2. Exterior Doors: Close top edges flush and seal joints against water penetration. Provide weep-hole openings in bottom of exterior doors to permit moisture to escape.
 3. Glazed Lites: Factory install glazed lites in accordance with requirements of tested assembly and to comply with assembly performance requirements. Provide fixed stops and moldings welded on secure side of door.
- D. Hollow-Metal Frames: Fabricate to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.
1. Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 2. Where welded frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated from same thickness metal as frames. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
 3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners or provide plug buttons to conceal fasteners.
 4. Floor Anchors for Welded Frames: Weld anchors to bottom of jambs and fixed mullions with at least four spot welds per anchor.
 5. Masonry Jamb Anchors for Welded Frames: Locate anchors not more than **18 inches (457 mm)** from top and bottom of frame. Space anchors not more than **32 inches (813 mm)** o.c. and provide minimum quantity as follows:
 - a. Two anchors per jamb up to **60 inches (1524 mm)** in height.
 - b. Three anchors per jamb from **60 to 90 inches (1524 to 2286 mm)** in height.
 - c. Four anchors per jamb from **90 to 96 inches (2286 to 2438 mm)** in height.
 - d. Four anchors per jamb plus one additional anchor per jamb for each **24 inches (610 mm)**, or fraction thereof, more than **96 inches (2438 mm)** in height.
 6. In-Place Masonry or Concrete Jamb Anchors for Welded Frames: Locate anchors installed using postinstalled expansion anchors not more than **6 inches (152 mm)** from top and bottom of frame. Space anchors not more than **26 inches (660 mm)** o.c. and provide minimum quantity as follows:
 - a. Three anchors per jamb up to **60 inches (1524 mm)** in height.
 - b. Four anchors per jamb from **60 to 90 inches (1524 to 2286 mm)** in height.
 - c. Five anchors per jamb from **90 to 96 inches (2286 to 2438 mm)** in height.
 - d. Five anchors per jamb plus one additional anchor per jamb for each **24 inches (610 mm)**, or fraction thereof, more than **96 inches (2438 mm)** in height.
 7. Stud-Wall Jamb Anchors for Welded Frames: Locate anchors not more than **18 inches (457 mm)** from top and bottom of frame. Space anchors not more than **32 inches (813 mm)** o.c. and provide minimum quantity as follows:
 - a. Three anchors per jamb up to **60 inches (1524 mm)** in height.
 - b. Four anchors per jamb from **60 to 90 inches (1524 to 2286 mm)** in height.
 - c. Five anchors per jamb from **90 to 96 inches (2286 to 2438 mm)** in height.
 - d. Five anchors per jamb plus one additional anchor per jamb for each **24 inches (610 mm)**,

- or fraction thereof, more than **96 inches (2438 mm)** in height.
- e. Two anchors per head for frames more than **42 inches (1067 mm)** wide and mounted in metal-stud partitions.
- 8. Jamb Anchors for Two-Piece Slip-On Frames: Locate as required to transfer loads to adjoining construction, but not more than **8 inches (203 mm)** from top and bottom of frame and spaced not more than **12 inches (305 mm)** o.c.
 - 9. Grouted-Frame Head Reinforcement for Welded Frames: For grouted frames more than **48 inches (1219 mm)** wide, weld continuous head reinforcement to back of frame at head full for the width of opening.
 - 10. Grout Guards for Welded Frames: Weld guards to frame at back of hardware cutouts, sound control seal preparations, and as required to close off other interior of openings in frames to be grouted.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Welded Frames: Remove temporary shipping spreader bars installed at factory. Restore exposed finishes by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION OF SIDE-HINGED, STEEL SOUND CONTROL DOOR ASSEMBLIES

- A. General: Install sound control door assemblies plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's written instructions.
 - 1. Fire-Rated Assemblies: Install in accordance with NFPA 80.
 - 2. Smoke- and Draft-Control Assemblies: Install in accordance with NFPA 105.
- B. Welded Frames: Set accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. Check squareness, twist, and plumbness of frames as walls are constructed. Shim as necessary to comply with installation tolerances. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - 1. Frames Fabricated in Sections: Field splice by welding face joint continuously; grind, fill, and dress; make splice smooth, flush, and invisible on exposed faces.
 - 2. Corrosion-Resistant Coating: Apply corrosion-resistant coating to backs of frames to be filled with grout containing antifreezing agents.
 - 3. Floor Anchors: Secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled

expansion anchors if so indicated and approved on Shop Drawings.

4. Grouted Frames in Masonry or Concrete Construction: Hand trowel grout to solidly fill space between frames and substrate. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 5. Metal-Stud Partitions: Fully fill frames with mineral-fiber insulation.
 6. In-Place Masonry or Concrete Construction: Secure jambs with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. In-Place Gypsum Board Partitions: Secure jambs with countersunk anchors, and fill and make smooth, flush, and invisible on exposed faces.
 8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above unless frame is anchored to structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
- C. Two-Piece Slip-On Frames: Set accurately in position; plumbed, and aligned in accordance with manufacturers written instruction.
- D. Steel Doors: Fit doors accurately in frames in accordance with manufacturer's written instructions and to comply with assembly performance requirements.
- E. Sound Control Seals: Where seals have been factory prefit and preinstalled and subsequently removed for shipping, reinstall seals and adjust in accordance with manufacturer's written instructions.
- F. Cam-Lift Hinges: Install in accordance with manufacturer's written instructions.
- G. Thresholds: Set thresholds in full bed of sealant complying with requirements in Section 079200 "Joint Sealants."
- H. Astragals for Double Doors: Install in accordance with manufacturer's written instructions.
- I. Glazing: Comply with installation requirements in **[Section 088000 "Glazing"]****[Section 088813 "Fire-Rated Glazing"]** and with manufacturer's written instructions.
1. Secure stops with **[tamper-resistant]** countersunk flat- or oval-head machine screws spaced uniformly not more than **9 inches (229 mm)** o.c. and not more than **2 inches (51 mm)** o.c. from each corner.
- J. Installation Tolerances:
1. Opening Width: Plus **1/16 inch (1.6 mm)** or minus **1/32 inch (0.8 mm)**, measured from rabbet to rabbet at top, middle, and bottom of frame.
 2. Opening Height: Plus **1/16 inch (1.6 mm)** or minus **1/32 inch (0.8 mm)**, measured from head rabbet to top of floor or bottom of frame minus jamb extensions at each jamb and across head.
 3. Squareness: Plus or minus **1/16 inch (1.6 mm)**, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 4. Alignment: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs on a horizontal line parallel to plane of wall.
 5. Twist: Plus or minus **1/16 inch (1.6 mm)**, measured at opposite face corners of jambs on parallel lines and perpendicular to plane of wall.
 6. Plumbness: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs on a perpendicular line from head to floor.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
- B. Acoustical Testing: To verify assemblies comply with acoustical performance requirements.
 - 1. Testing Extent: **[One sound control door assembly chosen at random][Every sound control door assembly]<Insert requirements>**.
 - 2. Testing Method: ASTM E336, with NIC rating calculated in accordance with ASTM E413.
 - 3. Acceptable Results: NIC rating within 5 dB of laboratory STC rating.
- C. Fire-Rated Door Assembly Acceptance Testing: Test and inspect fire-rated sound control door assemblies in accordance with NFPA 80.
- D. Smoke- and Draft-Control Door Assembly Acceptance Testing: Test and inspect smoke- and draft-control door assemblies in accordance with NFPA 105.
- E. Egress Door Assembly Acceptance Testing: Test and inspect egress doors in accordance with NFPA 101.
- F. Repair or remove and replace installations where testing and inspections indicate that they do not comply with specified requirements.
- G. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- H. Inspection Report: Prepared and submitted in writing to Architect and Contractor within 24 hours after testing.

3.5 ADJUSTING AND CLEANING

- A. Grouted Welded Frames: Clean grout off frames immediately after installation.
- B. Metallic-Coated Surface Touchup: Immediately after installation, clean abraded areas of doors and frames and repair with galvanizing repair paint in accordance with manufacturer's written instructions.
- C. Prime-Coat Touchup: Immediately after installation, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible, rust-inhibitive, air-drying primer.
- D. Factory-Applied Paint Touchup: Immediately after installation, repair damaged areas of factory-applied paint and touchup in accordance with manufacturer's written instructions.
- E. Remove and replace defective work, including defective or damaged sound seals and doors and frames that are warped, bowed, or otherwise defective.
 - 1. Adjust seals to provide contact required to comply with assembly performance requirements.
- F. Check and adjust seals, door bottoms, and other hardware items immediately before final inspection.

END OF SECTION 08 34 73 13



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Task	Specification	Specification Description
08 34 73 13	08 05 13 00	Stainless-Steel Doors and Frames



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SECTION 08 34 73 16 - WOOD SOUND CONTROL DOOR ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood sound control doors.

B. Related Requirements:

1. Section 083473.13 "Metal Sound Control Door Assemblies" for sound control assemblies with steel doors and steel frames.

1.2 COORDINATION

- A. Coordinate installation of anchorages for sound control door assemblies. Furnish setting drawings, templates, and directions for installing anchorages. Deliver sleeves, inserts, anchor bolts, and items with integral anchors to Project site in time for installation.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1. Review procedures for coordinating frame and anchor installation with wall construction.
2. Review required field quality-control procedures.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Wood sound control doors.

- B. Product Data Submittals: Include sound ratings, construction details, material descriptions, core descriptions, **[fire-resistance rating,][temperature-rise ratings,]** and finishes.

C. Sustainable Design Submittals:

1. Chain-of-Custody Qualification Data: For manufacturer and vendor.
2. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
3. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
4. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
5. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
6. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
7. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

8. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
9. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
10. Product Data: For composite wood products, indicating compliance with requirements for formaldehyde emissions.
11. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

D. Shop Drawings: For sound control door assemblies.

1. Include elevations of each door design.
2. Include details of sound control seals, door bottoms, and thresholds.
3. Include details of doors, including vertical- and horizontal-edge details and metal thicknesses.
4. Include frame details for each frame type, including dimensioned profiles and metal thicknesses.
5. Include locations of reinforcements and preparations for hardware.
6. Include details of each different wall opening condition.
7. Include details of anchorages, joints, field splices, and connections.
8. Include details of accessories.
9. Include details of moldings, removable stops, and glazing.
10. Include details of conduits and preparations for power, signal, and control systems.

E. Samples for Initial Selection: For units with factory-applied finishes.

F. Samples for Verification: For each type of exposed finish not less than **3 by 5 inches (76 by 127 mm)**.

1. Doors and Frames: Samples approximately **12 by 12 inches (305 by 305 mm)**.
 - a. Doors: Include section of vertical-edge, top, and bottom construction; automatic door bottom or gasket; core construction; **[glazing];** and hinge and other applied hardware reinforcement.
 - b. Frames: Include profile, corner joint, floor and wall anchors, and seals.

G. Schedule: Provide a schedule of sound control door assemblies prepared using same reference numbers for details and openings as those on Drawings. Coordinate with the Door Hardware Schedule on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[Installer][and][acoustical testing agency]**.
- B. Product Certificates: For each type of sound control door assembly.
- C. Product Test Reports: For each sound control door assembly, for tests performed by **[manufacturer and witnessed by a qualified testing agency][a qualified testing agency]**.
- D. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.
- E. Field quality-control reports.
- F. Sample Warranty: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sound control door assemblies to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.
- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- D. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- E. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- F. Acoustical Testing Agency Qualifications: An independent agency accredited as an acoustical laboratory according to the National Voluntary Laboratory Accreditation Program of NIST.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Avoid the use of nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store doors and frames vertically under cover at Project site with head up. Place on minimum **4-inch-(102-mm-)** high wood blocking. Provide minimum **1/4-inch (6-mm)** space between each stacked door to permit air circulation.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install wood sound control doors until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of sound control door assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Failure to meet sound rating requirements.
 - b. Faulty operation of sound seals.
 - c. Deterioration of metal frames, metal finishes, and other materials beyond normal use or weathering.
 - d. Wood doors that are warped (bow, cup, or twist) more than **1/4 inch (6 mm)** in a **42-by-84-inch (1067-by-2134-mm)** section, or show telegraphing of core construction in face veneers exceeding **0.01 inch in a 3-inch (0.25 mm in a 75-mm)** span.
2. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sound Rating: Provide sound control door assemblies identical to those of assemblies tested as sound-retardant units by an acoustical testing agency, and have the following minimum rating:
 1. STC Rating: **[As indicated on Drawings][As indicated in the Door Schedule on the Drawings]<Insert STC rating>** as calculated by ASTM E413 when tested in an operable condition in accordance with ASTM E90.
- B. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings[**and temperature-rise limits**] indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
 1. Smoke- and Draft Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.2 WOOD SOUND CONTROL DOORS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 1. **[AMBICO Limited]**
 2. **[Krieger Specialty Products Company]**
 3. **[Overly Door Company]**
 4. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 1. **[AMBICO Limited]**
 2. **[Krieger Specialty Products Company]**
 3. **[Overly Door Company]**
 4. **<Insert manufacturer's name>**
- C. Source Limitations: Obtain wood sound control door assemblies, including doors, frames, sound control seals, hinges, thresholds, and other items essential for sound control, from single source from single manufacturer.

- D. Certified Wood: Wood doors shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-00 and FSC STD-40-004.
- E. Certified Wood: Wood doors shall be certified as "FSC Pure"[or "**FSC Mixed Credit**"] according to FSC STD-01-001 and FSC STD-40-004.
- F. Certified Wood: Wood doors shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
- G. Certified Wood: Wood doors shall [**contain not less than 60 percent**][**be made from**] certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "Technical Barriers to Trade."
- H. Certified Wood: Wood doors shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
- I. Adhesives: Do not use adhesives that contain urea formaldehyde.
- J. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- K. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- L. Adhesives: Do not use adhesives that contain urea formaldehyde.
- M. Adhesives: Do not use adhesives that contain urea formaldehyde.
- N. Composite Wood Products: Products shall be made without urea formaldehyde.
- O. Composite Wood Products: Products shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- P. Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
- Q. Composite Wood Products: Formaldehyde emission rates shall not be greater than the following when tested according to ASTM D6007 or ASTM E1333:
 - 1. Hardwood Plywood: 0.05 ppm.
 - 2. Particleboard: 0.09 ppm.
 - 3. MDF More Than **5/16 Inch (8 mm)** Thick: 0.11 ppm.
 - 4. MDF **5/16 Inch (8 mm)** or Less in Thickness: 0.13 ppm.
- R. Composite Wood Products: Products shall be made without urea formaldehyde.
- S. Doors: Flush-design sound control doors, [**1-3/4 inches (44 mm) thick**][**2 inches (51 mm) thick**][**2-1/4 inches (57 mm) thick**][**thickness as required to provide STC rating**]<Insert dimension>; with

manufacturer's standard sound-retardant core as required to provide STC[**and fire**] rating indicated. Fabricate in accordance with WDMA 1.S.1-A.

- T. Materials: Comply with [Section 081416 "Flush Wood Doors"] [Section 081433 "Stile and Rail Wood Doors"] for grade, faces, veneer matching, fabrication, finishing, and other requirements unless otherwise indicated.

1. Glazing: As required by sound control door assembly manufacturer to comply with sound control[**and fire-rated-door labeling**] requirements.

- U. Finishes:

1. Factory finish sound control wood doors to match doors specified in [Section 081416 "Flush Wood Doors."] [Section 081433 "Stile and Rail Wood Doors."]

2.3 SOUND CONTROL FRAMES

- A. Frames: Fabricate sound control door frames with corners mitered, reinforced, and continuously welded the full depth and width of frame. Fabricate in accordance with NAAMM-HMMA 865.

1. Weld frames in accordance with NAAMM-HMMA 820.
2. Exterior Frames: Fabricate from metallic-coated steel sheet **0.079-inch (2.01-mm)** nominal thickness or thicker as required to provide STC rating indicated.
3. Interior Frames: Fabricate from cold-rolled steel sheet unless otherwise indicated, **0.075-inch (1.90-mm)** nominal thickness or thicker as required to provide STC rating indicated.
4. Hardware Reinforcement: Fabricate in accordance with NAAMM-HMMA 865 of same material as face sheets.
5. Head Reinforcement: Metallic-coated steel channel or angle stiffener, **0.108-inch (2.74-mm)** nominal thickness.
6. Jamb Anchors:
 - a. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than **0.064-inch (1.63-mm)** nominal-thickness metallic-coated steel with corrugated or perforated straps not less than **2 inches (51 mm)** wide by **10 inches (254 mm)** long; or wire anchors not less than **0.156 inch (3.9 mm)** thick.
 - b. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than **0.048-inch (1.21-mm)** nominal-thickness uncoated steel unless otherwise indicated.
 - c. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum **3/8-inch- (9.5-mm-)** diameter, metallic-coated steel bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
7. Floor Anchors: Not less than **0.079-inch (2.01-mm)** nominal-thickness metallic-coated steel, and as follows:
 - a. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - b. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than **2-inch (51-mm)** height adjustment. Terminate bottom of frames at finish floor surface.
8. Ceiling Struts: Minimum **3/8-inch-thick by 2-inch- (9.5-mm-thick by 50-mm-)** wide uncoated steel unless otherwise indicated.
9. Plaster Guards: Metallic-coated steel sheet, not less than **0.026 inch (0.6 mm)** thick.

B. Materials:

1. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
3. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B, with **G60 (Z180)** zinc (galvanized) or **A40 (ZF120)** zinc-iron-alloy (galvannealed) coating designation.
4. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls in accordance with ASTM A153/A153M, Class B.
5. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized in accordance with ASTM A153/A153M or ASTM F2329.
6. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching sound control door frames of type indicated.
7. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers.

C. Finishes:

1. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
 - a. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
2. Factory-Applied Paint Finish: Manufacturer's standard primer and finish coats, complying with SDI A250.3 for performance and acceptance criteria.
 - a. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range].**

2.4 HARDWARE

A. Sound Control Door Hardware: Manufacturer's standard sound control system, including head and jamb seals, door bottoms, **[cam-lift hinges,]** and thresholds, as required by testing to achieve STC **[and fire]** rating indicated.

1. Head and Jamb Seals: **[One of the following:]**
 - a. Neoprene Compression Seals: One-piece units consisting of closed-cell sponge neoprene seal held in place by metal retainer, with retainer cover of same material as door frame; attached to door frame with concealed screws.
 - b. Silicone Compression Seals: One-piece units consisting of silicone compression bulb and stabilizer flange; attached to door frame adhesively.
 - c. Magnetic Seals: One-piece units consisting of closed-cell sponge neoprene seal and resiliently mounted magnet held in place by metal retainer, with retainer cover of same material as door frame; attached to door frame with concealed screws.
2. Automatic Door Bottoms: Neoprene or silicone gasket, held in place by metal housing, that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.
 - a. Mounting: **[Mortised or semimortised into bottom of door][or][surface mounted on face of door]** as required by testing to achieve STC rating indicated.

3. Door Bottoms: Neoprene or silicone gasket held in place by metal housing; mortised into bottom edge of door.
4. Cam-Lift Hinges: Full-mortise template type that raises door 1/2 inch (13 mm) when door is fully open; with hardened pin; fabricated from stainless steel.
5. Thresholds: Flat, smooth, unfluted type as recommended by manufacturer; fabricated from **[aluminum][stainless steel][solid wood matching wood door faces]**.
 - a. Finish: **[Clear][Color]** anodic finish.
 - b. Color: **[Light bronze][Medium bronze][Dark bronze][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]**.

- B. Other Hardware: Comply with requirements in **[Section 087100 "Door Hardware."][Section 087111 "Door Hardware (Descriptive Specification)."]**

2.5 SOUND CONTROL ACCESSORIES

- A. Glazing: **[Manufacturers' standard factory-installed glazing.][Comply with requirements in Section 088000 "Glazing."]**
- B. Grout: Comply with ASTM C476, with a slump of not more than **4 inches (102 mm)** as measured in accordance with ASTM C143/C143M.
- C. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for **15-mil (0.4-mm)** dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 FABRICATION

- A. Wood Sound Control Door Fabrication: Factory fit doors to suit frame-opening sizes indicated, with uniform clearances and bevels in accordance with WDMA I.S.1-A unless otherwise indicated. Comply with final door hardware schedules and hardware templates.
 1. Comply with requirements in NFPA 80 for fire-rated and smoke control doors.
 2. Glazed Lites: Factory install glazed lites in accordance with requirements of tested assembly to achieve STC rating indicated.
 3. Locate door hardware as indicated, or if not indicated, in accordance with DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - a. Coordinate measurements of hardware mortises in steel frames to verify dimensions and alignment before factory machining.
- B. Sound Control Frame Fabrication: Fabricate sound control frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
 1. Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated from same thickness metal as frames.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per

- anchor.
4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than **18 inches (457 mm)** from top and bottom of frame. Space anchors not more than **32 inches (813 mm)** o.c. and as follows:
 - 1) Two anchors per jamb up to **60 inches (1524 mm)** in height.
 - 2) Three anchors per jamb from **60 to 90 inches (1524 to 2286 mm)** in height.
 - 3) Four anchors per jamb from **90 to 96 inches (2286 to 2438 mm)** in height.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each **24 inches (610 mm)**, or fraction thereof, more than **96 inches (2438 mm)** in height.
 - b. Stud-Wall Type: Locate anchors not more than **18 inches (457 mm)** from top and bottom of frame. Space anchors not more than **32 inches (813 mm)** o.c. and as follows:
 - 1) Three anchors per jamb up to **60 inches (1524 mm)** in height.
 - 2) Four anchors per jamb from **60 to 90 inches (1524 to 2286 mm)** in height.
 - 3) Five anchors per jamb from **90 to 96 inches (2286 to 2438 mm)** in height.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each **24 inches (610 mm)**, or fraction thereof, more than **96 inches (2438 mm)** in height.
 - 5) Two anchors per head for frames more than **42 inches (1066 mm)** wide and mounted in metal-stud partitions.
 - c. Postinstalled Expansion Type: Locate anchors not more than **6 inches (152 mm)** from top and bottom of frame. Space anchors not more than **26 inches (660 mm)** o.c.
 5. Head Reinforcement: For grouted frames more than **48 inches (1219 mm)** wide, weld continuous head reinforcement to back of frame at head full width of opening.
 6. Hardware Preparation: Factory prepare sound control frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping.
 - a. Reinforce frames to receive nontemplated mortised and surface-mounted door hardware.
 7. Plaster Guards: Weld guards to frame at back of hardware cutouts and glazing-stop screw and sound control seal preparations to close off interior of openings in frames to be grouted.
 8. Tolerances: Fabricate frames to tolerances indicated in NAAMM-HMMA 865.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations of sound control door frame connections before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling,

and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

- B. Prior to installation, adjust and securely brace sound control door frames to the following tolerances:
 - 1. Squareness: Plus or minus **1/16 inch (1.6 mm)**, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus **1/16 inch (1.6 mm)**, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install sound control door assemblies plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's written instructions.
- B. Frames: Install sound control door frames in sizes and profiles indicated.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames in accordance with NFPA 80.
 - b. At openings requiring smoke and draft control, install frames in accordance with NFPA 105.
 - c. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, and dress; make splice smooth, flush, and invisible on exposed faces.
 - d. Install sound control frames with removable glazing stops located on secure side of opening.
 - e. Remove temporary braces only after frames or bucks have been properly set and secured.
 - f. Check squareness, twist, and plumbness of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Apply corrosion-resistant coating to backs of frames to be filled with mortar, grout, and plaster containing antifreezing agents.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 3. Metal-Stud Partitions: Fully fill frames with mineral-fiber insulation.
 - 4. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 5. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 6. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above unless frame is anchored to masonry or to other structural support at each jamb. Bend top

of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.

7. Grouted Frames: Solidly fill space between frames and substrate with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
8. Installation Tolerances: Adjust sound control door frames for squareness, alignment, twist, and plumbness to the following tolerances:
 - a. Squareness: Plus or minus **1/16 inch (1.6 mm)**, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus **1/16 inch (1.6 mm)**, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs on a perpendicular line from head to floor.

C. Doors: Fit sound control doors accurately in frames, within clearances indicated below. Shim as necessary.

1. Non-Fire-Rated Doors: Fit non-fire-rated doors accurately in frames with the following clearances:
 - a. Jambs: **1/8 inch (3 mm)**.
 - b. Head with Butt Hinges: **1/8 inch (3 mm)**.
 - c. Head with Cam-Lift Hinges: As required by manufacturer, but not more than **3/8 inch (9.5 mm)**.
 - d. Sill: Manufacturer's standard.
 - e. Between Edges of Pairs of Doors: **1/8 inch (3 mm)**.

2. Fire-Rated Doors: Install fire-rated doors with clearances in accordance with NFPA 80.

D. Sound Control Seals: Where seals have been factory prefit and preinstalled and subsequently removed for shipping, reinstall seals and adjust in accordance with manufacturer's written instructions.

E. Cam-Lift Hinges: Install hinges in accordance with manufacturer's written instructions.

F. Thresholds: Set thresholds in full bed of sealant complying with requirements in Section 079200 "Joint Sealants."

G. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with sound control door assembly manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than **9 inches (230 mm)** o.c. and not more than **2 inches (51 mm)** o.c. from each corner.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.

B. Testing Services: Perform testing for verification that assembly complies with STC rating requirements.

1. Acoustical testing and inspecting agency must select **[one]<Insert number>** sound control door(s) at random from sound control door assemblies that are completely installed for testing.
2. Field tests must be conducted in accordance with ASTM E336, with results calculated in accordance with ASTM E413. Acceptable field NIC values must be within 5 dB of laboratory STC

values.

3. Inspection Report: Acoustical testing agency must submit report in writing to Architect and Contractor within 24 hours after testing.
 4. If tested door fails, replace or rework all sound control door assemblies to bring them into compliance at Contractor's expense.
 - a. Additional testing and inspecting at Contractor's expense will be performed to determine if replaced or additional work complies with specified requirements.
- C. Prepare test and inspection reports.

3.5 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and adjust seals, door bottoms, and other sound control hardware items right before final inspection. Leave work in complete and proper operating condition.
- B. Remove and replace defective work, including defective or damaged sound seals and doors and frames that are warped, bowed, or otherwise unacceptable.
 1. Adjust gaskets, gasket retainers, and retainer covers to provide contact required to achieve STC rating.
- C. Grouted Frames: Clean grout off sound control door frames immediately after installation.
- D. Prime-Coat Touchup: Immediately after erection of frames, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible, rust-inhibitive, air-drying primer.
- E. Metallic-Coated Surfaces: Clean abraded areas of frames and repair with galvanizing repair paint in accordance with manufacturer's written instructions.

END OF SECTION 08 34 73 16

SECTION 08 35 13 00 - FOLDING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Accordion folding doors.
2. Panel folding doors.
3. Metal bifold doors.
4. Mirrored bifold doors.
5. Fire-rated folding doors.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for folding doors.

B. Sustainable Design Submittals:

1. Environmental Product Declaration (EPD): For each product.
2. Health Product Declaration (HPD): For each product.
3. Environmental Product Declaration (EPD): For each product.
4. Health Product Declaration (HPD): For each product.
5. Environmental Product Declaration (EPD): For each product.
6. Environmental Product Declaration (EPD): For each product.
7. Environmental Product Declaration (EPD): For each product.
8. Third-Party Certifications: For each product.
9. Third-Party-Certified Life-Cycle Assessment: For each product.
10. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.

C. Shop Drawings:

1. Include plans, elevations, sections, and installation details.
2. Include clearances required for operation, **[operating and control mechanisms,][access requirements,][storage pockets and pocket doors,]** and accessory items.
3. Fire-Release System: Describe system, including testing and resetting instructions for fire-rated folding doors.
4. Include diagrams for power, signal, and control wiring.

D. Samples: For each exposed product and for each color and texture specified.

E. Samples for Initial Selection: For each type of exposed finish.

1. Include Samples of hardware and accessories involving color and finish selection.

F. Samples for Verification: For each type of exposed finish.

1. Include Samples of hardware and accessories to verify color and finish selection.

G. Product Schedule: For folding doors. [**Use same designations indicated on Drawings.**]

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each fire-rated folding door, for tests performed by a qualified testing agency.

C. Evaluation Reports: For fire-rated folding doors, from ICC-ES.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For folding doors to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of fire-rated folding doors.

B. Certified Wood: Provide an invoice, including vendor's chain-of-custody number, product cost, and entity being invoiced.

C. Vendor Qualifications: Provide proof of use of vendors that are certified for chain of custody by an FSC-accredited certification body.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install folding doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for building occupants after completion of construction during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 ACCORDION FOLDING DOORS

A. Description: Top-supported, horizontal-sliding, manually operated accordion folding doors, with chain controlling the spacing and extension of pantographic or X-type accordion folding frames. Continuous inner and outer covers completely cover the folding frames and pleat as the door retracts.

B. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be

incorporated into the Work include, but are not limited to, the following]:

1. [Advanced Door Technologies]
 2. [C.H.I. Overhead Doors, Inc.]
 3. [KWIK-WALL Company]
 4. [Moderco Inc]
 5. [Modernfold, Inc]
 6. <Insert manufacturer's name>
- C. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
1. [Advanced Door Technologies]
 2. [C.H.I. Overhead Doors, Inc.]
 3. [KWIK-WALL Company]
 4. [Moderco Inc]
 5. [Modernfold, Inc]
 6. <Insert manufacturer's name>
- D. Covers: Attached to accordion folding frames with concealed fasteners at sufficient intervals to prevent the cover from sagging and separating from the frame. Fastened to allow on-site cover removal and repair. Covers fabricated from material indicated with vertical seams located in valleys of pleats, formed when door is retracted, and with bottom and top hems or bindings.
1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: [25]<Insert value> or less.
 - b. Smoke-Developed Index: [50][450]<Insert value> or less.
 2. Vinyl Cover Material: Reinforced with woven backing weighing not less than [20 oz./linear yd. (567 g/m)]<Insert value>.
 - a. Color, Texture, and Pattern: [As indicated by manufacturer's designation][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color, texture, and pattern>.
 3. Fabric Cover Material: Weighing not less than [6.7 oz./linear yd. (208 g/m)][12 oz./linear yd. (372 g/m)]<Insert value>, treated to resist stains.
 - a. Color, Texture, and Pattern: [As indicated by manufacturer's designation][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color, texture, and pattern>.
 4. Carpet Cover Material: Manufacturer's standard nonwoven carpet, needle punched with fused fibers to prevent unraveling.
 - a. Color, Texture, and Pattern: [As indicated by manufacturer's designation][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color, texture, and pattern>.
- E. Sweep Seals: Manufacturer's standard top and bottom sweep seals on [both sides][one side] of door.
- F. Carriers: Four-wheel carriers at lead post and two-wheel carriers at intermediate spacing, as necessary for size and weight of partition, to ensure secure, easy, and quiet operation. Wheels are ball-bearing type and equipped with nylon tread and steel shafts.

- G. Tracks: Manufacturer's standard metal track, made of extruded aluminum or formed steel with factory-applied, corrosion-resistant finish. Limit track deflection, independent of structural supporting system, to no more than 80 percent of bottom clearance. Design and fabricate track to support accordion folding doors; to enable their operation without damage to track, folding unit, or adjacent surfaces; and with the following features:
1. Mounting: **[Recessed][Surface]** mounted.
 2. Ceiling Guard: Metal guard to protect adjacent ceiling surfaces from damage by door operation; with finish matching other exposed metal.
 3. Center Stop: For center-opening doors.
 4. Curved Track Sections: With ceiling clips to accommodate configuration indicated.
 5. Glide Switch: To divert door to auxiliary track.
 6. Pivot Switch: To change track direction.
 7. Cross-Track Switch: To allow one door to cross another.
- H. Hardware: Manufacturer's standard heavy-duty, manually operated metal pulls and latches as follows:
1. Finish: **[Clear-anodized aluminum][Satin stainless steel][Dull chromium-finish brass][Dull chromium-finish steel][Manufacturer's standard]<Insert finish>**.
 2. Latch: Operable from **[both sides][one side]** of closed door **[with coin-slot release on opposite side]**.
 3. Lock: **[Manufacturer's standard key-operated cylinder lock, operable from both sides][Manufacturer's standard key-operated cylinder lock, operable from one side; privacy lock on other side][Deadlock to receive cylinder, operable from both sides. See Section 087100 "Door Hardware" for cylinder requirements][Deadlock to receive cylinder, operable from both sides. See Section 087111 "Door Hardware (Descriptive Specification)" for cylinder requirements]<Insert requirements>**.
 4. Foot Bolts: On lead post where indicated. Secure to post to avoid interference with seals.
- I. Jamb Molding: Manufacturer's molding at closing jamb as required for light-tight jamb closure.
1. Jamb Strip: Nonferrous for end-opening doors to ensure tight closure by engaging rubber bumper on lead post.
- J. Posts: Manufacturer's standard steel or extruded-aluminum posts formed for rigidity and to provide light seal at supporting construction.
1. Fixed Jamb Post: To anchor door to stack jamb.
 2. Rolling Jamb Post: To allow door to disconnect from stack jamb.
 3. Sliding Jamb: To allow door to stack in storage pocket.
 4. Lead Post: At closing edge of door.
- K. Tiebacks: To maintain door in stacked position.
- L. Stacking Configuration: **[As indicated on Drawings]<Insert configuration>**.

2.2 PANEL FOLDING DOORS

- A. Description: Top-supported, horizontal-sliding, manually operated panel folding doors, with panels joined by continuous hinge connectors for the full height of panels.
- B. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

1. **[Won-Door Corporation]**
 2. **[Woodfold Manufacturing, Inc.]**
 3. **<Insert manufacturer's name>**
- C. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Won-Door Corporation]**
 2. **[Woodfold Manufacturing, Inc.]**
 3. **<Insert manufacturer's name>**
- D. Certified Wood: Verify wood doors are certified as "FSC Pure"[or **"FSC Mixed Credit"**] in accordance with FSC STD-01-001 and FSC STD-40-004.
- E. Certified Wood: Verify wood doors are labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" in accordance with FSC STD-01-001 and FSC STD-40-004, or be certified and labeled in accordance with the standards of the Programme for Endorsement of Forest Certification.
- F. Certified Wood: Verify wood doors are certified in accordance with the American Tree Farm System's "ATFS 2021 Standards of Sustainability," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
- G. Core Material and Thickness: Manufacturer's standard.
- H. Nominal Panel Width: **[4 inches (100 mm)][5 inches (125 mm)][6 inches (150 mm)][8 inches (200 mm)]<Insert dimension>**.
- I. Panel Facing: Complying with the following:
1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: **[25]<Insert value>** or less.
 - b. Smoke-Developed Index: **[50][450]<Insert value>** or less.
 2. Vinyl Facing: Factory bonded to core.
 - a. Color and Texture: **[As indicated by manufacturer's designation][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and texture>**.
 3. Vinyl Facing with Woven Backing: Factory bonded to core.
 - a. Color and Texture: **[As indicated by manufacturer's designation][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and texture>**.
 4. Plastic-Laminate Facing: Grade VGS, high-pressure plastic laminate complying with ISO 4586-3; adhesive applied under pressure to core.
 - a. Color, Texture, and Pattern: **[As indicated by manufacturer's designation][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color, texture, and pattern>**.
 5. Wood-Veneer Facing: **<Insert species>** wood veneer, laminated to core, with manufacturer's

standard **[clear][stained]** transparent finish.

- a. Stain Color: **[As indicated by manufacturer's designation][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.
- J. Carriers: Four-wheel carriers at lead post and two-wheel carriers at intermediate spacing, as necessary for size and weight of partition, to ensure secure, easy, and quiet operation.
1. Panels **5 Inches (125 mm)** Wide or Less: **[Nylon wheels and axles][Ball-bearing wheels with nylon tread and steel shafts][Manufacturer's standard wheels and axles]**.
 2. Panels More Than **5 Inches (125 mm)** Wide: Ball-bearing wheels with nylon tread and steel shafts.
- K. Tracks: Manufacturer's standard metal track, made of extruded aluminum or formed steel with factory-applied, corrosion-resistant finish. Limit track deflection, independent of structural supporting system, to no more than 80 percent of bottom clearance. Design and fabricate track to support operation without damage to track, folding unit, or adjacent surfaces; and with the following features:
1. Mounting: **[Recessed][Surface]** mounted.
 2. Ceiling Guard: Metal guard to protect adjacent ceiling surfaces from damage by door operation; with finish matching other exposed metal.
 3. Center Stop: For center-opening doors.
 4. Curved Track Sections: With ceiling clips to accommodate configuration indicated.
 5. Glide Switch: To divert door to auxiliary track.
 6. Pivot Switch: To change track direction.
 7. Cross-Track Switch: To allow one door to cross another.
- L. Hinge Connector: Manufacturer's standard extruded-vinyl hinge connector.
1. Color: **[As indicated by manufacturer's designation][Match Architect's sample][As selected by Architect from manufacturer's full range][Match or coordinate with facing color]<Insert color>**.
- M. Hardware: Manufacturer's standard heavy-duty, manually operated metal pulls and latches as follows:
1. Finish: **[Clear-anodized aluminum][Satin stainless steel][Dull chromium-finish brass][Dull chromium-finish steel][Manufacturer's standard]<Insert finish>**.
 2. Latch: Operable from **[both sides][one side]** of closed door.
 3. Lock: **[Manufacturer's standard key-operated cylinder lock, operable from both sides][Manufacturer's standard key-operated cylinder lock, operable from one side; privacy lock on other side][Deadlock to receive cylinder, operable from both sides. See Section 087100 "Door Hardware" for cylinder requirements][Deadlock to receive cylinder, operable from both sides. See Section 087111 "Door Hardware (Descriptive Specification)" for cylinder requirements]<Insert requirements>**.
 4. Foot Bolts: On lead post where indicated. Secure to post to avoid interference with seals.
- N. Jamb Molding: Manufacturer's molding at closing jamb as required for light-tight jamb closure.
1. Material: **[Wood, matching species and finish of panel facing][Metal, in manufacturer's standard finish]**.
 2. Jamb Strip: Nonferrous for end-opening doors to ensure tight closure by engaging rubber bumper on lead post.
- O. Wood Track Molding: Manufacturer's standard wood molding on each side of surface-mounted track to match species and finish of panel facings. Install with tight, hairline joints with all fasteners concealed.

- P. Jambs and Posts: Manufacturer's standard steel or extruded-aluminum posts formed for rigidity and to provide light seal at supporting construction.
1. Fixed Jambs: For doors anchors anchored to stack jamb.
 2. Double End Posts: To allow door to operate from both ends.
 3. Rolling Jamb Post: To allow door to disconnect from stack jamb.
 4. Sliding Jamb: To allow door to stack in storage pocket.
 5. Lead Post: At closing edge of door.
- Q. Tiebacks: To maintain door in stacked position.

2.3 METAL BIFOLD DOORS

- A. Description: Metal folding doors hinged together in pairs and supported on pivots at jamb, overhead track, and door guide pins.
- B. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
1. **[Dunbarton Corporation]**
 2. **[Renin Corporation]**
 3. **<Insert manufacturer's name>**
- C. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Dunbarton Corporation]**
 2. **[Renin Corporation]**
 3. **<Insert manufacturer's name>**
- D. Metal Panels: Formed from nominal **0.024-inch- (0.6-mm-)** thick, cold-rolled steel sheet. Channel form vertical edges and weld cross bracing to panel and channel-formed edges.
1. Surface Profile: **[As indicated on Drawings][Fully louvered][Flush][Paneled][Louvered and paneled]<Insert profile>**.
 2. Configuration: **[As indicated on Drawings][Two-panel bifold doors for openings up to 36 inches (914 mm) wide][Four-panel bifold doors for openings greater than 36 inches (914 mm) wide]**.
 3. Sheet Metal Texture: **[Smooth][Simulated leather]**.
 4. Protective Finish: Hot-dip galvanized coating applied to panels, stiffeners, hinges, and decorative trim.
 5. Baked-Enamel Finish: Electrostatically applied, baked-on factory finish in **[white][ivory][custom color as selected by Architect]<Insert color>**.
- E. Hardware: Manufacturer's standard felt pads, screws, and pulls in standard finish. Hinges, pivots, and manufacturer's standard wheels factory installed and as follows:
1. Hinges: Three self-aligning hinges per pair of doors.
 2. Guides and Pivots: Not less than **9/16-inch- (14-mm-)** diameter, adjustable screw-type, weight-bearing, zinc-plated pivot rod held in place by nylon rod clamp assemblies; with not less than **1/4-inch- (6.4-mm-)** diameter, spring-loaded, self-aligning, zinc-plated steel guide rods and top pivot rods held in place by nylon sleeves.
 3. Overhead Track: Extruded aluminum, **0.05 inch (1.3 mm)** thick, in mill finish.
 4. Floor Guide: **[Extruded-aluminum track matching top track that retains bottom guide]**

pin(s))**[Mill-finish aluminum floor-mounted bracket retains bottom pivot; provide aligning bracket at leading edges of door pairs for four-panel doors].**

2.4 MIRRORED BIFOLD DOORS

- A. Description: Mirrored folding doors hinged together in pairs and supported on pivots at jamb, with floor and overhead track and door guide pins.
- B. Manufacturers: Subject to compliance with requirements, **[provide products by the following]****[provide products by one of the following]****[available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
1. **[Contractors Wardrobe, Inc.]**
 2. **[Dunbarton Corporation]**
 3. **[Sliding Door Company (The)]**
 4. **<Insert manufacturer's name>**
- C. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Contractors Wardrobe, Inc.]**
 2. **[Dunbarton Corporation]**
 3. **[Sliding Door Company (The)]**
 4. **<Insert manufacturer's name>**
- D. Steel-Panel Door Construction: Flush profile, formed from nominal **0.024-inch- (0.6-mm-)** thick, cold-rolled steel sheet. Channel form vertical edges and weld cross bracing to panel- and channel-formed edges. Attach mirrored glass facing to steel sheet dual-faced cushion tape. Protect bottom edge of mirror with steel channel.
1. Configuration: **[As indicated on Drawings]****[Two-panel bifold doors for openings up to 36 inches (914 mm) wide]****[Four-panel bifold doors for openings greater than 36 inches (914 mm) wide].**
 2. Mirrored-Glass Edging: Mylar to match track and hardware finish.
 3. Protective Finish: Hot-dip galvanized coating applied to panels, stiffeners, hinges, and decorative trim.
 4. Baked-Enamel Finish: Electrostatically applied, baked-on factory finish in **[white]****[ivory]****[black]****[custom color as selected by Architect]****<Insert color>**.
 5. Overhead Track: Extruded aluminum; **0.05 inch (1.3 mm)** thick; **[mill]****[chrome]** finish.
 6. Floor Guide: **[Extruded-aluminum track matching top track that retains bottom guide pin(s)]****[Mill-finish aluminum floor-mounted bracket retains bottom pivot; provide aligning bracket at leading edges of door pairs for four-panel doors].**
- E. Metal-Framed Door Construction: **[Aluminum]****[Steel]** stiles and mechanically fitted rails with screw-attached stiffeners and with mirrored-glass facing attached securely to frames.
1. Panel Style: **[Exposed frame]****[Concealed frame; mirrored glass with polished vertical edges].**
 2. Configuration: **[As indicated on Drawings]****[Two-panel bifold doors for openings up to 36 inches (914 mm) wide]****[Four-panel bifold doors for openings greater than 36 inches (914 mm) wide].**
 3. Steel, Enamel Finish: Electrostatically applied, baked-on factory finish in **[white]****[off-white]****[brown]****[black]****[custom color as selected by Architect]****<Insert color>**.
 4. Steel, Metallic Finish: **[Chrome]****[Satin gold]****[Bright gold]****[As selected by Architect from**

manufacturer's full range]<Insert finish>.

5. Anodized Aluminum Finish: **[Satin brass][Bright brass][Satin chrome][Bright chrome]**.
6. Track: Overhead and bottom track prefinished to match door.

- F. Mirrored Glass: 3-mm thick, silvered, mirrored, film-backed safety glass, complying with 16 CFR 1201 for Category II safety glass and with ASTM C1036 for Type I (transparent, flat), Class 1 (clear), Quality q2 (mirror) annealed float glass.
- G. Hardware: Manufacturer's standard felt pads, screws, and pulls in standard finish to match door. Hinges, pivots, and manufacturer's standard wheels factory installed and as follows:
 1. Hinges: Three self-aligning concealed hinges.
 2. Guides and Pivots: Spring-loaded, zinc-plated steel guides and tops, and adjustable bottom pivot pins with nylon bushings and tips.

2.5 FIRE-RATED FOLDING DOORS

- A. Description: **[Electrically][Gravity-]**operated folding-door assembly, automatic or self-closing, listed and labeled for fire-resistance ratings indicated by a qualified testing agency, top supported, and complete with hardware, seals, track, closing devices, releasing devices, controls, and accessories necessary for intended operation.
- B. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 1. **[McKeon Door Company]**
 2. **[Won-Door Corporation]**
 3. **<Insert manufacturer's name>**
- C. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 1. **[McKeon Door Company]**
 2. **[Won-Door Corporation]**
 3. **<Insert manufacturer's name>**
- D. Listed Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing in accordance with **[NFPA 252][UL 10B]<Insert test method>**.
 1. Oversize Doors: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
- E. Configuration: **[As indicated on Drawings][Side opening][Center opening]**.
- F. Features:
 1. Track: **[Overhead track without floor guide][Overhead and floor tracks]**.
 2. Normal Position: Assembly's normal position is the open (stacked) position. Signal from fire-alarm system initiates self-closing operation.
 3. Manual Operation: Allow manual operation in either conventional or emergency mode. When opened manually during emergency mode, control mechanism automatically closes assembly.
 4. Access Control/Monitoring: **[Exit hardware does not respond until activated by signal from**

smoke detector or fire alarm][Electromagnetic lock resists manual opening until activated by a signal from fire alarm][Synchronized, computerized control system continuously controls and monitors up to 120 doors]<Insert requirements>.

5. Non-Sway Construction: To resist differential air pressure.
- G. Fire Rating: **[1][1-1/2][3]<Insert number>** hour(s).
- H. Panel Construction: **[Formed-galvanized-steel or formed-steel][Formed-stainless steel]** sheet panels connected by hinges of matching material.
- I. Perimeter Seals and Closures: Manufacturer's standard vinyl or neoprene vertical seals, horizontal top and bottom seals, and closures identical to products tested for fire rating indicated, and forming an effective smoke and draft seal.
 1. Points of Access to Elevators: Provide smoke seals that comply with requirements of authorities having jurisdiction for seals at points of access to elevators where indicated.
- J. Track and Trolley System: Single or dual steel or aluminum track systems, with ball-bearing roller trolleys and adjustable steel hanger rods for overhead support; designed for type of operation, size, and weight of fire-rated folding door indicated. Provide a continuous system of track sections and accessories identical to products tested for fire rating indicated, to accommodate configuration and layout indicated for door operation and storage.
- K. Lead Posts: Metal sheet material matching door-panel construction and connected to panels by specially adapted panels and equipped with manufacturer's standard handle on each side.
- L. Electric Operators and Controls:
 1. Operators: Factory-assembled power-drive unit consisting of motor, **[remote-located]** control panel, limit switches, torque-limiting devices, clutch, reversing magnetic motor operator, leading-edge obstruction detectors, and key-switch control for conventional operation.
 - a. Motor: **[In horsepower required for proper operation of door height and weight][1/3 hp][1/2 hp]<Insert horsepower>**, controlled by reversing magnetic starter and equipped with overload protection.
 - b. Limit Switches: To prevent overtravel.
 - c. Roller Chain or Cable: Connected to lead posts by means of vertical stabilizer bar assembly.
 - d. Drive Mechanism: Protected by torque limiter and emergency clutch.
 - e. Travel Speed: **18 inches (450 mm)** per second, maximum; **6 inches (150 mm)** per second, minimum.
 2. In case of fire, closing system is activated by building's fire- and smoke-detection equipment and automatically closes fire-rated folding doors.
 3. Electrical Service: Equip for **[120-V, single-phase, 60-cycle ac]<Insert service requirements>**.
 4. Battery: Electrical current connects through relay to battery charger that continuously charges 12-V dc battery and automatically maintains battery at capacity. Automatic audible signal device sounds off if battery falls below or exceeds proper charge, power loss has occurred, or high-ac line voltage has been experienced.
 5. Leading-Edge Obstruction Detector:
 - a. Equip with pressure-sensitive leading edge that, on contact with an obstruction, causes door to stop and pause before attempting to re-close.
 - b. Disable leading-edge obstruction detector until fire-rated folding door has opened swinging door on the storage pocket (pocket door).

6. Fire-rated folding doors can be manually opened by pushing against leading edge.
7. Audible alarm sounds at automatic closing of door.

M. Accessories:

1. Vision panels.
2. Exit Hardware: Located on both sides of fire-rated folding door. In emergency mode, slight pressure on hardware causes door to open a minimum of **32 inches (812 mm)**, pause for three seconds, and then automatically close. Furnish hardware that can be field programmable to allow automatic opening distances of up to the entire opening width. In conventional mode, hardware is used to operate door and move it back into storage pocket.
3. Swinging egress doors.
4. **<Insert accessory>**.

N. Finishes:

1. Factory-applied polyester or powder-coat finish for panels and hinges in **[manufacturer's standard color][colors as selected by Architect from manufacturer's full range]<Insert color>**.
2. Manufacturer's standard finish for handles.

O. Pocket Door: Swinging door that closes to conceal the storage pocket.

1. Solid-core pocket doors with **[reverse-action spring][continuous]** hinge; 90-degree minimum swing.
2. Face Finish: **[Match adjacent finishes]<Insert finishes>**.
3. Magnetic Catch: Holding force of no more than **30 lbf (133 N)**.
4. Maximum Opening Force: **50 lbf (222 N)**.
5. Bumper on interior side of pocket door as required by fire-rated folding-door manufacturer to prevent interference with opening or retracting operation of fire-rated folding door.
6. Coordinate pocket door sizes with fire-rated folding-door manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. For folding doors supported by or anchored to permanent construction, advise installers of specific requirements for placement of anchorage devices. Furnish installers of other work with templates and drawings indicating locations of anchorage devices and similar items.
- B. Fire-Rated Folding Doors: Level floor with header in path of fire-rated folding doors to tolerance of plus or minus **1/16 inch (1.6 mm)** across opening; grind or fill floor as necessary.

3.3 INSTALLATION

- A. General: Install folding doors complying with manufacturer's written installation instructions. Install track in one piece.
 - 1. Fire-Rated Folding Doors: Comply with NFPA 80 requirements for installation.
- B. Standard Floor Clearances: **1/4 to 3/4 inch (6.4 to 19 mm)** maximum (above floor finish).
- C. Coordinate provisions for sensing devices[, **electrical service,**] and final connections for fire-rated folding doors.

3.4 ADJUSTING

- A. Adjust units to ensure smooth, quiet operation without warping or binding. Adjust hardware to function smoothly. Confirm that latches engage accurately and securely without forcing or binding.
 - 1. Fire-Rated Folding Doors: Verify that all operations are functional and comply with requirements of authorities having jurisdiction.
- B. Pocket Doors: Adjust to operate smoothly and easily, without binding or warping. Adjust hardware to function smoothly. Confirm that latches and locks engage accurately and securely without forcing or binding.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-rated folding doors.

END OF SECTION 08 35 13 00

SECTION 08 35 13 13 - MULTIPANEL FOLDING ALUMINUM-FRAMED GLASS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Multipanel folding aluminum-framed glass doors.

B. Related Requirements:

1. Section 081816.16 "Multipanel Sliding Aluminum-Framed Glass Doors" for multipanel aluminum-framed glass doors that operate by sliding.
2. Section 084113 "Aluminum-Framed Entrances and Storefronts" for coordinating finish among aluminum fenestration units on the building exterior.
3. Section 085113 "Aluminum Windows" for coordinating finishes among aluminum fenestration units on the building exterior.
4. [Section 087100 "Door Hardware"] [Section 087111 "Door Hardware (Descriptive Specification)"] for hardware not specified in this Section.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Multipanel folding aluminum-framed glass doors.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for multipanel folding aluminum-framed glass doors.

C. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.

D. Shop Drawings:

1. Include plans, elevations, sections, and installation details.
2. Indicate dimensions, configuration of panels, and stacking layout.

E. Samples: For each multipanel folding aluminum-framed glass door and for each color specified, **12-inch-long (300-mm-long)** section with factory-applied color finish.

F. Samples for Initial Selection: For doors and hardware with factory-applied color finish.

G. Samples for Verification: For multipanel folding aluminum-framed glass doors and components required, prepared on Samples of size indicated below:

1. Main Framing Member: **12-inch-long (300-mm-long)** section with weather stripping, glazing

- bead and factory-applied color finish.
- 2. Hardware: Full-size units with factory-applied finish.
- 3. <Insert component>: <Insert description>.

- H. Product Schedule: For multipanel folding aluminum-framed glass doors.[**Use same designations indicated on Drawings.**]

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For [Installer][manufacturer][and][testing agency].
- B. Product Test Reports: For each multipanel folding aluminum-framed glass door, for tests performed by [manufacturer and witnessed by a qualified testing agency][a qualified testing agency]; and for each class and performance grade indicated, tested at AAMA gateway size.
- C. Field quality-control reports.
- D. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data:
 - 1. For multipanel folding aluminum-framed glass doors to include in maintenance manuals. Include finishes, weather stripping, operable panels, and operating hardware.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating multipanel folding aluminum-framed glass doors that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.
- B. Installer Qualifications: An installer acceptable to multipanel folding aluminum-framed glass door manufacturer for installation of units required for this Project.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup for multipanel folding aluminum-framed glass doors, as shown on Drawings.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace multipanel folding aluminum-framed glass doors that fail(s) in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Failure to meet performance requirements.
 - b. Structural failures, including excess deflection.
 - c. Excessive water leakage or air infiltration.
 - d. Faulty operation of movable panels and hardware.
 - e. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - f. Failure of insulating glass[**and laminated glass**].
 - g. **<Insert failure modes>**.
2. Warranty Period:
 - a. Multipanel Folding Aluminum-Framed Glass Doors: **[Five][10][20]<Insert number>** year(s) from date of Substantial Completion.
 - b. Insulating-Glass Units: **[10][20]<Insert number>** years from date of Substantial Completion.
 - c. Laminated Glass: **[Five]<Insert number>** years from date of Substantial Completion.
 - d. Aluminum Finish: **[Five][10][20]<Insert number>** years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: **[Five][10][20]<Insert number>** years from date of Substantial Completion.
- C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, peeling, or chipping.
 2. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 1. Product Certification: AAMA certified with label attached to each door.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: [Class R][Class LC][Class CW][Class AW][As indicated on Drawings]<Insert class>.
 2. Minimum Performance Grade: [Grade 15][Grade 20][Grade 25][Grade 30][Grade 35][Grade 40][Grade 45][Grade 50][As indicated on Drawings]<Insert grade>.
- C. Thermal Transmittance: NFRC 100 maximum total fenestration product U-factor of [0.30 Btu/sq. ft. x h x deg F (1.71 W/sq. m x K)][0.32 Btu/sq. ft. x h x deg F (1.83 W/sq. m x K)][0.35 Btu/sq. ft. x h x deg F (2.0 W/sq. m x K)][0.60 Btu/sq. ft. x h x deg F (3.43 W/sq. m x K)]<Insert value>.
- D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum total fenestration product SHGC of [0.40][0.30][0.27]<Insert value>.
- E. Condensation-Resistance Factor (CRF): Provide multipanel folding aluminum-framed glass doors tested for thermal performance in accordance with AAMA 1503, showing a CRF of [45][52]<Insert value>.
- F. Thermal Movements: Provide multipanel folding aluminum-framed glass doors, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): [120 deg F (67 deg C), ambient; 180 deg F (100 deg C)]<Insert temperature range>, material surfaces.
- G. Sound Transmission Class (STC): Rated for not less than [28][32]<Insert rating> STC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E413.
- H. Outside-Inside Transmission Class (OITC): Rated for not less than [23][27][29]<Insert rating> OITC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E1332.
- I. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone [1][2][3][4] for [basic][enhanced] protection.
1. Large-Missile Test: For glazing located within 30 feet (9.1 m) <Insert height> of grade.
 2. Small-Missile Test: For glazing located between 30 feet (9.1 m) and [60 feet (18.3 m)]<Insert height> above grade.
- J. <Insert requirements>.
- 2.2 MULTIPANEL FOLDING ALUMINUM-FRAMED GLASS DOORS
- A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
1. [Arcadia Inc.]
 2. [C.R. Laurence Co., Inc.; CRH Americas, Inc.]
 3. [Euro-Wall Systems, LLC]
 4. [LaCantina Doors; a division of JELD-WEN]
 5. [Lanai Doors]
 6. [Milgard Manufacturing, LLC]
 7. [Nana Wall Systems, Inc.]
 8. [Panda Windows & Doors]

9. [Solar Innovations, Inc.]
 10. <Insert manufacturer's name>
- B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
1. [Arcadia Inc.]
 2. [C.R. Laurence Co., Inc.; CRH Americas, Inc.]
 3. [Euro-Wall Systems, LLC]
 4. [LaCantina Doors; a division of JELD-WEN]
 5. [Lanai Doors]
 6. [Milgard Manufacturing, LLC]
 7. [Nana Wall Systems, Inc.]
 8. [Panda Windows & Doors]
 9. [Solar Innovations, Inc.]
 10. <Insert manufacturer's name>
- C. Multipanel Folding Aluminum-Framed Glass Doors: Provide extruded-aluminum-framed multipanel folding glass doors, complete with glazing, threshold, flashings, support, and anchorage devices.
1. Application: [Exterior][Interior], [inward opening][outward opening].
 2. Stack Storage Configuration: [Panels open from center to both sides][As shown on Drawings]<Insert configuration>.[Hinge panels together in separate pairs.]
- D. Frames and Door Panels: Fabricated from aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440. Provide factory-assembled door panels that are reglazable without dismantling panel framing, and [factory-assembled][or][field-assembled] frames.
1. Thermally Improved Construction: Fabricate frames and door panels with an integral, concealed, low-conductance thermal barrier located between exterior and interior surfaces in a manner that eliminates direct metal-to-metal contact.
 2. Door Panel Design: [As indicated][Narrow stile][Medium stile][Wide stile]<Insert dimensions> design[, with 10-inch (254-mm) nominal height bottom rail].
 3. Grilles (False Muntins): Provide between-glass grilles in designs indicated to each panel lite, with material and finish to match adjacent door panel finish.
 - a. Bar Width: Not less than [3/4 inch (19 mm)][7/8 inch (22 mm)][1-1/8 inches (28 mm)]<Insert dimension> wide.
 - b. Bar Profile: [Beveled][Ovolo][Square].

2.3 GLAZING

- A. Glass and Glazing: Manufacturer's standard glazing system that produces weathertight seal. [Comply with requirements for windborne-debris resistance][Comply with requirements indicated in Section 088000 "Glazing"]<Insert glazing requirements>.
1. Glass: ASTM C1036, Type 1, q3; Category II safety glass complying with testing requirements in 16 CFR 1201.
 2. Safety Glazing Labeling: Permanently mark safety glazing with certification label of [the SGCC][the SGCC or another certification agency acceptable to authorities having jurisdiction][or][the manufacturer]. Label must indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
 3. Tint: [Clear][Gray][Bronze][Green]<Insert tint>.
 4. Insulating-Glass Units: ASTM E2190[, certified through IGCC as complying with requirements of IGCC].

- a. Filling: Fill space between glass lites with [air][argon].
- b. Lites: [Two][Three].
- c. Low-E Coating: [Manufacturer's standard][Pyrolytic on second surface][Sputtered on second surface][Sputtered on third surface][Sputtered on second or third surface]<Insert coating>.

2.4 HARDWARE

- A. Provide manufacturer's standard hardware, fabricated from a corrosion-resistant material compatible with door panels and other components, and complying with AAMA 907. Provide hardware designed to smoothly operate, tightly close, and securely lock multipanel folding aluminum-framed glass doors. Size hardware to accommodate panel weights and dimensions. Provide full-perimeter weatherstripping for each door panel.
- B. Panel Support System: Provide panel support system designed for size, weight, and performance requirements of multipanel folding aluminum-framed glass doors indicated. Provide carriers with sealed ball bearings.
 - 1. Overhead Supported: Provide multiwheeled overhead carriers suspended from steel or aluminum track, with lower guide system engaged in threshold for smooth operation. Limit track deflection to no more than [0.10 inch (2.54 mm)]<Insert dimension> between supports when fully loaded.
 - 2. Bottom Supported: Provide carrier system designed to roll on track within threshold, with overhead wheeled guide that engages upper track.
 - 3. Adjustment: Provide panel support system capable of being adjusted for smooth operation and clearances without needing to remove panels from tracks.
 - 4. Threshold Configuration: Extruded-aluminum [, thermally broken,] threshold with [raised, weather-resistant profile][low profile, compliant with United States Access Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines"]<Insert profile>[recessed flush profile][with concealed drainage system].
 - a. Aluminum Finish: [To match panel][Clear anodized][Dark bronze anodized].
- C. Panel Hinges: Stainless steel, multileaf hinge with painted finish to match exterior. Provide integral hangers and guides for hinges that engage panel support system.
- D. Locking System:
 - 1. Primary Entrance Panel: Provide manufacturer's standard keyed multipoint locking device, with lever handles on the interior and exterior that operate dead bolt and concealed top and bottom rods.
 - 2. Secondary Entrance Panel: Provide [dummy trim on interior and exterior with concealed automatic flush bolts][two-point locking device that operates concealed top and bottom rods][surface-mounted flush bolt]<Insert locking type>.
 - 3. Panel Pairs: Provide manufacturer's [standard handles][removable custodial handles] and [two-point locking device that operates concealed top and bottom rods][surface-mounted flush bolt] at each panel pair.
 - 4. Trim Design: [As selected from manufacturer's full range]<Insert design>.
 - a. Finish: [As selected from manufacturer's full range of finishes][Polished brass][Antique brass][Satin chrome][Oil-rubbed bronze][Dark bronze][Painted white]<Insert finish>.
 - 5. Cylinders: [Manufacturer's standard.][ANSI/BHMA A156.5, Grade 1.][As specified in Section 087100 "Door Hardware."][As specified in Section 087111 "Door Hardware (Descriptive

Specification)."]

2.5 ACCESSORIES

- A. Trim: Provide interior and exterior casings, jamb extensions, and other components in material and finish to match door frames.
- B. Fasteners: Noncorrosive and compatible with door members, trim, hardware, anchors, and other components.
 - 1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.
- C. Anchors, Clips, and Accessories: Provide anchors, clips, and accessories of aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron for multipanel folding aluminum-framed glass doors, complying with ASTM B456 or ASTM B633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.
 - 1. Windborne-Debris Resistance: Provide anchors of same design used in windborne-debris resistance testing.

2.6 INSECT SCREENS

- A. Screen Fabric: Provide screen mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration; and complying with ASTM D3656/D3656M.
 - 1. Fabric Color: **[Manufacturer's standard][Charcoal gray][Silver gray]<Insert color>**.
- B. Pleated Insect Screen: Screen suspended from the top, with bottom guide, and finish **[to match exterior door face][as selected from manufactures' standard colors]**. Provide single- or two-function operation with screen meeting rails at same location as primary entrance of door.
- C. Coiling Insect Screen: Coiling screen housed in jamb-mounted cartridge, guided by upper and lower tracks. Finish **[to match exterior door face][as selected from manufactures' standard colors]**. Provide single- or two-function operation with screen meeting rails at same location as primary entrance of door.

2.7 FABRICATION

- A. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.
- B. Factory-Glazed Fabrication: Glaze sliding aluminum-framed glass doors in the factory.

2.8 GENERAL FINISH REQUIREMENTS

- A. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - 1. Color: **[Light bronze][Medium bronze][Dark bronze][Champagne][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>.**
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603, except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- D. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with **[AAMA 2604][AAMA 2605]** and containing not less than **[50][70]** percent PVDF resin by weight in color coat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- E. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- F. Superior-Performance Organic Finish, Four-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- G. Superior-Performance Organic Finish, Single-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- H. Superior-Performance Organic Finish, Two-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's**

sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of Work.
- B. Verify rough opening dimensions, levelness of threshold substrate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight hinged-door installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing multipanel folding aluminum-framed glass doors, hardware, accessories, and other components.
- B. Windborne-Debris Resistance: Anchor multipanel folding aluminum-framed glass doors that have been tested for windborne-debris resistance to structure, using anchoring method, fastener type, and fastening frequency identical to that used in windborne-debris resistance testing.
- C. Install multipanel folding aluminum-framed glass doors level, plumb, square, true to line; without distortion, warp, or rack of frames and panels, and without impeding thermal movement; anchored securely in place to structural support; and in proper relation to wall flashing, vapor retarders, air barriers, water/weather barriers, and other adjacent construction.
- D. Set threshold members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.
- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
 - 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing Services: Test and inspect installed multipanel folding aluminum-framed glass doors as follows:
 - 1. Testing Methodology: Test multipanel folding aluminum-framed glass doors for air infiltration and water resistance in accordance with AAMA 502.
 - 2. Air-Infiltration Testing:

- a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
 - b. Allowable Air-Leakage Rate: **[1.5]<Insert number>** times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
3. Water-Resistance Testing:
- a. Test Pressure: **[Two-thirds]<Insert number>** times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
 - b. Allowable Water Infiltration: No water penetration.
4. Testing Extent: **[Three][Three mockup]<Insert number or description>** multipanel folding aluminum-framed glass doors of each type as selected by Architect and a qualified independent testing and inspecting agency. Conduct tests after perimeter sealants have cured.
5. Test Reports: Prepared in accordance with AAMA 502.

- C. Multipanel folding aluminum-framed glass door will be considered defective if it does not pass tests and inspections.

3.4 ADJUSTING

- A. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.
- B. Adjust hardware and operable panels to function smoothly, and lubricate as recommended by manufacturer.

3.5 CLEANING

- A. Clean exposed surfaces immediately after installation. Avoid damaging protective coatings and finishes. Remove nonpermanent labels, excess sealants, glazing materials, dirt, and other substances.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

3.6 PROTECTION

- A. Protect multipanel folding aluminum-framed glass door surfaces from contact with contaminating substances resulting from construction operations. Remove contaminants immediately according to manufacturer's written instructions.
- B. Refinish or replace folding aluminum-framed glass doors with damaged finishes.

END OF SECTION 08 35 13 13



Task	Specification	Specification Description
08 35 13 13	08 35 13 00	Folding Doors



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SECTION 08 36 13 00 - SECTIONAL DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sectional-door assemblies.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.
2. **[Section 099113 "Exterior Painting"]****[and]****[Section 099123 "Interior Painting"]** for finish painting of factory-primed steel doors.
3. Section 111200 "Parking Control Equipment" for parking control equipment interlocked to sectional doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
2. For power-operated doors, include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard size.

D. Samples for Initial Selection: For units with factory-applied finishes.

1. Include Samples of accessories involving color selection.

E. Samples for Verification: For each type of exposed finish and for each color and texture required on the following components, in manufacturer's standard sizes:

1. Glazing.
2. Metal for door sections.
3. Hardware.
4. **<Insert requirements>**.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranties: For manufacturer's warranty [**and finish warranty**].

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sectional doors to include in maintenance manuals.
- B. Manufacturer's warranty.
- C. Finish warranty.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
- B. Regulatory Requirements: Comply with provisions in the [U.S. Department of Justice's "2010 ADA Standards for Accessible Design"] [U.S. Department of Transportation's "ADA Standards for Transportation Facilities"] [the United States Access Board's "Architectural Barriers Act (ABA) Standards"] [41 CFR, Appendix A to Subpart 101-19.6, "Uniform Federal Accessibility Standards"] [ICC A117.1] <Insert requirements> applicable to sectional doors.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Failure of components or operators before reaching required number of operation cycles.
 - c. Faulty operation of hardware.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
 - e. Delamination of exterior or interior facing materials.
 - 2. Warranty Period: [Two][Five]<Insert number> years from date of Substantial Completion.
- B. Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: [10]<Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain sectional doors from single source from single manufacturer.
 - 1. Obtain operators and controls from sectional door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction[**and without requiring temporary installation of reinforcing components**].
- B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
 - 1. Design Wind Load: **[As indicated on Drawings][Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward]<Insert requirements>**.
 - 2. Testing: In accordance with ASTM E330/E330M[**or DASMA 108 for garage doors and complying with DASMA 108 acceptance criteria**]<Insert requirements>.
 - 3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.
 - a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of door width.
 - b. Deflection of horizontal track assembly shall not exceed 1/240 of door height.
 - 4. Operability under Wind Load: Design sectional doors to remain operable under **[design][uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa)][uniform pressure (velocity pressure) of 30 lbf/sq. ft. (1436 Pa)]<Insert load>** wind load, acting inward and outward.
- C. Windborne-Debris Impact Resistance: Provide sectional doors complying with the following requirements:
 - 1. Glazed Openings: Pass ASTM E1886 Large Missile Test and cyclic-pressure tests in accordance with ASTM E1996 for **[basic][enhanced]** protection and Wind Zone **[applicable to basic design wind speed indicated on Drawings]<Insert requirements>**.
 - 2. Garage-Door Glazed Openings: Pass DASMA 115.
- D. Seismic Performance: Provide sectional doors that withstand the effects of earthquake motions determined in accordance with **[ASCE/SEI 7]<Insert requirement>**.
 - 1. Component Importance Factor: **[1.5][1.0]<Insert requirements>**.

2.3 SECTIONAL-DOOR ASSEMBLY

- A. Sectional Door: Provide **[steel][aluminum]** sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering**

products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Amarr Company]
- b. [Arm-R-Lite Manufacturing Co., Inc.]
- c. [BP - Glass Garage Doors & Entry Systems, Inc]
- d. [C.H.I. Overhead Doors, Inc.]
- e. [Clopay Building Products]
- f. [Fimbel Architectural Doors]
- g. [Haas Door; a Nofziger Company]
- h. [Hörmann LLC]
- i. [Martin Door Manufacturing]
- j. [Overhead Door Corporation]
- k. [Raynor Garage Doors]
- l. [Rite-Hite Holding Corporation]
- m. [Wayne Dalton; a division of Overhead Door Corporation]
- n. [Windsor Door]
- o. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Amarr Company]
- b. [Arm-R-Lite Manufacturing Co., Inc.]
- c. [BP - Glass Garage Doors & Entry Systems, Inc]
- d. [C.H.I. Overhead Doors, Inc.]
- e. [Clopay Building Products]
- f. [Fimbel Architectural Doors]
- g. [Haas Door; a Nofziger Company]
- h. [Hörmann LLC]
- i. [Martin Door Manufacturing]
- j. [Overhead Door Corporation]
- k. [Raynor Garage Doors]
- l. [Rite-Hite Holding Corporation]
- m. [Wayne Dalton; a division of Overhead Door Corporation]
- n. [Windsor Door]
- o. <Insert manufacturer's name>

- B. Operation Cycles: Door components and operators capable of operating for not less than [10,000][25,000][50,000][75,000][100,000]<Insert number> operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.
- C. Air Infiltration: Maximum rate of [0.4 cfm/sq. ft. (2.03 L/s per sq. m)]<Insert value> when tested in accordance with ASTM E283 or DASMA 105.
- D. U-Value: [0.052 Btu/sq. ft. x h x deg F (0.295 W/sq. m x K)][0.130 Btu/sq. ft. x h x deg F (0.738 W/sq. m x K)][0.149 Btu/sq. ft. x h x deg F (0.845 W/sq. m x K)]<Insert value>.
- E. Steel Door Sections: ASTM A653/A653M, zinc-coated (galvanized), cold-rolled, commercial steel sheet with [G60 (Z180)][G90 (Z275)] zinc coating.
 1. Door-Section Thickness: [1-3/8 inches (35 mm)][1-3/4 inches (44 mm)][2 inches (51 mm)]<Insert dimension>.
 2. Section Faces:

- a. Thermal-Break Construction: Provide sections with continuous thermal-break construction separating the exterior and interior faces of door.
- b. Exterior Face: Fabricated from single sheets, not more than **[24 inches (610 mm)]<Insert dimension>** high; with horizontal meeting edges rolled to continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove, weather- and pinch-resistant seals and reinforcing flange return.
 - 1) Steel Sheet Thickness: **[0.019-inch (0.48-mm)][0.022-inch (0.56-mm)][0.028-inch (0.71-mm)][0.040-inch (1.02-mm)][0.064-inch (1.63-mm)]<Insert dimension>** nominal coated thickness.
 - 2) Surface: Manufacturer's standard, **[flat][grooved][ribbed][paneled][stucco embossed][wood-grain embossed]<Insert requirement>**.
- c. Interior Face: Enclose insulation completely within steel exterior facing and interior facing material, with no exposed insulation. Provide the following interior-facing material:
 - 1) Zinc-Coated (Galvanized) Steel Sheet: With minimum nominal coated thickness of **[0.019 inch (0.48 mm)][0.022 inch (0.56 mm)][0.025 inch (0.64 mm)][0.028 inch (0.71 mm)][dimension recommended in writing by manufacturer to comply with performance requirements]<Insert dimension>**.
 - 2) Plastic: **[Manufacturer's standard vinyl material complying with DASMA 107 requirements]<Insert requirements>**.
3. End Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than **[0.040-inch (1.02-mm)][0.064-inch (1.63-mm)]<Insert dimension>** nominal coated thickness and welded to door section.
4. Intermediate Stiles: Provide intermediate stiles formed from not less than **[0.040-inch- (1.02-mm-)][0.064-inch- (1.63-mm-)]<Insert dimension>** thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than **[48 inches (1219 mm)]<Insert requirements>** apart.
5. Section Reinforcing: Horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. **[Ensure that reinforcement does not obstruct vision lites.]**
 - a. Bottom Section: Reinforce section with a continuous channel or angle conforming to bottom-section profile **[and allowing installation of astragal (weatherseal)]**.
 - b. Hardware Locations: Provide reinforcement for hardware attachment.
6. Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard **[CFC-free]** insulation of type indicated below:
 - a. Board Insulation: **[Polystyrene][or][polyurethane]**, secured to exterior face sheet.
 - b. Foamed-in-Place Insulation: Polyurethane, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load.
 - c. Fire-Resistance Characteristics: Maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, in accordance with ASTM E84.
- F. Aluminum Sections: **ASTM B221 (ASTM B221M)** extruded-aluminum stile and rail members of alloy and temper standard with manufacturer for type of use and finish indicated; **[in minimum thickness required to comply with requirements]<Insert requirements>**; with rail and stile dimensions and profiles indicated on Drawings; and with overlapped or interlocked weather- and pinch-resistant seal at meeting rails.
 1. Door-Section Thickness: **[1-3/4 inches (44 mm)][2 inches (51 mm)]<Insert dimension>**.
 2. Section Reinforcing: Continuous horizontal and diagonal reinforcement as required to stiffen door and for wind loading. Ensure that reinforcement does not obstruct vision lites.

- a. Hardware Locations: Provide reinforcement for hardware attachment.
3. Insulated Stiles and Rails: Fill stiles and rails **[manufacturer's standard polyurethane expanding foam]<Insert requirements>**.
4. Glazed Panels: Manufacturer's standard, aluminum-framed section with glazing sealed with glazing tape and **[aluminum][matching vinyl]<Insert requirements>** glazing bead. Glazing as follows:
 - a. Float Glass: 3 mm thick and complying with ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
 - b. Tempered Glass: 3 mm thick and complying with ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 1 (clear), Quality-Q3.
 - c. Insulating Glass Units: Manufacturers' standard unit with **[float glass lites complying with ASTM C1036][tempered glass lites complying with ASTM C1048, Kind FT (fully tempered), Condition A (uncoated)]**, Type I, Class 1 (clear), Quality-Q3.
 - d. **<Insert glazing requirements>**.
5. Solid Aluminum Panels: **ASTM B209 (ASTM B209M)**, alloy and temper standard with manufacturer for use and finish indicated.
 - a. Description: **[0.050 inch (1.3 mm) thick][1/2-inch- (12.7-mm-) thick overall insulated panel composed of 0.050-inch (1.3-mm) aluminum interior and exterior panels with an extruded polystyrene (EPS) core]<Insert requirements>**.
 - b. Attachment to Frame: Sealed with glazing tape and **[aluminum][matching vinyl]<Insert requirements>** glazing bead.
 - c. Aluminum Surface: **[Stucco embossed][Smooth]<Insert requirements>**.
6. Perforated Aluminum Panels: **ASTM B209 (ASTM B209M)**, alloy and temper standard with manufacturer for use and finish indicated.
 - a. Description: **[0.50 inch (1.3 mm) thick, with mill finish, 0.312-inch (7.9-mm) square perforations on 0.5-inch (12.7-mm) centers, and a total open area of 39 percent]<Insert requirements>**.
 - b. Attachment to Frame: Sealed with glazing tape and **[aluminum][matching vinyl]<Insert requirements>** glazing bead.
7. **<Insert panel requirements>**.
- G. Track: Manufacturer's standard, galvanized-steel, **[standard-lift][low-headroom][high-lift][vertical-lift][contour]<Insert description>** track system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.
 1. Material: Galvanized steel, ASTM A653/A653M, minimum **G60 (Z180)** zinc coating.
 2. Size: **[As recommended in writing by manufacturer for door size, weight, track configuration and door clearances indicated on Drawings][2 inches (51 mm) wide][3 inches (76 mm) wide]<Insert requirements>**.
 3. Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced **2 inches (51 mm)** apart for door-drop safety device.
 - a. Vertical Track: Incline vertical track to ensure weathertight closure at jambs. Provide **[continuous angle][continuous reverse angle][intermittent jamb brackets]<Insert requirements>** attached to track and wall.
 - b. Horizontal Track: Provide continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead

structural members.

- H. Removable Center Posts: Manufacturer's standard **[carry-away][roll-away][swing-up]** type for multiple doors in one opening; provide in quantity and locations indicated on Drawings.
- I. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom **[top][and][jamb]** of door. **[Provide combination bottom weatherseal and sensor edge for bottom seal.]**
- J. Windows: Manufacturer's standard window units of shape and size and in locations indicated on Drawings. Set glazing in vinyl, rubber, or neoprene glazing channel. Provide removable stops of same material as door-section frames. Provide the following glazing:
 - 1. Clear Float Glass: 3 mm thick and complying with ASTM C1036, Type I, Class 1, Quality-Q3.
 - 2. Clear Acrylic Plastic: 3 mm thick, transparent, smooth or polished, and formulated to be UV resistant. **[Provide double insulating units.]**
 - 3. Clear Polycarbonate Plastic: 3 mm thick, transparent, fire-retardant, UV-resistant, polycarbonate sheet manufactured by extrusion process.
 - 4. Insulating Glass Units: **[Manufacturer's standard]<Insert description>.**
 - 5. **<Insert glazing requirements>.**
- K. Pass Door: Provide manufacturer's standard pass door in size and location indicated on Drawings; complete with glazing, operating hardware, and mortise lock; and with welded frame, exterior matching door face, and integral shiplap weather seal.
 - 1. Hinges: **[Manufacturer's standard geared hinges]<Insert requirements>.**
 - 2. Door Closer: **[Manufacturer's standard pneumatic closer sized for swing door and mounted on interior]<Insert requirements>.**
 - 3. Lock Cylinders: Cylinders **[complying with Section 087100 "Door Hardware" requirements][complying with Section 087111 "Door Hardware (Descriptive Specification)" requirements][standard with manufacturer]<Insert requirements>.**
 - a. Keying: **[Keyed to building keying system]<Insert requirements>.**
 - b. Keys: **[Two][Three]<Insert number>** for each cylinder.
 - 4. Features:
 - a. Rain Cap: To protect door from accumulated water.
 - b. Vision Lite: **<Insert requirements>.**
 - c. **<Insert feature>.**
- L. Exhaust Port: **[Manufacturer's standard, installed in bottom section in location indicated on Drawings]<Insert requirements>.**
- M. Hardware: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless steel, or other corrosion-resistant fasteners, to suit door type.
 - 1. Hinges: Heavy-duty, galvanized-steel hinges of not less than **0.079-inch (2.01-mm)** nominal coated thickness at each end stile and at each intermediate stile, in accordance with manufacturer's written recommendations for door size.
 - a. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible.
 - b. Provide double-end hinges where required for doors more than **16 ft. (4.88 m)** wide unless otherwise recommended by door manufacturer in writing.

2. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Match roller-tire diameter to track width.
 - a. Roller-Tire Material: **[Case-hardened steel][Neoprene or bronze][Manufacturer's standard]<Insert requirements>**.
3. Push/Pull Handles: Equip each door with galvanized-steel lifting handles on each side of door, finished to match door.
4. Mail Slot: **[Manufacturer's standard; brushed aluminum]<Insert requirements>**.
5. **<Insert hardware requirements>**.

N. Locking Device:

1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
2. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 - a. Lock Cylinders: Cylinders **[complying with Section 087100 "Door Hardware" requirements][complying with Section 087111 "Door Hardware (Descriptive Specification)" requirements][standard with manufacturer]<Insert requirements>**.
 - b. Keying: **[Keyed to building keying system]<Insert requirements>**.
 - c. Keys: **[Two][Three]<Insert number>** for each cylinder.
3. Chain Lock Keeper: Suitable for padlock.
4. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

O. Counterbalance Mechanism:

1. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.
2. Cable Drums and Shaft for Doors: Cast-aluminum cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised.
 - a. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.
 - b. Provide one additional midpoint bracket for shafts up to **16 ft. (4.88 m)** long and two additional brackets at one-third points to support shafts more than **16 ft. (4.88 m)** long unless closer spacing is recommended in writing by door manufacturer.
3. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least **[5 to 1][7 to 1]<Insert requirements>**.
4. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.
5. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
6. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.
7. **<Insert requirements>**.

P. Manual Door Operator:

1. Push-Up Operation: Lift handles and pull rope for raising and lowering doors located on inside

- and outside of bottom section; with counterbalance mechanism designed so that required lift or pull for door operation does not exceed **[25 lbf (111 N)]<Insert value>**.
2. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum **[25 lbf (111 N)][35 lbf (155 N)]<Insert value>** force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.
- Q. Electric Door Operator: Electric door operator assembly of size and capacity recommended by door manufacturer for door and operation cycles specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
1. Comply with NFPA 70.
 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24 V ac or dc.
 3. Safety: Listed in accordance with UL 325 by a qualified testing agency for commercial or industrial use[; **moving parts of operator enclosed or guarded if exposed and mounted at 8 ft. (2.4 m) or lower**]<Insert requirements>.
 4. Usage Classification: **[Heavy duty, 25 or more cycles per hour and more than 90 cycles per day][Standard duty, up to 25 cycles per hour and up to 90 cycles per day][Medium duty, up to 12 cycles per hour and up to 50 cycles per day][Light duty, up to 10 cycles per hour]**<Insert classification>.
 5. Operator Type: **[Manufacturer's standard for door requirements][Trolley][Jackshaft, center mounted][Jackshaft, side mounted][As indicated on Drawings]**<Insert requirements>.
 6. Motor: Reversible-type [**with controller (disconnect switch)**] for **[interior, clean, and dry][exterior, dusty, wet, or humid]**<Insert requirements> motor exposure. Use adjustable motor-mounting bases for belt-driven operators.
 - a. Motor Size: **[As required to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor][1/3 hp (246 W)][1/2 hp (373 W)][3/4 hp (559 W)][1 hp (746 W)][3 hp (2238 W)]**<Insert requirements>.
 - b. Electrical Characteristics:
 - 1) Phase: **[Single phase][Polyphase]**.
 - 2) Volts: **[115][208][230][460]**<Insert value> V.
 7. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
 8. Obstruction Detection: Automatic external entrapment protection consisting of automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
 - a. Monitored Entrapment Protection: **[Photoelectric sensor][Electric sensor edge on bottom section]** designed to interface with door-operator control circuit to detect damage to or disconnection of sensor and complying with requirements in UL 325.
 - b. Unmonitored Entrapment Protection: **[Pneumatic sensor edge, black, located within weatherseal mounted to bottom bar][Retro-reflective photo sensor]**<Insert requirements>.
 9. Control Station: **[Flush][Surface]** mounted, **[three-position (open, close, and stop)][two-position (open and close)]** control.
 - a. Operation: **[Push button][Key][Push button interior and key exterior]**<Insert requirements>.
 - b. Interior-Mounted Unit: Full-guarded, surface-mounted, **[heavy-duty type, with general-**

- purpose NEMA ICS 6, Type 1][standard-duty, weatherproof-type, NEMA ICS 6, Type 4]<Insert requirements> enclosure.**
- c. Exterior-Mounted Unit: Full-guarded, surface-mounted, **[standard-duty, weatherproof type, NEMA ICS 6, Type 4]<Insert requirements> enclosure.**
 - d. Features: Provide the following:
 - 1) Vehicle detection operation.
 - 2) Radio-control operation.
 - 3) Card-reader control.
 - 4) Photocell operation.
 - 5) Door-timer operation.
 - 6) Explosion- and dust-ignition-proof control wiring.
 - 7) Audible and visual signals that comply with regulatory requirements for accessibility.
 - 8) **<Insert requirements>.**
10. Emergency Manual Operation: **[Push-up][Chain]** type designed so required force for door operation does not exceed **[25 lbf (111 N)][35 lbf (155 N)]<Insert value>.**
 11. Emergency Operation Disconnect Device: Hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
 12. Motor Removal: Design operator so motor can be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- R. Metal Finish: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
1. Factory Prime Steel Finish: Compatible with field-applied finish and in manufacturer's standard color. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
 2. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
 - a. Aluminum Finish: Comply with **[AAMA 2603][AAMA 2604]** requirements for pigmented organic coatings applied to aluminum extrusions and panels.
 - b. Color and Gloss: **[As indicated by manufacturer's designations][Matching Architect's sample][As selected by Architect from manufacturer's full range]<Insert requirements>.**
 3. Anodized Aluminum Finish: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
 - a. Clear Anodic Finish: AAMA 611, **[AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm]** or thicker.
 - b. Color Anodic Finish: AAMA 611, **[AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm]** or thicker.
 - 1) Color: **[Bronze][Black][Matching Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.**
 4. High-Performance, Organic, Aluminum Finish (Two-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: Cleaned with inhibited chemicals; Chemical Finish: Conversion coating;

Organic Coating: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than **[50][70]** percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with **[AAMA 2604][AAMA 2605]** and with coating and resin manufacturers' written instructions.

- a. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range of industry colors and color densities]<Insert color and gloss>**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.
- B. Tracks:
 1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than **24 inches (610 mm)** apart.
 2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- D. Power-Operated Doors: Install **[automatic garage doors openers]** in accordance with UL 325.

3.3 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.
- D. Touchup Painting Galvanized Material: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780/A780M.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 08 36 13 00



Task	Specification	Specification Description
08 36 13 00	08 33 23 00	Overhead Coiling Doors



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SECTION 08 38 00 00 - TRAFFIC DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rigid, insulated traffic doors.
2. Rigid, polymer traffic doors.
3. Rigid, wood-core traffic doors.
4. Rigid, sheet metal traffic doors.
5. Flexible traffic doors.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings:

1. Dimensioned elevations, sections, and details of construction.
2. Locations of reinforcements and preparations for hardware.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

D. Samples for Verification: Actual sample of finished products for each type of exposed finish.

1. Size: **[Manufacturers' standard size]**<Insert size>.

E. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For composite wood products, indicating compliance with the formaldehyde emissions evaluation.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For traffic doors.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For traffic doors.

1.5 QUALITY ASSURANCE

- A. NSF Certification: Provide traffic doors bearing NSF certification mark based on testing for compliance with requirements of NSF 2.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in accordance with manufacturer's written instructions, on edge, upright, and under cover in manufacturer's unopened packaging until ready for installation.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of traffic doors that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:

- a. Structural failure of frames.
 - b. Faulty operation of traffic doors.
 - c. Deterioration of finishes and other materials beyond normal use.
 - d. Verify warranty periods.

- 2. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain traffic doors from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Corrosion Resistance: **[Manufacturer's standard corrosion-resistant materials and construction][Provide corrosion-resistant materials and construction that withstand washdown environments based on history of in-service use]<Insert requirements>**.
- B. Sanitation Requirements: Provide traffic doors that achieve USDA sanitation objectives contained in 9 CFR 416.

2.3 RIGID, INSULATED TRAFFIC DOORS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **[Allmark Door]**
 - 2. **[Chase Doors; a Senneca Company]**
 - 3. **[E S Robbins Corporation; ALECO]**

4. **[Eliason Corporation; a Senneca Company]**
 5. **[National Access Design]**
 6. **[Perma Tech Inc.]**
 7. **[Super Seal Mfg. Ltd]**
 8. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Allmark Door]**
 2. **[Chase Doors; a Senneca Company]**
 3. **[E S Robbins Corporation; ALECO]**
 4. **[Eliason Corporation; a Senneca Company]**
 5. **[National Access Design]**
 6. **[Perma Tech Inc.]**
 7. **[Super Seal Mfg. Ltd]**
 8. **<Insert manufacturer's name>**
- C. Insulating Core:
1. Insulation: **[Manufacturer's standard high-density foam][Non-CFC urethane][Expanded polystyrene]<Insert requirements>**.
 - a. Minimum Total R-Value: **[9.86][10.83][25]<Insert requirements>** determined in accordance with ASTM C 518.
 2. Internal Reinforcement: **[Manufacturer's standard][Tubular steel][Welded aluminum frame][Rubber frame][Extruded-PVC frame][Wood frame]<Insert requirements>**.
- D. Door Face Panels:
1. Rotationally Molded HDPE: **[1/4 inch (6 mm)][1/8 inch (3 mm)]<Insert dimension>** thick.
 - a. Color: **[As selected by Architect from manufacturer's standard range]<Insert requirements>**.
 2. ABS: **[1/8 inch (3 mm)]<Insert dimension>** thick.
 - a. Color: **[As selected by Architect from manufacturer's standard range]<Insert requirements>**.
 3. Metal: **[Stainless steel, 0.05 inch (1.27 mm) thick][Tempered aluminum top panels, 0.032 inch (0.81 mm) thick; stainless steel bottom plates, 0.05 inch (1.27 mm) thick]<Insert requirements>**.
 4. High-Pressure Decorative Laminate: ISO 4586-3 in color and pattern **[selected by Architect from manufacturer's standard range][matching Architect's sample]<Insert requirements>**.
 5. **<Insert requirements>**.
- E. Door Edges:
1. Edge Capping Material: **[Manufacturer's standard]<Insert requirements>**.
 2. Jamb-Edge Reinforcing Spine: **[Manufacturer's standard][Galvanized-steel sheet][Stainless steel][Aluminum sheet with black powder-coat finish]<Insert requirements>**.
 3. Perimeter Seals: **[Provide manufacturer's standard full-perimeter, replaceable gaskets/seals]<Insert requirements>**.

F. Vision Lites:

1. Size: **[As indicated on Drawings][9 by 14 inches (229 by 356 mm)]<Insert dimensions>**.
2. Safety Glazing: **[Manufacturer's standard][1/8-inch- (3-mm-) thick polycarbonate,][1/4-inch- (6-mm-) thick acrylic,][1/4-inch- (6-mm-) thick glass,]<Insert requirements>** colorless, transparent glazing complying with testing requirements in 16 CFR 1201.
 - a. Provide **[single glazing][double glazing][double glazing with security bars on 7-inch (178-mm) centers][triple glazing][insulating glass, triple glazed with argon fill]<Insert requirements>**.
3. Frame: **[Manufacturer's standard]<Insert requirements>**.

G. Double-Acting Hinges: V-cam hinge system.

1. Swing: **[90 by 90][90 by 180][120 by 120]<Insert requirements>** degrees.
2. Material: **[Manufacturer's standard corrosion-resistant material][Stainless steel]<Insert requirements>**.
3. Spring Assist: **[None][Manufacturer's standard]<Insert requirements>**.

H. Accessories:

1. Teardrop bumpers.
2. Cart guards.
3. Stainless steel push plates.
4. **[Stainless steel][ABS][HDPE]<Insert requirement>** impact plates.
5. **[Corrosion-resistant][Stainless steel]** bottom-hinge guard/cover.
6. **[Corrosion-resistant][Stainless steel]** top-hinge cover.
7. Door-swing limiting posts; HDPE with high-density foam core **[in color selected by Architect from manufacturer's full range]<Insert requirements>**.
8. Cane bolts.
9. Locking collars.
10. **<Insert requirements>**.

2.4 RIGID, POLYMER TRAFFIC DOORS

A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

1. **[Chase Doors; a Senneca Company]**
2. **[Dortek Inc.]**
3. **[E S Robbins Corporation; ALECO]**
4. **[Eliason Corporation; a Senneca Company]**
5. **[National Access Design]**
6. **[Perma Tech Inc.]**
7. **<Insert manufacturer's name>**

B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

1. **[Chase Doors; a Senneca Company]**
2. **[Dortek Inc.]**
3. **[E S Robbins Corporation; ALECO]**

4. [Eliason Corporation; a Senneca Company]
5. [National Access Design]
6. [Perma Tech Inc.]
7. <Insert manufacturer's name>

C. Door Panels:

1. ABS: [1/8-inch- (3-mm-) thick ABS, bonded to a honeycomb polymer core][1/4 inch (6 mm) thick]<Insert requirements>.
 - a. Color: [As selected by Architect from manufacturer's standard range]<Insert requirements>.
2. HDPE: [1/2 inch (13 mm)]<Insert dimension> thick.
 - a. Color: [As selected by Architect from manufacturer's standard range]<Insert requirements>.
3. FRP: Minimum [1-1/2 inches (38 mm)]<Insert dimension> thick with gelcoat finish.
 - a. Color: [As selected by Architect from manufacturer's standard range][Match Architect's sample]<Insert requirements>.
4. <Insert requirements>.

D. Door Edges:

1. Jamb-Edge Reinforcing Spine: [Manufacturer's standard][Triple-layer spine with manufacturer's standard back channel][Galvanized-steel sheet with black powder-coat finish][Stainless steel][Extruded aluminum with black powder-coat finish]<Insert requirements>.
2. Perimeter Seals: [None][Provide manufacturer's standard full-perimeter, replaceable gaskets/seals]<Insert requirements>.

E. Vision Lites:

1. Size: [As indicated on Drawings][9 by 14 inches (229 by 356 mm)]<Insert dimensions>.
2. Safety Glazing: [Manufacturer's standard][1/4-inch- (6-mm-) thick acrylic][1/8-inch- (3-mm-) thick polycarbonate]<Insert requirements> complying with testing requirements in 16 CFR 1201.
 - a. Provide [single glazing][double glazing]<Insert requirements>.
3. Frame: [Manufacturer's standard]<Insert requirements>.

F. Double-Acting Hinges: [Roller-and-cam hinge system with top-hinge cover and stabilizing bottom hinge pin][Manufacturer's standard spring hinges]<Insert requirements>.

1. Material: [Manufacturer's standard corrosion-resistant material][Stainless steel]<Insert requirements>.

G. Accessories:

1. Teardrop bumpers.
2. Cart guards.

3. Jamb guards.
4. **[Stainless steel][ABS][HDPE]<Insert requirement>** impact plates.
5. **[Corrosion-resistant][Stainless steel]** bottom-hinge guard/cover.
6. **<Insert requirements>**.

2.5 RIGID, WOOD-CORE TRAFFIC DOORS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 1. **[Chase Doors; a Senneca Company]**
 2. **[E S Robbins Corporation; ALECO]**
 3. **[Eliason Corporation; a Senneca Company]**
 4. **[National Access Design]**
 5. **[Perma Tech Inc.]**
 6. **[Super Seal Mfg. Ltd]**
 7. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 1. **[Chase Doors; a Senneca Company]**
 2. **[E S Robbins Corporation; ALECO]**
 3. **[Eliason Corporation; a Senneca Company]**
 4. **[National Access Design]**
 5. **[Perma Tech Inc.]**
 6. **[Super Seal Mfg. Ltd]**
 7. **<Insert manufacturer's name>**
- C. Wood Core: Solid, moisture-resistant **[plywood][or][composite wood]** cores.
 1. Minimum Core Thickness: **[1/2 inch (13 mm)][3/4 inch (19 mm)]<Insert requirements>**.
- D. Composite Wood Products: Verify products are made using ultra-low-emitting formaldehyde resins, as defined in CARB 93120, "Airborne Toxic Control Measure (ATCM) for Formaldehyde Emissions from Composite Wood Products," or are made with no added formaldehyde.
- E. Composite Wood Products: Verify formaldehyde emission rates are not greater than the following when tested in accordance with ASTM D6007 or ASTM E1333:
 1. Hardwood Plywood: 0.05 ppm.
 2. Particleboard: 0.09 ppm.
 3. MDF More Than 5/16 Inch (8 mm) Thick: 0.11 ppm.
 4. MDF 5/16 Inch (8 mm) or Less in Thickness: 0.13 ppm.
- F. Door Face Panels: Permanently adhered to cores.
 1. High-Pressure Decorative Laminate: ISO 4586-3 in color and pattern **[selected by Architect from manufacturer's standard range][matching Architect's sample]<Insert requirements>**.
 2. ABS: **[1/8 inch (3 mm)]<Insert dimension>** thick.
 - a. Color: **[As selected by Architect from manufacturer's standard range]<Insert requirements>**.

3. Metal: **[Stainless steel, 0.05 inch (1.27 mm) thick][Aluminum sheet top panels, 0.032 inch (0.81 mm) thick, clear satin anodized; stainless steel bottom plates, 0.05 inch (1.27 mm) thick]<Insert requirements>.**
4. **<Insert requirements>.**

G. Door Edges:

1. Edge Capping Material: **[Manufacturer's standard][Stainless steel][Extruded aluminum, clear satin anodized]<Insert requirements>.**
2. Jamb-Edge Reinforcing Spine: **[Manufacturer's standard][Galvanized-steel sheet][Extruded aluminum, clear satin anodized]<Insert requirements>.**
3. Perimeter Seals: **[None][Provide manufacturer's standard full-perimeter, replaceable gaskets/seals]<Insert requirements>.**

H. Vision Lites:

1. Size: **[As indicated on Drawings][9 by 14 inches (229 by 356 mm)]<Insert dimensions>.**
2. Safety Glazing: **[Manufacturer's standard][1/4-inch- (6-mm-) thick acrylic,][1/8-inch- (3-mm-) thick polycarbonate,]<Insert requirements>** clear glazing complying with testing requirements in 16 CFR 1201.
 - a. Provide **[single glazing][double glazing]<Insert requirements>.**
3. Glazing Frame: **[Manufacturer's standard]<Insert requirements>.**

I. Double-Acting Hinges: Manufacturer's standard [roller-and-cam][V-cam] hinge system.

1. Swing: **[90 by 90][90 by 180]<Insert requirements>** degrees.
2. Material: **[Manufacturer's standard corrosion-resistant material][Stainless steel]<Insert requirements>.**

J. Accessories:

1. Teardrop bumpers.
2. Cart guards.
3. Stainless steel push plates.
4. **[Stainless steel][ABS]<Insert requirements>** impact plates.
5. **[Corrosion-resistant][Stainless steel]** bottom-hinge guard/cover.
6. **<Insert requirements>.**

2.6 RIGID, SHEET METAL TRAFFIC DOORS

A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. **[E S Robbins Corporation; ALECO]**
2. **[Eliason Corporation; a Senneca Company]**
3. **[National Access Design]**
4. **[World Manufacturing Inc.]**
5. **<Insert manufacturer's name>**

B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [E S Robbins Corporation; ALECO]
2. [Eliason Corporation; a Senneca Company]
3. [National Access Design]
4. [World Manufacturing Inc.]
5. <Insert manufacturer's name>

C. Door Panels:

1. Aluminum Sheet: [0.063 inch (1.6 mm)]<Insert dimension> thick.
 - a. Finish: [Manufacturer's standard clear satin anodized][High-pressure decorative laminate adhered to both sides in color and pattern selected by Architect from manufacturer's standard range]<Insert requirements>.
2. Stainless Steel Sheet: [0.05 inch (1.27 mm)][0.0625 inch (1.588 mm)]<Insert dimension> thick.

D. Door Edges: Leading and jamb edges formed in triangular shape for stiffness and durability.

E. Vision Lites: Single glazed.

1. Size: [As indicated on Drawings][9 by 14 inches (229 by 356 mm)]<Insert dimensions>.
2. Safety Glazing: [Manufacturer's standard][1/4-inch- (6-mm-) thick acrylic][1/8-inch- (3-mm-) thick polycarbonate]<Insert requirements> complying with testing requirements in 16 CFR 1201.
3. Gasket Frame: [Manufacturer's standard]<Insert requirements>.

F. Double-Acting Hinges: [Manufacturer's standard roller-and-cam hinge system with corrosion-resistant finish]<Insert requirements>.

1. Upper Hinge Assembly: Provide with dust guard.
2. Bottom Pin: Provide with [dust cover][jamb guard].

G. Accessories:

1. Cart guards.
2. [Stainless steel][ABS]<Insert requirement> impact plates.
3. <Insert requirements>.

2.7 FLEXIBLE TRAFFIC DOORS

A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. [Chase Doors; a Senneca Company]
2. [E S Robbins Corporation; ALECO]
3. [National Access Design]
4. [Perma Tech Inc.]
5. [Super Seal Mfg. Ltd]
6. [World Manufacturing Inc.]
7. <Insert manufacturer's name>

B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's

name; product name or designation> or comparable product by one of the following:

1. **[Chase Doors; a Senneca Company]**
2. **[E S Robbins Corporation; ALECO]**
3. **[National Access Design]**
4. **[Perma Tech Inc.]**
5. **[Super Seal Mfg. Ltd]**
6. **[World Manufacturing Inc.]**
7. **<Insert manufacturer's name>**

C. Flexible Door Panels:

1. PVC: **[Single][Double]** ply.
 - a. Minimum Ply Thickness: **[0.080 inch (2.0 mm)][0.120 inch (3.0 mm)][0.125 inch (3.2 mm)][0.160 inch (4.1 mm)][0.250 inch (6.4 mm)][0.275 inch (7.0 mm)][0.394 inch (10.0 mm)]<Insert dimension>**.
 - b. Color: **[Clear][As selected by Architect from manufacturer's full range]<Insert requirements>**.
 - c. PVC Formulation: Suitable for **[freezer][cooler]** applications.
2. Vinyl-Coated Nylon: **[40 oz./sq. yd. (1356 g/sq. m)][45 oz./sq. yd. (1526 g/sq. m)]<Insert requirements>**.
 - a. Color: **[As selected by Architect from manufacturer's full range]<Insert requirements>**.

D. Panel Edges:

1. Leading Edges: **[Manufacturer's standard][3-inch (76-mm)]<Insert requirements>** overlap.
2. Jamb Edges: **[Manufacturer's standard bulb seals]<Insert requirements>**.
3. Top and Bottom Edges: **[Manufacturer's standard wiper seals]<Insert requirements>**.

E. Flexible, Horizontal Panel Stays: Manufacturer's standard in **[one row][two rows]<Insert requirements>**.

F. Hinge Bracket Pockets: **[Manufacturer's standard]<Insert requirements>**.

G. Panel Weight Plates: **[Manufacturer's standard located at bottom of panels]<Insert requirements>**.

H. Vision Lites: **[Manufacturer's standard][Clear PVC][1/8-inch- (3-mm-) thick polycarbonate]<Insert requirements>** complying with testing requirements in 16 CFR 1201.

I. Impact Plates: **[Manufacturer's standard][1/8-inch- (3-mm-) thick HDPE]<Insert requirements>**.

J. Hardware: **[Top-mounted, double-acting gravity hinges with bracket arms and without bottom hinges][Full-length vertical frames with double-acting, adjustable-torsion spring hinges and top and bottom pivots]<Insert requirements>**.

1. Duty Classification: Manufacturer's **[standard][heavy-duty]** hinge.
2. Swing: **[90 by 90][90 by 180]<Insert requirements>** degrees.
3. Material: **[Galvanized steel][Stainless steel]<Insert requirements>**.
4. Accessories: **[Closing magnets]<Insert requirements>**.

2.8 TRAFFIC DOOR FRAMES

- A. Provide frames manufactured or recommended in writing by traffic door manufacturer for applications indicated on Drawings.
- B. Flush, Hollow-Metal Frames: Provide frames without rabbets recommended in writing by manufacturer for light- to medium-duty traffic and reinforced internally for hardware installation.
 - 1. Type: **[Knock-down construction with minimum two anchors per jamb][Fully welded for gypsum board construction with minimum of three sets of strap anchors per jamb][Fully welded for masonry construction with faces predrilled for anchoring to door opening with exposed fasteners]<Insert requirements>.**
 - 2. Material:
 - a. Galvanized-Steel Sheet: Minimum **0.064 inch (1.626 mm)** thick; **[factory primed for field painting][with manufacturer's standard factory powder-coat finish in color selected by Architect from manufacturer's full range]<Insert requirements>.**
 - b. Stainless Steel Sheet: Minimum **0.0625 inch (1.588 mm)** thick.
 - 3. Fasteners: Noncorrosive fasteners recommended in writing by manufacturer for supporting construction.
- C. Channel Frames: Provide channel frames that wrap heads and jambs of supporting walls; recommended in writing by manufacturer for medium- to heavy-duty traffic; fabricated in three pieces with internal reinforcement plates for field assembly and hardware installation; and predrilled for hardware installation and fastening frame to supporting wall and to floor construction through two external floor flanges per jamb.
 - 1. Material: **[Steel sheet, 0.1046-inch (2.657-mm) nominal thickness, factory powder coated in color selected by Architect from manufacturer's full range][Galvanized-steel sheet, 0.108-inch (2.743-mm) nominal thickness][Stainless steel sheet, 0.1094 inch (2.779 mm) thick]<Insert requirements>.**
 - 2. Channel Dimensions: **[As indicated on Drawings][2 inches (51 mm) deep by width of supporting wall construction]<Insert dimensions>.**
 - 3. Fasteners: Noncorrosive exposed fasteners recommended in writing by manufacturer for fastening frame.
- D. Structural-Steel Tube Frames: Self-supporting, rectangular-tube frames recommended in writing by manufacturer for heavy-duty traffic; fabricated in three pieces for on-site assembly; with predrilled floor plates for bolting frames on both sides of each jamb to supporting floor construction; and with headers and jambs predrilled for fastening frames to wall construction and hardware installation.
 - 1. Material: **[Steel tube with manufacturer's standard factory powder-coat finish in color selected by Architect from manufacturer's full range][Stainless steel tube]<Insert requirements>.**
 - 2. Nominal Wall Thickness: **[As required to support door specified][3/16 inch (5 mm)]<Insert requirements>.**
 - 3. Tube Dimensions: **[As indicated on Drawings][2 by 4 by inches (51 by 102 mm)][2 by 6 inches (51 by 152 mm)][2 by 8 inches (51 by 203 mm)]<Insert dimensions>.**
 - 4. Bolt Fasteners: Noncorrosive bolts recommended in writing by manufacturer.

2.9 MATERIALS

- A. Steel Sheet: ASTM A1011/A1011M, hot-rolled, mild steel.
- B. Galvanized-Steel Sheet: ASTM A653/A653M, galvanized by hot-dip process.
- C. Steel Tube: ASTM A500/A500M.
- D. Stainless Steel Sheet: ASTM A666, Type 304, No. 4 finish.
- E. Stainless Steel Tube: ASTM A554, Type 304, No. 4 finish.
- F. Aluminum Sheet and Plate: ASTM B209/B209M, alloy and temper standard with manufacturer for use and finish indicated.
- G. Extruded Aluminum: **ASTM B221 (ASTM B221M)**, alloy and temper to suit structural and finish requirements, but with not less than the strength and durability of Alloy 6063-T52.
- H. Plastic Laminate: ISO 4586-3, high-pressure decorative laminate.
- I. Glass: ASTM C1036, Type 1, q3.
- J. Acrylic Glazing: ASTM D4802, Finish 1 (smooth or polished).
- K. Polycarbonate Glazing: ASTM C1349, polished finish,

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF DOOR FRAMES

- A. Install door frames plumb, rigid, true in line, and securely fastened in place.
- B. Installation Tolerances: Adjust frames to the following tolerances:
 - 1. Squareness: Plus or minus **1/16 inch (1.6 mm)**, measured on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus **1/16 inch (1.6 mm)**, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus **1/16 inch (1.6 mm)**, measured at jambs at floor.
- C. Flush, Hollow-Metal Frames: Install in accordance with manufacturer's written instructions.
- D. Channel Frames: Install in accordance with manufacturer's written instruction with channel flanges

fastened to supporting construction with exposed fasteners.

- E. Structural-Steel Tube Frames: Install in accordance with manufacturer's written instructions with floor plates bolted to floor construction.

3.3 INSTALLATION OF TRAFFIC DOORS

- A. Install traffic doors and field-installed accessories in accordance with manufacturer's written instructions.
- B. Install door panels plumb and true in line.
 - 1. Align to provide effective seal at perimeters.

3.4 ADJUSTING AND CLEANING

- A. Adjust hardware to function smoothly and open and close freely without binding; lubricate as recommended in writing by manufacturer.
- B. Adjust doors to provide effective perimeter seal.
- C. Clean surfaces as recommended in writing by manufacturer.

END OF SECTION 08 38 00 00



Task	Specification	Specification Description
08 38 13 00	08 38 00 00	Traffic Doors
08 38 16 00	08 05 13 00	Stainless-Steel Doors and Frames
08 38 16 00	08 38 00 00	Traffic Doors
08 38 19 00	08 05 13 00	Stainless-Steel Doors and Frames
08 38 19 00	08 38 00 00	Traffic Doors



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SECTION 08 42 13 00 - ALUMINUM-FRAMED ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed entrance door systems.

B. Related Requirements:

1. Section 081116.13 "Interior Aluminum Doors and Frames" for interior aluminum framing.
2. Section 084226 "All-Glass Entrances" for systems without aluminum support framing.

1.2 ALLOWANCES

- A. See Section 012100 "Allowances" for description of allowances affecting items specified in this Section.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Aluminum-framed entrance door systems.

B. Product Data Submittals: For each product.

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories.

C. Shop Drawings:

1. Plans, elevations, sections, full-size details, and attachments to other work.
2. Details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
3. Full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrance door systems, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.

4. Connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
 5. Point-to-point wiring diagrams showing the following:
 - a. Power requirements for each electrically operated door hardware.
 - b. Location and types of switches, signal device, conduit sizes, and number and size of wires.
 6. **<Insert requirements>**.
 7. Signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.
- E. Samples for Verification: Actual sample of finished products for each type of exposed finish.
1. Size: **[Manufacturers' standard size]<Insert size>**.
- F. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from **12-inch (300-mm)** lengths of full-size components and showing details of the following:
1. Joinery, including concealed welds.
 2. Anchorage.
 3. Expansion provisions.
 4. Glazing.
 5. Flashing and drainage.
- G. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- H. Delegated Design Submittals: For aluminum-framed entrances and storefront systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- I. Sustainable Design Submittals:
1. Product Data: For sealants, indicating VOC content.
 2. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.
 3. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
 4. Environmental Product Declaration (EPD): For each product.
 5. Health Product Declaration (HPD): For each product.
 6. Environmental Product Declaration (EPD): For each product.
 7. Health Product Declaration (HPD): For each product.
 8. Environmental Product Declaration (EPD): For each product.
 9. Environmental Product Declaration (EPD): For each product.
 10. Environmental Product Declaration (EPD): For each product.
 11. Third-Party Certifications: For each product.
 12. Third-Party-Certified Life-Cycle Assessment: For each product.

1.5 INFORMATIONAL SUBMITTALS

- A. Energy Performance Certificates: For aluminum-framed entrance door systems, accessories, and

components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance.
- B. Product Test Reports: For aluminum-framed entrance door systems, for tests performed by **[a qualified testing agency][manufacturer and witnessed by a qualified testing agency]**.
- C. Field Quality-Control Reports: For aluminum-framed entrance door systems.
- D. Qualification Statements:
 1. For Installer **[and field testing agency][and egress door inspector]**.
- E. Delegated Design Engineer Qualifications: For aluminum-framed entrance and storefront systems.
- F. Sample Warranties: For aluminum-framed entrance door systems.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For aluminum-framed entrance door systems.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 1. Fabricator of products.
 2. Entity that employs installers and supervisors who are trained and approved by manufacturer.
 3. Authorized representative who is trained and approved by manufacturer.
 4. Entity that is certified under the North American Contractor Certification Program (NACC) and that employs installers and supervisors who are trained and approved by manufacturer **[and who are certified under the Architectural Glass and Metal Technician (AGMT) certification program]**.
- B. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in **[state]<Insert jurisdiction>** where Project is located and who is experienced in providing engineering services of the type indicated.
- C. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated **[and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025]** and acceptable to Owner and Architect.
- D. Egress Door Inspector Qualifications:
 1. Inspector for field quality-control inspections of egress door assemblies to comply with qualifications set forth in NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."
 2. Inspector for field quality-control inspections of egress door assemblies to be certified under DHI's certification program as a Fire and Egress Door Assembly Inspector (FDAI) or a Certified Fire and Egress Door Assembly Inspector (CFDAI).
- E. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions,

arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.8 WARRANTY

- A. Special Warranty: **[Manufacturer agrees][Installer agrees][Manufacturer and Installer agree]** to repair or replace components of aluminum-framed entrance door systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Structural failures, including **<Insert type of failure>**.
 - b. Faulty operation of **<Insert components>**.
 - c. Deterioration of metals[, **metal finishes**,] and other materials beyond normal **[weathering][use]**.
 - d. **<Insert conditions relating to specified products>**.
 - e. **<Insert failure modes>**.
2. Warranty Period: **[Two][Five][10]<Insert number>** years from date of Substantial Completion.

- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Warranty Period: **[Five][10][20]<Insert number>** years from date of Substantial Completion.

- C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D 4214.
 - c. Cracking, peeling, or chipping.
2. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain all components of aluminum-framed entrance door systems, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrance door systems.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrance door systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- C. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: **[As indicated on Drawings]<Insert loads>**.
- D. Structural: Test in accordance with ASTM E330/E330M as follows:
 - 1. When tested at **[150]<Insert number>** percent of positive and negative wind-load design pressures, entrance doors, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding **[0.2]<Insert number>** percent of span.
 - 2. Test Durations: As required by design wind velocity, but not less than **[10]<Insert number>** seconds.
- E. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
 - 1. No evidence of water penetration through fixed glazing and framing areas of entrance doors when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than **[6.24 lbf/sq. ft. (300 Pa)][10 lbf/sq. ft. (480 Pa)][15 lbf/sq. ft. (720 Pa)]<Insert value>**.
- F. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
 - 1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than **[0.41 Btu/sq. ft. x h x deg F (2.33 W/sq. m x K)][0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K)][0.57 Btu/sq. ft. x h x deg F (3.23 W/sq. m x K)][0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K)]<Insert value>** as determined in accordance with NFRC 100.
 - b. Entrance Doors: U-factor of not more than **[0.68 Btu/sq. ft. x h x deg F (3.86 W/sq. m x K)][0.77 Btu/sq. ft. x h x deg F (4.37 W/sq. m x K)][0.83 Btu/sq. ft. x h x deg F (4.71 W/sq. m x K)][1.10 Btu/sq. ft. x h x deg F (6.253 W/sq. m x K)]<Insert value>** as determined in accordance with NFRC 100.
 - 2. Solar Heat-Gain Coefficient (SHGC):
 - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than

- [0.26][0.35][0.40][0.45]<Insert value> as determined in accordance with NFRC 200.
- b. Entrance Doors: SHGC of not more than [0.22][0.25][0.35][0.40][0.45]<Insert value> as determined in accordance with NFRC 200.
3. Air Leakage:
- a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than [0.06 cfm/sq. ft. (0.30 L/s per sq. m)]<Insert value> at a static-air-pressure differential of [1.57 lbf/sq. ft. (75 Pa)][6.24 lbf/sq. ft. (300 Pa)]<Insert value> when tested in accordance with ASTM E283.
- b. Entrance Doors: Air leakage of not more than [1.0 cfm/sq. ft. (5.08 L/s per sq. m)]<Insert value> at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
4. Condensation Resistance Factor (CRF):
- a. Fixed Glazing and Framing Areas: CRF for the system of not less than [35][55][70]<Insert value> as determined in accordance with AAMA 1503.
- b. Entrance Doors: CRF of not less than [57][63][68]<Insert value> as determined in accordance with AAMA 1503.
- G. Noise Reduction: Test in accordance with ASTM E90, with ratings determined by ASTM E1332, as follows.
1. Outdoor-Indoor Transmission Class: Minimum [26][30][34]<Insert number>.
- H. Blast Resistance:
1. Hazard Rating: [No Break][No Hazard][Minimal Hazard][Very Low Hazard][Low Hazard][High Hazard] in accordance with ASTM F2912.
2. Performance Condition: [1][2][3a][3b][4][5] per GSA-TS01.
- I. Ballistic Resistance, UL 752: [Listed and labeled as][Level 1][Level 2][Level 3][Level 4][Level 5][Level 6][Level 7][Level 8][Level 9][Level 10][Level 1-SG][Level 2-SG][Level 3-SG][Level 4-SG][Level 5-SG][Level 6-SG][Level 7-SG][Level 8-SG][Level 9-SG][Level 10-SG] when tested in accordance with UL 752.
- J. Ballistic Resistance, ASTM F1233: [Class/Level HG1][Class/Level HG2][Class/Level HG3][Class/Level HG4][Class/Level SMG][Class/Level R1][Class/Level R2][Class/Level R3][Class/Level R4-AP][Class/Level R5][Class/Level SH1][Class/Level SH2] when tested in accordance with ASTM F1233.
- K. Ballistic Resistance, HPW-TP-0500.03: [A][B][C][D][E] when tested in accordance with HPW-TP-0500.03.
- L. Ballistic Resistance, SD-STD-01.01: [R][SH] when tested in accordance with SD-STD-01.01.
- M. Ballistic Resistance, NIJ STD-0108.01: [Level I][Level IIA][Level II][Level IIIA][Level III][Level IV] when tested in accordance with NIJ STD-0108.01.
- N. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone [1][2][3][4] for [basic][enhanced] protection.
1. Large-Missile Test: For glazing located within [30 feet (9.1 m)]<Insert dimension> of grade.
2. Small-Missile Test: For glazing located between 30 feet (9.1 m) and [60 feet (18.3 m)]<Insert dimension> above grade.

- O. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
 - 1. Temperature Change: **120 deg F (67 deg C)**, ambient; **180 deg F (100 deg C)**, material surfaces.

2.3 ALUMINUM-FRAMED ENTRANCE DOOR SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **[Andersen Windows, Inc.; Andersen Corporation]**
 - 2. **[Arcadia Inc.]**
 - 3. **[CMI Architectural Products, Inc.]**
 - 4. **[Coral Architectural Products; Coral Industries, Inc.]**
 - 5. **[EFCO Corporation]**
 - 6. **[Kawneer Company, Inc.; Arconic Corporation]**
 - 7. **[Leed Himmel Industries, Inc.]**
 - 8. **[Manko Window Systems, Inc.]**
 - 9. **[OldCastle BuildingEnvelope (OBE)]**
 - 10. **[Pittco Architectural Metals, Inc.]**
 - 11. **[Trulite Glass & Aluminum Solutions, LLC.]**
 - 12. **[Tubelite Inc.]**
 - 13. **[U.S. Aluminum; C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - 14. **[YKK AP America Inc.]**
 - 15. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1. **[Andersen Windows, Inc.; Andersen Corporation]**
 - 2. **[Arcadia Inc.]**
 - 3. **[CMI Architectural Products, Inc.]**
 - 4. **[Coral Architectural Products; Coral Industries, Inc.]**
 - 5. **[EFCO Corporation]**
 - 6. **[Kawneer Company, Inc.; Arconic Corporation]**
 - 7. **[Leed Himmel Industries, Inc.]**
 - 8. **[Manko Window Systems, Inc.]**
 - 9. **[OldCastle BuildingEnvelope (OBE)]**
 - 10. **[Pittco Architectural Metals, Inc.]**
 - 11. **[Trulite Glass & Aluminum Solutions, LLC.]**
 - 12. **[Tubelite Inc.]**
 - 13. **[U.S. Aluminum; C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - 14. **[YKK AP America Inc.]**
 - 15. **<Insert manufacturer's name>**
- C. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
 - 1. Door Construction: **[1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-)][2-inch (50.8-mm) overall thickness, with minimum 0.188-inch- (4.8-mm-)][2- to 2-1/4-inch (50.8- to 57.2-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-)]** thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

- a. Thermal Construction: **[High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior]<Insert description>**.
2. Door Design: **[As indicated][Narrow stile; 2-1/8-inch (54-mm) nominal width][Medium stile; 3-1/2-inch (88.9-mm) nominal width][Wide stile; 5-inch (127-mm) nominal width]<Insert description>**.
3. Glazing Stops and Gaskets: **[Beveled][Square]<Insert description>**, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.
4. Door Finish: **[Clear anodic finish][Color anodic finish][Baked-enamel or powder-coat finish][High-performance organic finish][Superior-performance organic finish]**.
- D. Framing Members: Manufacturer's standard extruded aluminum, minimum **0.125 inch (3.2 mm)** thick and reinforced as required to support imposed loads.
 1. Nominal Size: **[1-3/4 by 4-1/2 inches (45 by 115 mm)][1-3/4 by 6 inches (45 by 150 mm)][As indicated on Drawings]<Insert nominal size>**.
 2. Exterior Framing Construction: **[Thermally broken][Thermally improved][Nonthermal]<Insert description>**.
 3. Interior Vestibule Framing Construction: **[Nonthermal]<Insert description>**.
 4. Finish: Match door finish.
- E. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- F. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- G. Materials:
 1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: **ASTM B209 (ASTM B209M)**.
 - b. Extruded Bars, Rods, Profiles, and Tubes: **ASTM B221 (ASTM B221M)**.
 - c. Structural Profiles: **ASTM B308/B308M**.
 2. Steel Reinforcement:
 - a. Structural Shapes, Plates, and Bars: **ASTM A36/A36M**.
 - b. Cold-Rolled Sheet and Strip: **ASTM A1008/A1008M**.
 - c. Hot-Rolled Sheet and Strip: **ASTM A1011/A1011M**.
 3. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.
- H. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- I. Product Data: Verify materials were fabricated within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered within **100 miles (160 km)** of Project site.

- J. Product Data: Verify materials were fabricated within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered within **500 miles (800 km)** of Project site. If materials are transported by rail or water, multiply the distance by 0.25 to determine the distance to Project site.

2.4 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in **[Section 087100 "Door Hardware."][Section 087111 "Door Hardware (Descriptive Specification)."]**
- B. General: Provide entrance door hardware and **[entrance door hardware sets indicated in door and frame schedule][entrance door hardware sets indicated in "Entrance Door Hardware Sets" Article]** for each entrance door, to comply with requirements in this Section.
1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and **[named manufacturers' products][products equivalent in function and comparable in quality to named products][products complying with BHMA standard referenced]**.
 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 3. Opening-Force Requirements:
 - a. Egress Doors: Not more than **15 lbf (67 N)** to release the latch and not more than **30 lbf (133 N)** to set the door in motion **[and not more than 15 lbf (67 N) to open the door to its minimum required width]**.
 - b. Accessible Interior Doors: Not more than **5 lbf (22.2 N)** to fully open door.
- C. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- D. Pivot Hinges: BHMA A156.4, Grade 1.
1. Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.
- E. Butt Hinges: BHMA A156.1, Grade 1, radius corner.
1. Nonremovable Pins: Provide setscrew in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
 2. Exterior Hinges: **[Stainless steel, with stainless steel pin][Nonferrous]<Insert material>**.
 3. Quantities:
 - a. For doors up to **[87 inches (2210 mm)]<Insert dimension>** high, provide three hinges per leaf.
 - b. For doors more than **[87 and up to 120 inches (2210 and up to 3048 mm)]<Insert dimensions>** high, provide four hinges per leaf.
- F. Continuous-Gear Hinges: BHMA A156.26.
- G. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.

- H. Manual Flush Bolts: BHMA A156.16, Grade 1.
- I. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.
- J. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing in accordance with UL 305.
- K. Cylinders:
 - 1. **[As specified in Section 087100 "Door Hardware."][As specified in Section 087111 "Door Hardware (Descriptive Specification)."]**
 - 2. BHMA A156.5, Grade 1.
 - a. Keying: **[No master][Master]** key system. Permanently inscribe each key with a visual key control number and include notation **["DO NOT DUPLICATE"]****[to be furnished by Owner]**.
- L. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- M. Operating Trim: BHMA A156.6.
- N. Removable Mullions: BHMA A156.3 extruded aluminum.
 - 1. When used with panic exit devices, provide **[keyed]** removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing in accordance with UL 305. Use only mullions that have been tested with exit devices to be used.
- O. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.
- P. Concealed Overhead Holders and Stops: BHMA A156.8, Grade 1.
- Q. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.
- R. Weather Stripping: Manufacturer's standard replaceable components.
 - 1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.
 - 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- S. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- T. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of **1/2 inch (12.7 mm)**.
- U. Finger Guards: Manufacturer's standard collapsible neoprene or PVC gasket anchored to frame hinge-jamb at center-pivoted doors.

2.5 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: **[Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.][Comply with Section 088000 "Glazing."]**
- C. Glazing Sealants: **[As recommended by manufacturer.][Comply with Section 088000 "Glazing."]**
 - 1. Product Data: Verify architectural sealant has a VOC content of 250 g/L or less.

2.6 ACCESSORIES

- A. Automatic Door Operators: **[Section 087113 "Power Door Operators."][Section 084229.33 "Swinging Automatic Entrances."]**
- B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads[, **finished to match framing system**][, **fabricated from 300 series stainless steel**].
- C. Anchors: Three-way adjustable anchors with minimum adjustment of **[1 inch (25.4 mm)]<Insert dimension>** that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- D. Concealed Flashing: **[Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials][Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, complying with ASTM A240/A240M, of type recommended by manufacturer].**
- E. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.
- F. Rigid PVC filler.

2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.

3. Physical and thermal isolation of glazing from framing members.
 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
1. At interior and exterior doors, provide compression weather stripping at fixed stops.
- E. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 2. At exterior doors, provide weather sweeps applied to door bottoms.
- F. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- G. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.8 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, **[AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm]** or thicker.
- B. Color Anodic Finish: AAMA 611, **[AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm]** or thicker.
1. Color: **[Light bronze][Medium bronze][Dark bronze][Champagne][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- D. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with **[AAMA 2604][AAMA 2605]** and containing not less than **[50][70]** percent PVDF resin by weight in color coat.
1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- E. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- F. Superior-Performance Organic Finish, Four-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- G. Superior-Performance Organic Finish, Single-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- H. Superior-Performance Organic Finish, Two-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOOR SYSTEMS

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.**I. Install joint filler behind sealant as recommended by sealant manufacturer.****J. Install components plumb and true in alignment with established lines and grades.****K. Install entrance doors to produce smooth operation and tight fit at contact points.**

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

L. Install glazing as specified in Section 088000 "Glazing."**3.3 FIELD QUALITY CONTROL****A. Testing Agency: [Owner will engage][Engage] a qualified testing agency to perform tests.****B. Tests: Perform the following tests on aluminum-framed entrance door systems.**

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect to be tested in accordance with AAMA 501.2 and to not evidence water penetration.
2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than **0.09 cfm/sq. ft. (0.45 L/s per sq. m)** at a static-air-pressure differential of **1.57 lbf/sq. ft. (75 Pa)**.
3. Water Penetration: ASTM E1105 at a minimum **[uniform][and][cyclic]** static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than **6.24 lbf/sq. ft. (300 Pa)**, and to not evidence water penetration.

C. Inspection Agency: [Owner will engage][Engage] a qualified inspector to perform inspections.**D. Inspections:**

1. Egress Door Inspections: Inspect each aluminum-framed entrance door equipped with panic hardware, located in an exit enclosure, electrically controlled, and equipped with special locking arrangements, in accordance with NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."

E. Aluminum-framed entrance door systems will be considered defective if they do not pass tests and inspections.**F. Prepare test and inspection reports.**

3.4 MAINTENANCE SERVICE

A. Entrance Door Hardware Maintenance:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
2. Initial Maintenance Service: Beginning at Substantial Completion, provide **[six]<Insert number>** months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

3.5 ENTRANCE DOOR HARDWARE SETS

A. <Insert schedule>.

END OF SECTION 08 42 13 00



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Task	Specification	Specification Description
08 42 13 00	08 12 16 00	Aluminum-Framed Entrances And Storefronts



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SECTION 08 42 26 00 - ALL-GLASS ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior all-glass entrance and storefront systems.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for overhead-steel support for all-glass systems.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Exterior all-glass entrance and storefront systems.

B. Product Data Submittals: For each product.

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for all-glass system.

C. Shop Drawings: For exterior all-glass entrance and storefront systems.

1. Plans, elevations, and sections.
2. Details of fittings and glazing, including isometric drawings of fittings.
3. Door hardware locations, mounting heights, and installation requirements.
4. **<Insert requirements>**.
5. Signed and sealed by the qualified professional engineer responsible for their preparation.

D. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of fitting, accessory fitting, glass, and door hardware.

E. Samples for Verification: Actual sample of finished products for each type of fitting, accessory fitting, glass showing exposed edge finish, and door hardware.

1. Size: **[Manufacturers' standard size]<Insert size>**.

F. Fabrication Sample: **[Patch fitting at sill on pivot side only][Continuous rail fitting at bottom]<Insert requirements>**, made from **12-inch (300-mm)** lengths of full-size components and showing details of the following:

1. Joinery.

2. Anchorage.
3. Glazing[**with butt glazing**].

- G. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with all-glass entrance-system components, assemblies, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- H. Delegated Design Submittals: For exterior all-glass entrance and storefront systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- I. Sustainable Design Submittals:
 1. Product Data: For sealants, indicating VOC content.
 2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each exterior all-glass entrance and storefront system, for tests performed by **[a qualified testing agency][manufacturer and witnessed by a qualified testing agency]**.
- B. Field Quality-Control Reports: For exterior all-glass entrance and storefront systems.
- C. Qualification Statements:
 1. For Installer[**and testing agency**][**and egress door inspector**].
- D. Delegated Design Engineer Qualifications: For exterior all-glass entrance and storefront systems.
- E. Sample Warranties: For exterior all-glass entrance and storefront systems.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For exterior all-glass entrance and storefront systems.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
 1. Fabricator of products.
 2. Entity that employs installers and supervisors who are trained and approved by manufacturer.
 3. Authorized representative who is trained and approved by manufacturer.
 4. Entity that is certified under the North American Contractor Certification Program (NACC) and that employs installers and supervisors who are trained and approved by manufacturer[**and who are certified under the Architectural Glass and Metal Technician (AGMT) certification program**].
- B. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in **[state]<Insert jurisdiction>** where Project is located and who is experienced in providing engineering services of the type indicated.

- C. Testing Agency Qualifications: Qualified according to ASTM E699 for testing indicated[**and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025**].
- D. Egress Door Inspector Qualifications:
 - 1. Inspector for field quality-control inspections of egress door assemblies to comply with qualifications set forth in NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."
 - 2. Inspector for field quality-control inspections of egress door assemblies to be certified under DHI's certification program as a Fire and Egress Door Assembly Inspector (FDAI) or a Certified Fire and Egress Door Assembly Inspector (CFDAI).
- E. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 MOCKUPS

- A. Build mockups [**to verify selections made under Sample submittals**][**to demonstrate aesthetic effects**][**to set quality standards for materials and execution**][**to set quality standards for fabrication and installation**].
 - 1. Build mockup [**as indicated on Drawings**]**<Insert mockup requirements>**.
 - 2. Testing must be performed on mockups in accordance with requirements in "Field Quality Control" Article.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 WARRANTY

- A. Special Warranty: [**Manufacturer agrees**][**Installer agrees**][**Manufacturer and Installer agree**] to repair or replace components of exterior all-glass entrance and storefront systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection[, **air leakage, or water penetration**].
 - b. Faulty operation of **<Insert components>**.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal **[weathering][use]**.
 - d. **<Insert conditions relating to specified products>**.
 - e. **<Insert failure modes>**.
 - 2. Warranty Period: [**Two**]**<Insert number>** years from date of Substantial Completion.
 - a. Concealed Floor Closers: [**Five**][**10**][**25**]**<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain all components of exterior all-glass entrance and storefront systems, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design exterior all-glass entrance and storefront systems.
- B. General Performance: Comply with performance requirements specified, as determined by testing of exterior all-glass entrance and storefront systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- C. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: **[As indicated on Drawings]<Insert loads>**.
 - 3. Deflection Limits: Deflection normal to glazing plane is limited to **[1 inch (25 mm)][1/175 of clear span or 3/4 inch (19 mm), whichever is smaller]<Insert deflection limit>**.
- D. Seismic Performance: All-glass entrance and storefront systems to withstand the effects of earthquake motions determined in accordance with **[ASCE/SEI 7]<Insert requirement>**.
- E. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
 - 1. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature change>**.

2.3 EXTERIOR ALL-GLASS ENTRANCE AND STOREFRONT SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **[GGI; General Glass International]**
 - 2. **[PRL Glass Systems Inc.]**
 - 3. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1. **[GGI; General Glass International]**
 - 2. **[PRL Glass Systems Inc.]**
 - 3. **<Insert manufacturer's name>**
- C. Fitting Configuration:

1. Manual-Swinging, All-Glass Entrance Doors: **[Patch fittings at head and sill on pivot side only (A-Style)][Patch fittings at head and sill on pivot side, and for lock at sill of swing side (F-Style)][Patch fitting at top and continuous rail fitting at bottom (BP-Style)][Continuous rail fitting at top and bottom (P-Style)]<Insert fitting configuration>.**
 2. All-Glass Storefronts: **[Recessed glazing channel at top and continuous rail fitting at bottom][Recessed glazing channel at top and bottom][Continuous rail fitting at top and bottom]<Insert fitting configuration>.**
- D. Fitting Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum].**
- E. Rail Fittings:
1. Height:
 - a. Top Rail: **[3-1/2 inches (89 mm)][As indicated]<Insert dimension>.**
 - b. Bottom Rail: **[3-1/2 inches (89 mm)][10 inches (255 mm)][As indicated]<Insert dimension>.**
 2. Profile: **[Tapered][Tapered flat][Tapered at 60 degrees minimum from horizontal][Square][Curved][As indicated]<Insert profile>.**
 3. End Caps: Manufacturer's standard precision-fit end caps for rail fittings.
- F. Accessory Fittings:
1. Overhead doorstop.
 2. Center-housing lock.
 3. U-channel.
 4. Glass-support-fin brackets.
- G. Anchors and Fastenings: Concealed.
- H. Weather Stripping: Pile type; replaceable without removing all-glass entrance doors from pivots.
- I. Materials:
1. Aluminum: **ASTM B221 (ASTM B221M)**, with strength and durability characteristics of not less than Alloy 6063-T5.
 - a. Clear Anodic Finish: AAMA 611, **[AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm]** or thicker.
 - b. Color Anodic Finish: AAMA 611, **[AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm]** or thicker.
 - c. Color: **[Light bronze][Medium bronze][Dark bronze][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>.**
 2. Bronze Cladding: ASTM B36/B36M, alloy **[as standard with manufacturer]<Insert requirements>.**
 - a. Finish: **[Polished M21-O6x][Satin M31-M34-O6x][Statuary M31-C5][Match Architect's sample][As selected by Architect from full range of industry finishes]<Insert finish>.**
 3. Brass Cladding: ASTM B36/B36M, alloy **[as standard with manufacturer]<Insert requirements>.**

- a. Finish: **[Polished M21-O6x][Satin M31-M34-O6x][As selected by Architect from full range of industry finishes]<Insert finish>**.
- 4. Stainless Steel Cladding: ASTM A240/A240M or ASTM A666, Type 304.
 - a. Finish: **[ASTM A480/480M No. 4 directional satin finish][ASTM A480/480M No. 8 mirrorlike reflective, nondirectional polish]<Insert finish>**.

2.4 GLASS

- A. Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), Quality-Q3, tested for surface and edge compression in accordance with ASTM C1048 and for impact strength in accordance with 16 CFR 1201 for Category II materials.
 - 1. Class 1: Clear monolithic.
 - a. Thickness: **[10][12][16][19]** mm.
 - b. Locations: **[As indicated]<Insert locations>**.
 - 2. Class 2: Tinted monolithic.
 - a. Color: **[Gray][Bronze]<Insert color>**.
 - b. Thickness: **[10][12]** mm.
 - c. Locations: **[As indicated]<Insert locations>**.
 - d. Visible Light Transmittance: **<Insert number>** percent minimum.
 - e. Solar Heat-Gain Coefficient: **<Insert value>** maximum.
 - f. Outdoor Visible Reflectance: **<Insert number>** percent maximum.
 - 3. Exposed Edges: Machine ground and flat polished.
 - 4. Butt Edges: Flat ground.
 - 5. Corner Edges: Lap-joint corners with exposed edges polished.

2.5 ENTRANCE DOOR HARDWARE

- A. General: Entrance door hardware units in sizes, quantities, and types recommended by manufacturer for all-glass entrance systems indicated. For exposed parts, match metal and finish of fittings.
- B. Concealed Floor Closers and Top Pivots: Center hung; ANSI/BHMA A156.4, Grade 1; including cases, bottom arms, top walking beam pivots, plates, and accessories required for complete installation.
 - 1. Swing: **[Single][Double]** acting.
 - a. Positive Dead Stop: Coordinated with hold-open angle if any, or at angle selected.
 - 2. Hold Open: **[Automatic, at angle selected][Selective][None]**.
 - 3. Opening-Force Requirements:
 - a. Egress Doors: Not more than **15 lbf (67 N)** to release the latch and not more than **30 lbf (133 N)** to set the door in motion **[and not more than 15 lbf (67 N) to open the door to its minimum required width]**.
- C. Concealed Overhead Holder: ANSI/BHMA A156.8, Grade 1, with dead-stop setting coordinated with

concealed floor closer.

- D. Push-Pull Set: **[As selected from manufacturer's full range][As indicated]<Insert description>.**
- E. Single-Door and Active-Leaf Locksets: **[Center-housing deadbolt with pulls][Center-housing combination deadbolt and latchbolt with lever handles][Bottom-fitting or bottom-rail deadbolt]<Insert description>.**
 - 1. Deadbolt operated by key outside and **[key][thumbturn]** inside.
- F. Inactive-Leaf Locksets: Bottom-fitting or bottom-rail deadbolt.
 - 1. Deadbolt operated by key outside and **[key][thumbturn]** inside.
- G. Cylinders: **[As specified in Section 087100 "Door Hardware."][As specified in Section 087111 "Door Hardware (Descriptive Specification)."]****[Six-pin cylinder, ANSI/BHMA A156.5, Grade 1.]<Insert requirements.>**
- H. Exit Devices: UL 305.
 - 1. Function: Operation by push-pull when **[inside operator is locked down (dogged)][inside operator is locked down (dogged); outside operation by key]**.
 - 2. Latching: At **[threshold or floor plate][door head][threshold or floor plate and door head]**.
 - 3. Style: **[Exposed vertical rod][Concealed vertical rod in housing style indicated]<Insert style>.**
 - 4. Provide exit devices on both leaves of pairs of doors.
- I. Threshold: Not more than **1/2 inch (12 mm)** high.

2.6 BUTT-GLAZING SEALANTS

- A. Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, for Uses NT, G, and A.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Adfast]**
 - b. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - c. **[Pecora Corporation]**
 - d. **[Polymeric Systems, Inc.; PPG Industries, Inc.]**
 - e. **[The Dow Chemical Company]**
 - f. **[Tremco Incorporated]**
 - g. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Adfast]**
 - b. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - c. **[Pecora Corporation]**
 - d. **[Polymeric Systems, Inc.; PPG Industries, Inc.]**

- e. **[The Dow Chemical Company]**
- f. **[Tremco Incorporated]**
- g. **<Insert manufacturer's name>**

- 3. Sealant shall have a VOC content of 250 g/L or less.
- 4. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- 5. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- 6. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
- 7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- 8. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

2.7 FABRICATION

- A. Provide holes and cutouts in glass to receive hardware, fittings, and accessory fittings before tempering glass. Do not cut, drill, or make other alterations to glass after tempering.
 - 1. Fully temper glass using horizontal (roller-hearth) process, and fabricate so that when glass is installed, roll-wave distortion is parallel with bottom edge of door or lite.
- B. Factory assemble components and factory install hardware and fittings to greatest extent possible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF EXTERIOR ALL-GLASS ENTRANCE AND STOREFRONT SYSTEMS

- A. Install all-glass entrance and storefront systems and associated components according to manufacturer's written instructions.
- B. Set units level, plumb, and true to line, with uniform joints.

- C. Maintain uniform clearances between adjacent components.
- D. Lubricate hardware and other moving parts in accordance with manufacturer's written instructions.
- E. Set, seal, and grout floor closer cases as required to suit hardware and substrate indicated.
- F. Install butt-joint sealants according to manufacturer's written instructions and as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests.
- B. Tests: Perform the following tests on **[representative areas of exterior all-glass storefront systems][mockups]<Insert requirements>**.
 - 1. Water-Spray Test: After completion of all-glass storefront installation and nominal curing of sealant and glazing compounds, but before installation of interior finishes, test storefront for water leaks in accordance with AAMA 501.2.
 - a. Perform test for total areas **[as designated by Architect]<Insert description>**.
- C. Inspection Agency: **[Owner will engage][Engage]** a qualified inspector to perform inspections.
- D. Inspections:
 - 1. Egress Door Inspections: Inspect each exterior all-glass entrance door equipped with panic hardware, located in an exit enclosure, electrically controlled, and equipped with special locking arrangements, in accordance with NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."
- E. Exterior all-glass entrance and storefront systems will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

3.4 ADJUSTING AND CLEANING

- A. Adjust all-glass entrance doors and hardware to function smoothly and fit tightly at contact points and weather stripping.
 - 1. For exterior all-glass entrance doors accessible to people with disabilities, adjust closers to provide a three-second closer sweep period for doors to move from a 70-degree open position to **3 inches (75 mm)** from the latch measured to the leading door edge.
- B. Remove excess sealant and glazing compounds and dirt from surfaces.

END OF SECTION 08 42 26 00

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SECTION 08 42 26 00A - ALL-GLASS ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior, manual-swinging, all-glass entrance systems.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for overhead-steel support for all-glass systems.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Exterior, manual-swinging, all-glass entrance systems.

B. Product Data Submittals: For each product.

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Shop Drawings:

1. Plans, elevations, and sections.
2. Details of fittings and glazing, including isometric drawings of fittings.
3. Door hardware locations, mounting heights, and installation requirements.
4. **<Insert requirements>**.
5. Signed and sealed by the qualified professional engineer responsible for their preparation.

- D. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of fitting, accessory fitting, glass, and door hardware.

- E. Samples for Verification: Actual sample of finished products for each type of fitting, accessory fitting, glass, and door hardware

1. Size: **[Manufacturers' standard size]<Insert size>**.

- F. Fabrication Sample: **[Patch fitting at sill on pivot side only][Continuous rail fitting at bottom]<Insert requirements>**, made from **12-inch (300-mm)** lengths of full-size components and showing details of the following:

1. Joinery.

2. Anchorage.
3. Glazing.

- G. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with all-glass entrance-system components, assemblies, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- H. Delegated Design Submittals: For all-glass entrance systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each exterior all-glass entrance system, for tests performed by **[a qualified testing agency][manufacturer and witnessed by a qualified testing agency]**.
- B. Field quality-control reports: For exterior all-glass entrance systems.
- C. Qualification Statements:
1. For Installer **[and egress door inspector]**.
- D. Delegated Design Engineer Qualifications: For exterior all-glass entrance systems.
- E. Sample Warranties: For exterior all-glass entrance systems.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For exterior all-glass entrance systems. Furnish a complete set of specialized tools and maintenance instructions as required for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications:
1. Fabricator of products.
 2. Entity that employs installers and supervisors who are trained and approved by manufacturer.
 3. Authorized representative who is trained and approved by manufacturer.
 4. Entity that is certified under the North American Contractor Certification Program (NACC) and that employs installers and supervisors who are trained and approved by manufacturer **[and who are certified under the Architectural Glass and Metal Technician (AGMT) certification program]**.
- B. Egress Door Inspector Qualifications:
1. Inspector for field quality-control inspections of egress door assemblies to comply with qualifications set forth in NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."
 2. Inspector for field quality-control inspections of egress door assemblies to be certified under

DHI's certification program as a Fire and Egress Door Assembly Inspector (FDAI) or a Certified Fire and Egress Door Assembly Inspector (CFDAI).

- C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 MOCKUPS

- A. Build mockups **[to verify selections made under Sample submittals][to demonstrate aesthetic effects][to set quality standards for materials and execution][to set quality standards for fabrication and installation]**.
 - 1. Build mockup **[as indicated on Drawings]<Insert mockup requirements>**.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 WARRANTY

- A. Special Warranty: **[Manufacturer agrees][Installer agrees][Manufacturer and Installer agree]** to repair or replace components of all-glass entrance systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of **<Insert components>**.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal **[weathering][use]**.
 - c. **<Insert conditions relating to specified products>**.
 - d. **<Insert failure modes>**.
 - 2. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion.
 - a. Concealed Floor Closers: **[Five][10][25]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain all components of exterior all-glass entrance systems, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design exterior all-glass entrance systems.
- B. General Performance: Comply with performance requirements specified, as determined by testing of exterior all-glass entrance systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- C. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: **[As indicated on Drawings]<Insert loads>**.
 - 3. Deflection Limits: Deflection normal to glazing plane is limited to **[1 inch (25 mm)][1/175 of clear span or 3/4 inch (19 mm), whichever is smaller]<Insert deflection limit>**.
- D. Seismic Performance: All-glass entrance systems must withstand the effects of earthquake motions determined in accordance with **[ASCE/SEI 7]<Insert requirement>**.
- E. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
 - 1. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature change>**.

2.3 EXTERIOR, MANUAL-SWINGING, ALL-GLASS ENTRANCE SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - 2. **[Coral Architectural Products; Coral Industries, Inc.]**
 - 3. **[GGI; General Glass International]**
 - 4. **[OldCastle BuildingEnvelope (OBE)]**
 - 5. **[PRL Glass Systems Inc.]**
 - 6. **[Trulite Glass & Aluminum Solutions, LLC.]**
 - 7. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - 2. **[Coral Architectural Products; Coral Industries, Inc.]**
 - 3. **[GGI; General Glass International]**
 - 4. **[OldCastle BuildingEnvelope (OBE)]**
 - 5. **[PRL Glass Systems Inc.]**
 - 6. **[Trulite Glass & Aluminum Solutions, LLC.]**
 - 7. **<Insert manufacturer's name>**
- C. Fitting Configuration:
 - 1. Door Fittings: **[Patch fittings at head and sill on pivot side only (A-Style)][Patch fittings at head and sill on pivot side, and for lock at sill of swing side (F-Style)][Patch fitting at top**

- and continuous rail fitting at bottom (BP-Style)][Continuous rail fitting at top and bottom (P-Style)]<Insert fitting configuration>.
2. Sidelight Fittings: [Recessed glazing channel at top and continuous rail fitting at bottom][Recessed glazing channel at top, side, and bottom][Continuous rail fitting at top and bottom]<Insert fitting configuration>.
- D. Fitting Material: [Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum].
- E. Rail Fittings:
1. Height:
 - a. Top Rail: [3-1/2 inches (89 mm)][As indicated]<Insert dimension>.
 - b. Bottom Rail: [3-1/2 inches (89 mm)][10 inches (255 mm)][As indicated]<Insert dimension>.
 2. Profile: [Tapered][Tapered flat][Tapered at 60 degrees minimum from horizontal][Square][Curved][As indicated]<Insert profile>.
 3. End Caps: Manufacturer's standard precision-fit end caps for rail fittings.
- F. Accessory Fittings:
1. Overhead doorstop.
 2. Center-housing lock.
 3. U-channel.
- G. Anchors and Fastenings: Concealed.
- H. Weather Stripping: Pile type; replaceable without removing all-glass entrance doors from pivots.
- I. Materials:
1. Aluminum: **ASTM B221 (ASTM B221M)**, with strength and durability characteristics of not less than Alloy 6063-T5.
 - a. Clear Anodic Finish: AAMA 611, [AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm] or thicker.
 - b. Color Anodic Finish: AAMA 611, [AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm] or thicker.
 - c. Color: [Light bronze][Medium bronze][Dark bronze][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>.
 2. Bronze Cladding: ASTM B36/B36M, alloy [as standard with manufacturer]<Insert requirements>.
 - a. Finish: [Polished M21-O6x][Satin M31-M34-O6x][Statuary M31-C5][Match Architect's sample][As selected by Architect from full range of industry finishes]<Insert finish>.
 3. Brass Cladding: ASTM B36/B36M, alloy [as standard with manufacturer]<Insert requirements>.
 - a. Finish: [Polished M21-O6x][Satin M31-M34-O6x][As selected by Architect from full range of industry finishes]<Insert finish>.

4. Stainless Steel Cladding: ASTM A240/A240M or ASTM A666, Type 304.
 - a. Finish: **[ASTM A480/A480M No. 4 directional satin finish][ASTM A480/A480M No. 8 mirrorlike reflective, nondirectional polish]<Insert finish>**.

2.4 GLASS

- A. Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), Quality-Q3, tested for surface and edge compression in accordance with ASTM C1048 and for impact strength in accordance with 16 CFR 1201 for Category II materials.
 1. Class 1: Clear monolithic.
 - a. Thickness: **[10][12][16][19]** mm.
 - b. Locations: **[As indicated]<Insert locations>**.
 2. Class 2: Tinted monolithic.
 - a. Color: **[Gray][Bronze]<Insert color>**.
 - b. Thickness: **[10][12]** mm.
 - c. Locations: **[As indicated]<Insert locations>**.
 - d. Visible Light Transmittance: **<Insert number>** percent minimum.
 - e. Solar Heat-Gain Coefficient: **<Insert value>** maximum.
 - f. Outdoor Visible Reflectance: **<Insert number>** percent maximum.
 3. Exposed Edges: Machine ground and flat polished.
 4. Butt Edges: Flat ground.
 5. Corner Edges: Lap-joint corners with exposed edges polished.

2.5 ENTRANCE DOOR HARDWARE

- A. General: Entrance door hardware units in sizes, quantities, and types recommended by manufacturer for all-glass entrance systems indicated. For exposed parts, match metal and finish of fittings.
- B. Concealed Floor Closers and Top Pivots: Center hung; ANSI/BHMA A156.4, Grade 1; including cases, bottom arms, top walking beam pivots, plates, and accessories required for complete installation.
 1. Swing: **[Single][Double]** acting.
 - a. Positive Dead Stop: Coordinated with hold-open angle if any, or at angle selected.
 2. Hold Open: **[Automatic, at angle selected][Selective][None]**.
 3. Opening-Force Requirements:
 - a. Egress Doors: Not more than **15 lbf (67 N)** to release the latch and not more than **30 lbf (133 N)** to set the door in motion **[and not more than 15 lbf (67 N) to open the door to its minimum required width]**.
- C. Concealed Overhead Holder: ANSI/BHMA A156.8, Grade 1, with dead-stop setting coordinated with concealed floor closer.
- D. Push-Pull Set: **[As selected from manufacturer's full range][As indicated]<Insert description>**.

- E. Single-Door and Active-Leaf Locksets: **[Center-housing deadbolt with pulls][Center-housing combination deadbolt and latchbolt with lever handles][Bottom-fitting or bottom-rail deadbolt]<Insert description>**.
 - 1. Deadbolt operated by key outside and **[key][thumbturn]** inside.
- F. Inactive-Leaf Locksets: Bottom-fitting or bottom-rail deadbolt.
 - 1. Deadbolt operated by key outside and **[key][thumbturn]** inside.
- G. Cylinders: **[As specified in Section 087100 "Door Hardware."][As specified in Section 087111 "Door Hardware (Descriptive Specification)."]****[Six-pin cylinder, ANSI/BHMA A156.5, Grade 1.]<Insert requirements.>**
- H. Exit Devices: UL 305.
 - 1. Function: Operation by push-pull when **[inside operator is locked down (dogged)][inside operator is locked down (dogged); outside operation by key]**.
 - 2. Latching: At **[threshold or floor plate][door head][threshold or floor plate and door head]**.
 - 3. Style: **[Exposed vertical rod][Concealed vertical rod in housing style indicated]<Insert style>**.
 - 4. Provide exit devices on both leaves of pairs of doors.
- I. Threshold: Not more than **1/2 inch (12 mm)** high.

2.6 FABRICATION

- A. Provide holes and cutouts in glass to receive hardware, fittings, and accessory fittings before tempering glass. Do not cut, drill, or make other alterations to glass after tempering.
 - 1. Fully temper glass using horizontal (roller-hearth) process, and fabricate so that when glass is installed, roll-wave distortion is parallel with bottom edge of door or lite.
- B. Factory assemble components and factory install hardware and fittings to greatest extent possible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF EXTERIOR, MANUAL-SWINGING, ALL-GLASS ENTRANCE SYSTEMS

- A. Install exterior all-glass entrance systems and associated components in accordance with manufacturer's written instructions.
- B. Set units level, plumb, and true to line, with uniform joints.

- C. Maintain uniform clearances between adjacent components.
- D. Lubricate hardware and other moving parts in accordance with manufacturer's written instructions.
- E. Set, seal, and grout floor closer cases as required to suit hardware and substrate indicated.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: **[Owner will engage][Engage]** a qualified inspector to perform inspections.
- B. Inspections:
 - 1. Egress Door Inspections: Inspect each exterior all-glass entrance door equipped with panic hardware, located in an exit enclosure, electrically controlled, and equipped with special locking arrangements, in accordance with NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."
- C. Exterior all-glass entrance systems will be considered defective if they do not pass inspections.
- D. Prepare inspection reports.

3.4 ADJUSTING AND CLEANING

- A. Adjust all-glass entrance doors and hardware to function smoothly and fit tightly at contact points and weather stripping.
 - 1. For exterior all-glass, entrance doors accessible to people with disabilities, adjust closers to provide a three-second closer sweep period for doors to move from a 70-degree open position to **3 inches (75 mm)** from the latch measured to the leading door edge.
- B. Remove excess sealant and glazing compounds and dirt from surfaces.

END OF SECTION 08 42 26 00A



Task	Specification	Specification Description
08 42 26 00	08 12 16 00	Aluminum-Framed Entrances And Storefronts



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SECTION 08 42 29 23 - SLIDING AUTOMATIC ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sliding automatic entrances.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for **[installing recessed metal frames for control mats in concrete][and][forming recesses in concrete for recessed thresholds]**.
2. Section 084243 "Intensive Care Unit/Critical Care Unit (ICU/CCU) Entrances" for swinging-sliding, manual ICU/CCU entrance door assemblies.
3. Section 087113 "Power Door Operators" for automatic door operators furnished separately from doors and frames.

1.2 DEFINITIONS

- A. AAADM: American Association of Automatic Door Manufacturers.
- B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.
- C. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.
- D. For automatic door terminology, see ANSI/BHMA A156.10 for definitions of terms.

1.3 COORDINATION

- A. Coordinate sizes and locations of recesses in concrete floors for **[recessed sliding tracks][and][recessed control mats]** that control automatic entrances. Concrete, reinforcement, and formwork requirements are specified elsewhere.
- B. Templates: Distribute for doors, frames, and other work specified to be factory prepared for installing automatic entrances.
- C. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish. Coordinate hardware for automatic entrances with hardware required for rest of Project.
- D. Electrical System Roughing-in: Coordinate layout and installation of automatic entrances with connections to power supplies **[and access-control system][and remote activation devices][and remote monitoring systems]**.
- E. System Integration: Integrate sliding automatic entrances with other systems as required for a complete working installation.

1. Provide electrical interface control capability for activation of sliding automatic entrances by security access system on doors with electric locking.
2. Provide electrical interface to deactivate door operators on activation of fire alarm system.
3. Provide electrical interface to allow for remote monitoring of automatic entrance door panel status.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference **[at Project site][by web conference]<Insert location>**.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. **<Insert requirements>**.

- B. Shop Drawings:

1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Indicate locations of activation and safety devices.
5. Include hardware schedule and indicate hardware types, functions, quantities, and locations.
6. **<Insert requirements>**.

- C. Samples for Initial Selection: Manufacturer's standard finish sheets, showing full range of available finishes for units with factory-applied **[color][and][metal-clad]** finishes.

1. Include Samples of hardware and accessories involving color or finish selection.

- D. Samples for Verification: Actual samples of finished products for each type of exposed finish required.

1. Size: **[Manufacturer's standard size]<Insert size>**.

- E. Delegated Design Submittals: For automatic entrances, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- F. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
3. Health Product Declaration (HPD): For each product.
4. Health Product Declaration (HPD): Provide HPD.

5. Cradle to Cradle: For each product, provide documentation of Cradle to Cradle certification.
6. Cradle to Cradle: For each product, provide documentation of Cradle to Cradle certification.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of automatic entrance. **[Include emergency-exit features of automatic entrances serving as a required means of egress.]**
- B. Product Test Reports: For each type of automatic entrance, for tests performed by **[a qualified testing agency][manufacturer and witnessed by a qualified testing agency]**.
- C. Field quality control reports: For automatic entrances.
- D. Sample Warranties: For automatic entrances.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For automatic entrances, safety devices, and control systems.
- B. Warranty Documentation:
 1. Manufacturers' special warranties.
 2. Installer's special warranties.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer with Company Certificate issued by AAADM indicating that manufacturer has a Certified Inspector on staff.
- B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project **[and who employs a Certified Inspector]**.
 1. Maintenance Proximity: Not more than **[two]<Insert number>** hours' normal travel time from Installer's place of business to Project site.
- C. Certified Inspector Qualifications: Certified by AAADM.
- D. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in **[state]<Insert jurisdiction>** where Project is located and who is experienced in providing engineering services of the type indicated.

1.9 WARRANTY

- A. Special Warranty: **[Manufacturer agrees][Installer agrees][Manufacturer and Installer agree]** to repair or replace components of automatic entrances that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.

- b. Faulty operation of operators, controls, and hardware.
- c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Hunter units when tested in accordance with ASTM D2244.
- b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
- c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: **[Five][10][20]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain sliding **[folding][and][swinging]** automatic entrances from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Power-Operated Door Standard: ANSI/BHMA A156.10.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design automatic entrances.

D. Seismic Performance: Automatic entrances to withstand the effects of earthquake motions determined in accordance with **[ASCE/SEI 7]<Insert requirement>**.

E. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone **[1][2][3][4]** for **[basic][enhanced]** protection.

- 1. Large-Missile Test: For glazing located within **[30 ft. (9.1 m)]<Insert dimension>** of grade.
- 2. Small-Missile Test: For glazing located between **30 ft. (9.1 m)** and **[60 ft. (18.3 m)]<Insert dimension>** above grade.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

- 1. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature change>**.

G. Operating Temperature Range: Automatic entrances to operate within **[minus 20 to plus 122 deg F (minus 29 to plus 50 deg C)]<Insert temperature range>**.

H. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-Factor):
 - a. Entrance Doors: U-factor of not more than [0.63 Btu/sq. ft. x h x deg F (3.58 W/sq. m x K)][0.68 Btu/sq. ft. x h x deg F (3.86 W/sq. m x K)][0.77 Btu/sq. ft. x h x deg F (4.37 W/sq. m x K)][0.83 Btu/sq. ft. x h x deg F (4.71 W/sq. m x K)][0.90 Btu/sq. ft. x h x deg F (5.11 W/sq. m x K)]<Insert value> as determined in accordance with NFRC 100.
2. Solar Heat-Gain Coefficient (SHGC):
 - a. Entrance Doors: SHGC of not more than [0.21][0.25][0.35][0.40][0.45]<Insert value> as determined in accordance with NFRC 200.
3. Air Leakage:
 - a. Power-Operated Sliding Doors: Air leakage of not more than [1.0 cfm/sq. ft. (5.1 L/s per sq. m)]<Insert value> at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) when tested in accordance with ASTM E283/E283M.
4. Condensation Resistance Factor (CRF):
 - a. Entrance Doors: CRF of not less than [57][63][68]<Insert value> as determined in accordance with AAMA 1503.

I. Opening Force:

1. Power-Operated Doors: Not more than **50 lbf (222 N)** required to manually set door in motion if power fails, and not more than **15 lbf (67 N)** required to open door to minimum required width.
2. Breakaway Device for Power-Operated Doors: Not more than **50 lbf (222 N)** required for a breakaway door or panel to open.

J. Entrapment-Prevention Force:

1. Power-Operated Sliding Doors: Not more than **30 lbf (133 N)** required to prevent stopped door from closing.

2.3 SLIDING AUTOMATIC ENTRANCES

A. General: Provide manufacturer's standard automatic entrances, including doors, sidelites, framing, headers, carrier assemblies, roller tracks, door operators, controls, and accessories required for a complete installation.

B. Sliding, Power-Operated Automatic Entrances :

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [ASSA ABLOY Entrance Systems; ASSA ABLOY]
 - b. [dormakaba USA Inc.]
 - c. [Gildor Automatic Doors]
 - d. [Horton Automatics; Overhead Door Corporation]

- e. **[NABCO Entrances, Inc]**
 - f. **[Record USA; ASSA ABLOY]**
 - g. **[STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]**
 - h. **[TORMAX USA Inc.]**
 - i. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[ASSA ABLOY Entrance Systems; ASSA ABLOY]**
 - b. **[dormakaba USA Inc.]**
 - c. **[Gildor Automatic Doors]**
 - d. **[Horton Automatics; Overhead Door Corporation]**
 - e. **[NABCO Entrances, Inc]**
 - f. **[Record USA; ASSA ABLOY]**
 - g. **[STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]**
 - h. **[TORMAX USA Inc.]**
 - i. **<Insert manufacturer's name>**
3. Configuration:
- a. Single-Sliding: Single-sliding door with one sliding leaf[, **transom,**][**and**][**pocketed**] sidelite.
 - 1) Traffic Pattern: **[One][Two]** way.
 - 2) Emergency Breakaway Capability: **[As indicated on Drawings][Sliding leaf only][Sliding leaf and sidelite]**.
 - 3) Mounting: **[Between jambs][Surface]**.
 - b. Biparting-Sliding: Biparting-sliding doors with two sliding leaves[, **transom,**][**and**][**pocketed**] sidelites on each side.
 - 1) Traffic Pattern: **[One][Two]** way.
 - 2) Emergency Breakaway Capability: **[As indicated on Drawings][Sliding leaves only][Sliding leaves and sidelites]**.
 - 3) Mounting: **[Between jambs][Surface]**.
 - c. Telescoping: **[Single-telescoping-sliding door with two][Biparting-telescoping-sliding doors with four]** sliding leaves[, **transom,**] and sidelite(s).
 - 1) Traffic Pattern: **[One][Two]** way.
 - 2) Emergency Breakaway Capability: **[As indicated on Drawings][Center leaves only][All leaves]**.
 - 3) Mounting: **Between jambs**.
4. Operator Features:
- a. Power opening and closing.
 - b. Drive System: **[Chain][or][belt]**.
 - c. Adjustable opening and closing speeds.
 - d. Adjustable hold-open time between zero and 30 seconds.
 - e. Obstruction recycle.
 - f. On-off/hold-open switch to control electric power to operator[, **key operated**].
 - g. **<Insert features required>**.

5. Sliding-Door Carrier Assemblies and Overhead Roller Tracks: Carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered, ball-bearing-center steel wheels operating on a continuous roller track, or ball-bearing-center steel wheels operating on a nylon- or delrin-covered, continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly.
 - a. Rollers: Minimum of two ball-bearing roller wheels and two antirise rollers for each active leaf.
6. Sliding-Door Threshold: Threshold members and bottom-guide-track system with stainless steel, ball-bearing-center roller wheels.
 - a. Configuration:
 - 1) Threshold: Saddle-type threshold across door opening and **[surface-mounted][recessed]** guide-track system at sidelites.
 - 2) No Threshold: No threshold across door opening and **[surface-mounted][recessed]** guide-track system at sidelites.
7. Controls: Activation and safety devices **[as indicated on Drawings and]** in accordance with cited ANSI/BHMA standards.
 - a. Activation Device:
 - 1) Motion Sensor: Mounted on each side of door header to detect pedestrians in activating zone and to open door.
 - 2) Activating Control Mat: Installed on ingress side of door to detect pedestrians in activating zone and to open door.
 - 3) Switch: **[Push-plate switch][Push-button switch][Key switch][Touchless switch][on each side of door]** to activate door operator.
 - b. Safety Device:
 - 1) Photoelectric Beam Presence Sensor: Two photoelectric beams mounted in sidelite jambs on each side of door to detect pedestrians in presence zone and to prevent door from closing; with presence sensor monitoring before each closing cycle.
 - 2) Active Infrared-Based Presence Sensor Under Door Header and Photoelectric Beam Presence Sensor: Active infrared-based presence sensor mounted to underside of door header and two photoelectric beams mounted in sidelite jambs on one side of the door to detect pedestrians in presence zone and to prevent door from closing; with presence sensor monitoring before each closing cycle.
 - 3) Active Infrared-Based Presence Sensor on Sides of Door Header and Photoelectric Beam Presence Sensor: Active infrared-based presence sensor mounted on each side of door header and two photoelectric beams mounted in sidelite jambs on one side of the door to detect pedestrians in presence zone and to prevent door from closing; with presence sensor monitoring before each closing cycle.
 - 4) Safety Control Mat: Installed on egress side of door to detect pedestrians in presence and safety zones and to prevent door from closing; with presence sensor monitoring before each closing cycle.
 - 5) Sidelite Safety Device: Presence sensor, mounted above each sidelite on side of door opening through which doors travel, to detect obstructions and to prevent door from opening; with presence sensor monitoring before each closing cycle.
 - 6) Opening-Width Control: Two-position switch that in the normal position allows sliding doors to travel to full opening width and in the alternate position reduces opening to a selected partial opening width.

8. Finish: Finish framing, door(s), and header with **[Class I, clear anodic finish][Class II, clear anodic finish][Class I, color anodic finish][Class II, color anodic finish][baked-enamel or powder-coat finish][high-performance organic finish (two-coat fluoropolymer)][high-performance organic finish (three-coat fluoropolymer)][finish matching adjacent curtain wall][finish matching adjacent storefront]**.
 - a. Color: **[Light bronze][Medium bronze][Dark bronze][Black][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
9. Metal Cladding and Finish: Clad framing, door(s), and header with **[No. 4 directional-satin-finish stainless steel sheet][No. 8 mirrorlike reflective, nondirectional-polish-finish stainless steel sheet][satin-brass sheet][polished-brass sheet][satin-bronze sheet][polished-bronze sheet][metal sheet in finish matching Architect's sample][metal sheet in finish as selected by Architect from manufacturer's full range][metal sheet in finish matching adjacent storefront]<Insert finish>**.

2.4 ENTRANCE COMPONENTS

- A. Framing Members: Extruded aluminum, minimum **0.125 inch (3.2 mm)** thick and reinforced as required to support imposed loads.
 1. Nominal Size: **[As indicated on Drawings][1-3/4 by 4-1/2 inches (45 by 115 mm)][1-3/4 by 6 inches (45 by 150 mm)]<Insert dimensions>**.
 2. Extruded Glazing Stops and Applied Trim: Minimum **0.062-inch (1.6-mm)** wall thickness.
- B. Stile and Rail Doors: **1-3/4-inch- (45-mm-)** thick, glazed doors with minimum **0.125-inch- (3.2-mm-)** thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie-rods that span full length of top and bottom rails.
 1. Glazing Stops and Gaskets: **[Beveled][Square]**, snap-on, extruded-aluminum stops and preformed gaskets.
 2. Stile Design: **[As indicated on Drawings][Thin stile, less than 1-3/4-inch (45-mm) nominal width][Narrow stile, 2-1/8-inch (55-mm) nominal width][Medium stile, 3-1/2-inch (90-mm) nominal width][Wide stile, more than 4-inch (100-mm) nominal width]**.
 3. Rail Design: **[As indicated on Drawings][5-inch (125-mm) nominal height][6-1/2-inch (165-mm) nominal height][10-inch (254-mm) nominal height]**.
 4. Muntin Bars: Horizontal tubular rail member for each door; match stile design and finish.
- C. All-Glass Sliding Doors: Fabricated from **1/2-inch- (13-mm-)** thick tempered glass, with polished vertical edges and minimum **0.125-inch- (3.2-mm-)** thick, extruded-aluminum top and bottom rails.
 1. Rail Design: **[3-1/2-inch (90-mm)][5-inch (125-mm)]** nominal height.
- D. Sidelite(s): **1-3/4-inch- (45-mm-)** deep sidelite(s) with minimum **0.125-inch- (3.2-mm-)** thick, extruded-aluminum tubular stile and rail members matching door design.
 1. Glazing Stops and Gaskets: **[Same materials and design as for stile and rail door][Beveled, snap-on, extruded-aluminum stops and preformed gaskets][Square, snap-on, extruded-aluminum stops and preformed gaskets]**.
 2. Muntin Bars: Horizontal tubular rail members for each sidelite; match stile design.
- E. Transom: **1-3/4-inch- (45-mm-)** deep transom with minimum **0.125-inch- (3.2-mm-)** thick, extruded-aluminum tubular stile and rail members matching door design.

1. Glazing Stops and Gaskets: **[Same materials and design as for stile and rail door][Beveled, snap-on, extruded-aluminum stops and preformed gaskets][Square, snap-on, extruded-aluminum stops and preformed gaskets]**.
- F. Headers: Fabricated from minimum **0.125-inch- (3.2-mm-)** thick extruded aluminum and extending full width of automatic entrance units to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
 1. Mounting: **[Surface mounted][Concealed, with one side of header flush with framing]**.
 2. Capacity: Capable of supporting doors of up to **[175 lb (79 kg) per leaf over spans of up to 14 ft. (4.3 m)]<Insert load and span required>** without intermediate supports.
 - a. Provide sag rods for spans exceeding **14 ft. (4.3 m)**.
- G. Brackets and Reinforcements: High-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- H. Signage: As required by cited ANSI/BHMA standard.
 1. Application Process: **[Decals][Silk-screened][Door manufacturer's standard process]<Insert requirement>**.
 2. Provide sign materials with instructions for field application after glazing is installed.

2.5 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 1. Extrusions: **ASTM B221 (ASTM B221M)**.
 2. Sheet: ASTM B209/B209M.
- B. Steel Reinforcement: Reinforcement with corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Use surface preparation methods in accordance with recommendations in SSPC-SP COM and prepare surfaces in accordance with applicable SSPC standard.
- C. Stainless Steel Bars: ASTM A276/A276M or ASTM A666, **[Type 304][Type 316]<Insert type>**.
- D. Stainless Steel Tubing: ASTM A554, **[Grade MT 304][Grade MT 316]<Insert grade>**.
- E. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, **[Type 304][Type 316]<Insert type>**, stretcher-leveled standard of flatness, in entrance manufacturer's standard thickness.
- F. Brass Sheet: ASTM B36/B36M, Alloy UNS No. C26000 (cartridge brass, 70 percent copper), in entrance manufacturer's standard thickness.
- G. Bronze Sheet: ASTM B36/B36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper) or Alloy UNS No. C23000 (red brass, 85 percent copper), in entrance manufacturer's standard thickness.
- H. Expanded Aluminum Mesh: **[Expanded][Expanded and flattened]** aluminum sheet in accordance with the geometry of ASTM F1267.
- I. Polycarbonate Sheet: ASTM C1349, Appendix X1, Type II, coated, mar-resistant, UV-stabilized polycarbonate with coating on both surfaces.

- J. Glazing: As specified in [Section 088000 "Glazing."][Section 088853 "Security Glazing."]
- K. Sealants and Joint Fillers: Provide type recommended in writing by manufacturer for joint size and movement. Sealant to remain permanently elastic, nonshrinking, and nonmigrating.
- L. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout; complying with ASTM C1107/C1107M; of consistency suitable for application.
- M. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- N. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
- O. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than <Insert number> percent.

2.6 DOOR OPERATORS AND CONTROLS

- A. General: Provide operators and controls, which include activation and safety devices, in accordance with cited ANSI/BHMA standards, for condition of exposure, and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.
- B. Door Operators: Provide door operators of size recommended by manufacturer for door size, weight, and movement.
 - 1. Door Operator Performance: Door operators to open and close doors and maintain them in fully closed position when subjected to Project's design wind loads.
 - 2. Electromechanical Operators: Concealed, self-contained, overhead units powered by fractional-horsepower, permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor; with solid-state microprocessor controller; complying with UL 325; and with manual operation with power off.
- C. Motion Sensors: Self-contained, K-band-frequency, microwave-scanner units; fully enclosed by their plastic housings; adjustable to provide detection-field sizes and functions required by ANSI/BHMA A156.10.
 - 1. Provide capability for switching between bi- and unidirectional detection.
 - 2. For one-way traffic, sensor on egress side to not be active when doors are fully closed.
- D. Active Infrared-Based Presence Sensors: Self-contained, active-infrared scanner units; door mounted or overhead mounted; adjustable to provide detection-field sizes and functions required by ANSI/BHMA A156.10. Sensors remain active at all times.
- E. Photoelectric Beam Presence Sensors: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams to not be active when doors are fully closed.
- F. Presence Sensor Monitoring: Means to verify the functionality of each presence sensor in accordance with ANSI/BHMA A156.10. A detected fault condition of the presence sensor system will cause automatic operation to cease until fault is corrected.
- G. Control Mats: **1/2-inch- (13-mm-)** thick, synthetic-rubber or flexible-plastic mat in safety-ribbed surface pattern, with extruded-aluminum frame; with pressure switches for low-voltage control wiring; and complying with performance requirements of ANSI/BHMA A156.10.

1. Frame: **[Recessed to fit flush with floor, with concealed anchors][Surface mounted, with tapered safety edge].**
 2. Size: As indicated, but no smaller than required by ANSI/BHMA A156.10, including Appendix A.
 3. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from full range of industry colors and color densities].**
- H. Control Mat Monitoring: Means to verify the functionality of each safety control mat in accordance with ANSI/BHMA A156.10. A detected fault condition of the safety control mat will cause automatic operation to cease until fault is corrected.
- I. Push-Plate Switch: Momentary-contact door-control switch with flat push-plate actuator, **with contrasting-colored, engraved message].**
1. Configuration:
 - a. Round Push Plate: With **4-by-4-inch (100-by-100-mm)** junction box.
 - 1) Mounting: **[As indicated on Drawings][Recess mounted, semiflush in wall][Surface mounted on wall].**
 - b. Square Push Plate: With **4-by-4-inch (100-by-100-mm)** junction box.
 - 1) Mounting: **[As indicated on Drawings][Recess mounted, semiflush in wall][Surface mounted on wall].**
 - c. Rectangular Push Plate: With **2-by-4-inch (50-by-100-mm)** junction box.
 - 1) Mounting: **[As indicated on Drawings][Recess mounted, semiflush in wall][Recess mounted in door jamb][Surface mounted on wall][Surface mounted on post][Surface mounted on guide rail].**
 2. Push-Plate Mounting Height: Operational height **[as indicated on Drawings]<Insert height>.**
 3. Push-Plate Material: **[Stainless steel][Plastic]**, as selected by Architect from manufacturer's full range.
 4. Message: **[Plain face with no message.]["Push to Open."]["International symbol of accessibility.][International symbol of accessibility and "Push to Open."]**
- J. Touchless Switch: Hands-free-activation door-control switch with flat motion sensor faceplate **with contrasting-colored, engraved message].**
1. Configuration: **[6-inch (152.4-mm) round][4.56-by-4.56-inch (115.8-by-115.8-mm) (double gang) square][2.77-by-4.56-inch (70-by-115.8-mm) (single gang) rectangular][1.68-by-4.56-inch (42.6-by-115.8-mm) jamb-style] faceplate.**
 - a. Mounting: **[As indicated on Drawings][Recess mounted in wall][Recess mounted in door jamb][Surface mounted on wall].**
 2. Faceplate Mounting Height: Operational height **[as indicated on Drawings]<Insert height>.**
 3. Faceplate Material: **[Stainless steel][Plastic][Stainless steel with backlight acrylic window]**, as selected by Architect from manufacturer's full range.
 4. Message: **["Wave to Open"]["Wave to Open" and wave symbol][International symbol of accessibility][International symbol of accessibility, "Wave to Open," and wave symbol].**
- K. Push-Button Switch: Momentary-contact door-control switch with one red-button actuator; enclosed in nominal **[2-by-4-inch (50-by-100-mm)][4-by-4-inch (100-by-100-mm)]** junction box.

1. Provide faceplate engraved with "Press to Open" letters[**and international symbol of accessibility**] in contrasting color.
 2. Provide blue plastic cover engraved with "Press Button to Open" in white letters and international symbol of accessibility.
 3. Mounting: [**As indicated on Drawings**][**Surface mounted on wall**][**Surface mounted on post**][**Surface mounted on guide rail**][**Recess mounted in wall**].
 4. Faceplate Mounting Height: Operational height [**as indicated on Drawings**]<Insert height>.
 5. Faceplate Material: [**Stainless steel**][**Painted metal**], as selected by Architect from manufacturer's full range.
- L. Key Switch: Recess-mounted, door-control switch with key-controlled actuator; enclosed in **2-by-4-inch (50-by-100-mm)** junction box. Provide faceplate engraved with letters indicating switch functions.
1. Functions: [**On-off, momentary contact**][**On-off, maintained contact**][**Two-way automatic, hold open, one-way exit, and off**][**Two-way automatic, hold open, one-way exit, off, full open, and partial open**].
 2. Mounting: [**As indicated on Drawings**][**Recess mounted, semiflush in wall**][**Recess mounted in door jamb**][**Surface mounted on wall**][**Surface mounted on post**].
 3. Faceplate Mounting Height: Operational height [**as indicated on Drawings**]<Insert height>.
 4. Faceplate Material: [**Stainless steel**][**Painted metal**], as selected by Architect from manufacturer's full range.
- M. Wireless or Remote Radio Control Switch: Auxiliary radio control system consisting of header-mounted receiver and [**wall-mounted**][**hand-held, battery-operated**] transmitter switch[**for each entrance**]<Insert requirement>.
1. Wall-Mounted Transmitter Switch: One red-button, momentary-contact actuator enclosed in **4-by-4-inch (100-by-100-mm)** junction box. Provide blue plastic cover engraved with "Press Button to Open" in white letters and international symbol of accessibility.
- N. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.7 HARDWARE

- A. General: Provide units in sizes and types recommended by automatic entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish[**unless otherwise indicated**].
- B. Breakaway Device for Power-Operated Doors: Device that allows door to swing out in direction of egress to full 90 degrees from any operating position. Maximum force to open door to be as stipulated in "Performance Requirements" Article. Interrupt powered operation of door operator while in breakaway mode.
1. Include [**one adjustable detent device mounted at the top of each breakaway panel**][**two adjustable detent devices mounted in each breakaway panel; one top mounted and one bottom mounted**] to control breakaway force.
 - a. Panel Closer: Factory-installed concealed hydraulic door closer.
 - b. Limit Arms: Limit swing to 90 degrees, spring loaded with adjustable friction damping.
- C. Deadlocks: Deadbolt operated by exterior cylinder and interior thumb turn, with minimum **1-inch- (25-mm-)** long throw bolt; ANSI/BHMA A156.5, Grade 1.

1. Cylinders: **[ANSI/BHMA A156.5, Grade 1, six-pin mortise type.][As specified in Section 087100 "Door Hardware."][As specified in Section 087111 "Door Hardware (Descriptive Specification)."]**
 - a. Keying: **[No master][Integrate into building master]** key system.
 - b. Keys: **[Two][Three]<Insert number>** for each cylinder.
 2. Deadbolts: **[Laminated-steel hook][Steel]**, mortise type, ANSI/BHMA A156.5, Grade 1.
 3. Two-Point Locking for Stile and Rail Sliding Doors: Mechanism in stile of active door leaf that automatically extends second lockbolt into **[overhead carrier assembly][threshold]**.
 4. Three-Point Locking for Stile and Rail Sliding Doors: Mechanism in stile of active door leaf that automatically extends lockbolts into overhead carrier assembly and threshold.
 5. Lock/Unlock Indicator: Lock position indicators integrated with locking system. Stile is mounted on secure side of door. Visual display of lock position as follows: "OPEN" in black letters when unlocked, and "LOCKED" in red letters when locked.
 6. Armored Strike: Reinforced security strike plate.
- D. Automatic Locking: Electrically controlled device mounted in header that automatically locks sliding door in closed position, preventing door panels from sliding manually. Provide fail- **[secure][safe]** operation if power fails.
1. Power Interruption: **[Lock to be engaged, preventing doors from sliding manually][Lock to be disengaged, allowing doors to slide manually]**.
 2. Means of Egress: Standard breakaway feature.
- E. Access-Control Locking: Electrically controlled device mounted in header that automatically locks sliding door in closed position, preventing door panels from sliding manually. Provide fail- **[secure][safe]** operation if power fails.
1. Include concealed, vertical-rod, tamper-proof exit devices, complying with UL 305, with latching into threshold and overhead carrier assembly and released by **[full-width panic bar][push paddle]**, **[surface mounted][recessed][flush mounted and concealed within horizontal muntin bar]**, prohibiting manual breakout of door(s) from exterior.
 2. Power Interruption: **[Lock to be engaged, preventing doors from sliding manually][Lock to be disengaged, allowing doors to slide manually]**.
 3. Means of Egress: Vertical rod exit device.
 4. Include locking devices for sidelites to prevent manual breakout.
- F. Uninterrupted Power Supply: UL 1778, fully integrated unit mounted **[within header][above ceiling]**.
1. Power Interruption: Supply power to operator, controls, activation device, and safety systems of sliding automatic door for up to **[1.5]<Insert number>** hours of normal operation.
 2. Include low-battery shutdown feature to safely open or close door prior to complete battery discharge.
 3. Include audible battery replacement alarm to indicate that battery will no longer accept a charge and replacement is required.
- G. Dustproof Strikes for All-Glass Sliding Doors: **[Recessed, floor type, ANSI/BHMA A156.16, Grade 1, to receive deadbolt.][As specified in Section 087100 "Door Hardware."][As specified in Section 087111 "Door Hardware (Descriptive Specification)."]**
- H. Weather Stripping: Replaceable components.
1. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

2.8 ACCESSORIES

A. Guide Rails:

1. **[Anodized aluminum][Baked-enamel or powder-coated aluminum][Stainless steel]**, fabricated from **[bars][or][tubing]**, minimum **30 inches (762 mm)** high, and finished to match doors unless otherwise indicated; positioned and projecting from face of door jamb for distance as indicated[, **but not less than that required by ANSI/BHMA A156.10 for type of door and direction of travel**]<Insert requirement>; with filler panel.
 - a. Filler Panel: **[Expanded aluminum mesh][Clear polycarbonate sheet][Colored polycarbonate sheet]**<Insert material>.
 - 1) Orient expanded aluminum mesh with long dimension of diamonds **[parallel to top rail][perpendicular to top rail]**.
 - 2) Color: **[Match Architect's sample][As selected by Architect from manufacturer's full range]**<Insert color>.
 - b. Mounting: **[As indicated on Drawings][Jamb and floor][Floor, freestanding]**.
 - c. Aluminum Finish: **[Class I, clear anodic finish][Class II, clear anodic finish][Class I, color anodic finish][Class II, color anodic finish][Baked-enamel or powder-coat finish][Finish matching door and frame]**<Insert finish>.
 - 1) Color: **[Light bronze][Medium bronze][Dark bronze][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]**<Insert color>.
 - d. Stainless Steel Finish: **[No. 4 directional-satin-finish stainless steel][Finish matching door and frame]**<Insert finish>.
2. See **[Section 055213 "Pipe and Tube Railings."][Section 057300 "Decorative Metal Railings.]**

2.9 FABRICATION OF SLIDING AUTOMATIC ENTRANCES

- A. General: Factory fabricate automatic entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.
 1. Form aluminum shapes before finishing.
 2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
 3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws[, **finished to match framing**][, **fabricated from stainless steel**].
 - a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - b. Reinforce members as required to receive fastener threads.
 4. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
- B. Framing: Provide automatic entrances as prefabricated assemblies. Complete fabrication, assembly,

finishing, hardware application, and other work before shipment to Project site.

1. Fabricate tubular and channel frame assemblies with welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
 2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
 3. Form profiles that are sharp, straight, and free of defects or deformations.
 4. Provide components with concealed fasteners and anchor and connection devices.
 5. Fabricate components with accurately fitted joints, with ends coped or mitered to produce hairline joints free of burrs and distortion.
 6. Fabricate exterior components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior. Provide anchorage and alignment brackets for concealed support of assembly from building structure.
 7. Allow for thermal expansion of exterior units.
- C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
- D. Metal Cladding: Factory-fabricated and -installed metal cladding, completely covering all visible surfaces as part of prefabricated entrance assembly before shipment to Project site.
1. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
 2. Form profiles that are sharp, straight, and free of defects or deformations.
 3. Provide components with concealed fasteners and anchor and connection devices.
 4. Fabricate components with accurately fitted joints, with ends coped or mitered to produce hairline joints free of burrs and distortion.
 5. Fabricate exterior components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior. Allow for thermal expansion at exterior entrances.
- E. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.
- F. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, in accordance with NGA's "GANA Glazing Manual."
- G. Hardware: Factory install hardware to greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.
1. Provide sliding-type weather stripping, mortised into door, at perimeter of doors[**and breakaway sidelites**].
- H. Controls:
1. General: Factory install activation and safety devices in doors and headers as required by ANSI/BHMA A156.10 for type of door and direction of travel.
 2. Install photoelectric beams in vertical jambs of sidelites, with dimension above finished floor as follows:
 - a. Top Beam: **[48 inches (1219 mm)]<Insert dimension>**.
 - b. Bottom Beam: **[24 inches (610 mm)]<Insert dimension>**.

2.10 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- B. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**][**AA-M12C22A31, Class II, 0.010 mm**] or thicker.
- B. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**][**AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.
- D. High-Performance Organic Finish, Two-Coat: Fluoropolymer finish complying with [**AAMA 2604**][**AAMA 2605**] and containing not less than [**50**][**70**] percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.
- E. High-Performance Organic Finish, Three-Coat: Fluoropolymer finish complying with AAMA 2605 and containing not less than [**50**][**70**] percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances.
- B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic entrance installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF SLIDING AUTOMATIC ENTRANCES

- A. General: Install automatic entrances in accordance with manufacturer's written instructions and cited ANSI/BHMA A156.10 for direction of pedestrian travel, including signage, controls, wiring, and connection to the building's power supply.
 - 1. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
 - 2. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
 - 3. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous coating.
- B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
 - 1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
 - 2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
 - 3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior.
 - 4. Level recesses for recessed thresholds using nonshrink grout.
- C. Door Operators: Connect door operators to electrical power distribution system.
- D. Access-Control Devices: Connect access-control devices to access-control system, as specified in Section 281300 "Access Control Software and Database Management."
- E. Controls: Install and adjust activation and safety devices in accordance with manufacturer's written instructions and cited ANSI/BHMA standard for direction of pedestrian travel. Connect control wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- F. Guide Rails: Install rails in accordance with ANSI/BHMA A156.10, including Appendix A, and manufacturer's written instructions unless otherwise indicated.
- G. Glazing: Install glazing as specified in [Section 088000 "Glazing."][Section 088853 "Security Glazing."]
- H. Sealants and Joint Fillers: Comply with requirements in Section 079200 "Joint Sealants" for installing sealants, fillers, and gaskets.
 - 1. Set[thresholds,][bottom-guide-track system,] framing members and flashings in full sealant bed.
 - 2. Seal perimeter of framing members with sealant.
- I. Signage: Apply signage on both sides of each door[and breakaway sidelite], as required by cited ANSI/BHMA standard for direction of pedestrian travel.
- J. Wiring within Automatic Entrance Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's written limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 FIELD QUALITY CONTROL

- A. Certified Inspector: **[Owner will engage][Engage]** a Certified Inspector to test and inspect components, assemblies, and installations, including connections.
- B. Perform the following tests and inspections **[with the assistance of a factory-authorized service representative]**:
 - 1. Test and inspect each automatic entrance, using AAADM inspection forms, to determine compliance of installed systems with applicable ANSI/BHMA standards.
 - 2. Automatic entrances will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust hardware, moving parts, door operators, and controls to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable ANSI/BHMA standards.
 - 1. Adjust exterior doors for tight closure.
- B. Readjust door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).
- C. Occupancy Adjustments: When requested within **[12]<Insert number>** months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to **[two]<Insert number>** visits to Project during other-than-normal occupancy hours for this purpose.

3.5 CLEANING

- A. Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.
 - 1. Comply with requirements in **[Section 088000 "Glazing"]****[Section 088853 "Security Glazing"]** for cleaning and maintaining glass.

3.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service to include **[three][six][nine][12]** months' full maintenance by skilled employees of automatic entrance Installer. Include **[monthly][quarterly]** preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper automatic entrance operation. Parts and supplies to be manufacturer's authorized replacement parts and supplies.
 - 1. Engage a Certified Inspector to perform safety inspection after each adjustment or repair and at end of maintenance period. Furnish completed inspection reports to Owner.
 - 2. Perform maintenance, including emergency callback service, during normal working hours.
 - 3. Include 24-hour-per-day, 7-day-per-week emergency callback service.



3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic entrances.

END OF SECTION 08 42 29 23



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SECTION 08 42 29 23A - INTENSIVE CARE UNIT_CRITICAL CARE UNIT (ICU_CCU) ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes manually operated, intensive care unit/critical care unit (ICU/CCU) entrances[**for individual special-care rooms**].
- B. Related Requirements:
 - 1. Section 084229.13 "Folding Automatic Entrances" for entrances packaged with folding automatic door operators and controls.
 - 2. Section 084229.23 "Sliding Automatic Entrances" for entrances packaged with sliding automatic door operators and controls.
 - 3. Section 084229.33 "Swinging Automatic Entrances" for entrances packaged with swinging automatic door operators and controls.

1.2 COORDINATION

- A. Recesses: Coordinate sizes and locations of recesses in concrete floors for recessed tracks. Concrete, reinforcement, and formwork requirements are specified elsewhere.
- B. Templates: Distribute for doors, frames, and other work specified to be factory prepared for installing ICU/CCU entrances.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.4 ACTION SUBMITTALS

- A. Product Data: For each configuration of ICU/CCU entrance indicated.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Sustainable Design Submittals:
 - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 - 2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
 - 3. Environmental Product Declaration (EPD): For each product.
 - 4. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.

Intensive Care Unit_Critical Care Unit (ICU_CCU)

5. Environmental Product Declaration: For each product.
6. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
7. Environmental Product Declaration: For each product.
8. Environmental Product Declaration: For each product.
9. Third-Party Certifications: For each product.
10. Third-Party Certified Life Cycle Assessment: For each product.

C. Shop Drawings: For each ICU/CCU installation.

1. Include plans, elevations, sections, hardware mounting heights, and attachment details.

D. Samples for Initial Selection: For units with factory-applied **[color][and][metal-cladding]** finishes.

E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For manufacturer's warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings to receive ICU/CCU entrances by field measurements before fabrication.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of ICU/CCU entrances that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures including, but not limited to, excessive deflection.
- b. Faulty operation of hardware.
- c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer agrees to repair finishes or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Warranty Period: **[Five][10][20]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Source Limitations: Obtain **[ICU/CCU entrances][each type of ICU/CCU entrance]** from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Opening Force: Not more than **5 lbf (22.2 N)** to fully open door.
- B. Air Leakage: Entrance assemblies for **[smoke control][and][pressurized rooms]** shall be listed and labeled for smoke and draft control by qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and having maximum air leakage **[according to NFPA 105]<Insert requirement>** unless otherwise indicated.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 SLIDING ICU/CCU ENTRANCE ASSEMBLIES

- A. Sliding ICU/CCU Entrance Assemblies: Provide manufacturer's **[factory-glazed]** ICU/CCU entrances indicated including door leaves, sidelites, framing, headers, carrier assemblies, roller tracks, and accessories required for a complete installation.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ASSA ABLOY Entrance Systems; ASSA ABLOY]**
 - b. **[dormakaba USA Inc.]**
 - c. **[Gildor, Inc.]**
 - d. **[Horton Automatics; Overhead Door Corporation]**
 - e. **[NABCO Entrances, Inc]**
 - f. **[record-usa]**
 - g. **[STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]**
 - h. **[TORMAX USA Inc.]**
 - i. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the

following:

- a. **[ASSA ABLOY Entrance Systems; ASSA ABLOY]**
 - b. **[dormakaba USA Inc.]**
 - c. **[Gildor, Inc.]**
 - d. **[Horton Automatics; Overhead Door Corporation]**
 - e. **[NABCO Entrances, Inc.]**
 - f. **[record-usa]**
 - g. **[STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]**
 - h. **[TORMAX USA Inc.]**
 - i. **<Insert manufacturer's name>**
- B. Breakaway Hardware: Release hardware that allows indicated panels to swing out in direction of egress to full 90 degrees from closed door position.
1. Maximum Force to Open Panel: **[50 lbf (222 N)]<Insert value>**.
 2. Release Position: **[Sliding door fully open][At any point in sliding-door travel]**.
- C. Sliding ICU/CCU Entrance :
1. Performance: **[Standard assembly][Smoke-control assembly][Pressurized-entrance assembly]<Insert requirement>**.
 - a. Alarm Interface: Equip entrance with electromagnet closer that closes door when alarm is triggered.
 2. Configuration:
 - a. Single-sliding two-panel door, with one operable leaf and sidelite; with breakaway hardware **[for sliding leaf only][for sliding leaf and sidelite][as indicated on Drawings]**.
 - b. Single-sliding three-panel door, with one operable leaf and two sidelites; with breakaway hardware **[for sliding leaf only][for sliding leaf and one sidelite][for sliding leaf and both sidelites][as indicated on Drawings]**.
 - c. Biparting-sliding four-panel door, with one operable leaf and sidelite on each side; with breakaway hardware **[for sliding leaves only][for sliding leaves and both sidelites][as indicated on Drawings]**.
 - d. Single-telescoping three-panel door, with two operable leaves and one sidelite; with breakaway hardware **[for sliding leaves only][for sliding leaves and sidelite][as indicated on Drawings]**.
 - e. Biparting-telescoping six-panel door, with two operable leaves and one sidelite on each side; with breakaway hardware **[for sliding leaves only][for sliding leaves and both sidelites][as indicated on Drawings]**.
 3. Mounting: **[Between jambs][Surface]**.
 4. Floor Track Configuration: No track across sliding-door opening and **[at sidelites (trackless)][recessed, pin-guide track system at sidelites][surface-mounted, roller-guide track system at sidelites]**.
 5. Stile Design: **[Narrow stile; 2-1/8-inch (55-mm) nominal width][Medium stile; 3-1/2-inch (90-mm) nominal width][Wide stile; more than 4-inch (100-mm) nominal width][As indicated on Drawings]**.
 6. Rail Design: **[3-1/2-inch (90-mm) nominal height][5-inch (125-mm) nominal height][As indicated on Drawings]**.
 7. Muntin Bars: **[On sidelites only][On doors and sidelites][None]**.
 8. Glazing Stops and Gaskets: **[Beveled][Square]**.

9. Glazing: **[Clear tempered][Electrochromic][Miniblinds]<Insert requirement>**.
10. Finish framing, door(s)[, sidelite(s)], and header with **[Class I, clear anodic finish][Class II, clear anodic finish][Class I, color anodic finish][Class II, color anodic finish][baked-enamel or powder-coat finish][high-performance organic finish (two-coat fluoropolymer)][high-performance organic finish (three-coat fluoropolymer)][metal cladding]<Insert finish>**.
 - a. Color: **[Light bronze][Dark bronze][Black][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
 - b. Metal Cladding: **[No. 4, directional-satin-finish stainless steel][No. 8, mirrorlike reflective, nondirectional-polish-finish stainless steel][Satin brass][Polished brass][Satin bronze]<Insert finish>**.

2.4 SWINGING ICU/CCU ENTRANCE ASSEMBLIES

- A. Swinging ICU/CCU Entrance Assemblies: Provide manufacturer's **[factory-glazed]** ICU/CCU entrances as indicated including door leaves, framing, and accessories required for a complete installation.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ASSA ABLOY Entrance Systems; ASSA ABLOY]**
 - b. **[Horton Automatics; Overhead Door Corporation]**
 - c. **[STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]**
 - d. **[TORMAX USA Inc.]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ASSA ABLOY Entrance Systems; ASSA ABLOY]**
 - b. **[Horton Automatics; Overhead Door Corporation]**
 - c. **[STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]**
 - d. **[TORMAX USA Inc.]**
 - e. **<Insert manufacturer's name>**
- B. Swinging ICU/CCU Entrance :
 1. Performance: **[Standard assembly][Smoke-control assembly][Pressurized-entrance assembly]<Insert requirement>**.
 2. Configuration: **[Single panel][Two equal panels (both primary panels)][Two unequal panels (one active, primary panel and one inactive, secondary panel)]<Insert configuration>**.
 3. Mounting: Between jambs.
 4. Stile Design: **[Narrow stile; 2-1/8-inch (55-mm) nominal width][Medium stile; 3-1/2-inch (90-mm) nominal width][Wide stile; more than 4-inch (100-mm) nominal width][As indicated on Drawings]**.
 5. Top Rail Design: **[3-1/2-inch (90-mm) nominal height][5-inch (125-mm) nominal height][As indicated on Drawings]<Insert requirement>**.
 6. Bottom Rail Design: **[3-1/2-inch (90-mm) nominal height][5-inch (125-mm) nominal height][10-inch (255-mm) nominal height][As indicated on Drawings]<Insert requirement>** with weather sweep.

7. Muntin Bars: **[On doors][None]**.
8. Glazing Stops and Gaskets: **[Beveled][Square]**.
9. Glazing: **[Clear tempered][Electrochromic][Miniblinds]<Insert requirement>**.
10. Finish framing and door(s) with **[Class I, clear anodic finish][Class II, clear anodic finish][Class I, color anodic finish][Class II, color anodic finish][baked-enamel or powder-coat finish][high-performance organic finish (two-coat fluoropolymer)][high-performance organic finish (three-coat fluoropolymer)][metal cladding]<Insert finish>**.
 - a. Color: **[Light bronze][Dark bronze][Black][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
 - b. Metal Cladding: **[No. 4, directional-satin-finish stainless steel][No. 8, mirrorlike reflective, nondirectional-polish-finish stainless steel][Satin brass][Polished brass][Satin bronze]<Insert finish>**.

2.5 SWINGING/FOLDING ICU/CCU ENTRANCE ASSEMBLIES

- A. Swinging/Folding ICU/CCU Entrance Assemblies: Provide manufacturer's standard **[factory-glazed]** ICU/CCU entrances including door leaves, framing, headers, carrier assemblies, and accessories required for a complete installation as indicated.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ASSA ABLOY Entrance Systems; ASSA ABLOY]**
 - b. **[dormakaba USA Inc.]**
 - c. **[Horton Automatics; Overhead Door Corporation]**
 - d. **[record-usa]**
 - e. **[STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]**
 - f. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ASSA ABLOY Entrance Systems; ASSA ABLOY]**
 - b. **[dormakaba USA Inc.]**
 - c. **[Horton Automatics; Overhead Door Corporation]**
 - d. **[record-usa]**
 - e. **[STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]**
 - f. **<Insert manufacturer's name>**
- B. Breakaway Hardware: Release hardware that allows folding panels to swing out in direction of egress to full 90 degrees from closed door position.
 1. Maximum Force to Open Folding Panels: **[50 lbf (222 N)]<Insert value>**.
- C. Swinging/Folding ICU/CCU Entrance :
 1. Configuration: Three-panel assembly consisting of one swinging panel (primary) and two folding panels (secondary) **[with breakaway hardware for folding panels]**.

- a. Provide double-acting swinging panel capable of swinging in both directions.
2. Mounting: Between jambs.
3. Floor Track: Trackless.
4. Stile Design: **[Narrow stile; 2-1/8-inch (55-mm) nominal width][Medium stile; 3-1/2-inch (90-mm) nominal width][Wide stile; more than 4-inch (100-mm) nominal width][As indicated on Drawings]**.
5. Top Rail Design: **[3-1/2-inch (90-mm) nominal height][5-inch (125-mm) nominal height][As indicated on Drawings]<Insert requirement>**.
6. Bottom Rail Design: **[3-1/2-inch (90-mm) nominal height][5-inch (125-mm) nominal height][10-inch (255-mm) nominal height][As indicated on Drawings]<Insert requirement>** with weather sweep.
7. Muntin Bars: **[On doors][None]**.
8. Glazing Stops and Gaskets: **[Beveled][Square]**.
9. Glazing: **[Clear tempered][Electrochromic][Miniblinds]<Insert requirement>**.
10. Finish framing, door(s), and header with **[Class I, clear anodic finish][Class II, clear anodic finish][Class I, color anodic finish][Class II, color anodic finish][baked-enamel or powder-coat finish][high-performance organic finish (two-coat fluoropolymer)][high-performance organic finish (three-coat fluoropolymer)][metal cladding]<Insert finish>**.
- a. Color: **[Light bronze][Dark bronze][Black][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
- b. Metal Cladding: **[No. 4, directional-satin-finish stainless steel][No. 8, mirrorlike reflective, nondirectional-polish-finish stainless steel][Satin brass][Polished brass][Satin bronze]<Insert finish>**.

2.6 COMPONENTS

- A. Framing**[and Transom]** Members: Extruded aluminum, minimum **0.125 inch (3.2 mm)** thick and reinforced as required to support imposed loads.
 1. Nominal Size: **[1-3/4 by 4-1/2 inches (45 by 115 mm)][1-3/4 by 6 inches (45 by 150 mm)][As indicated on Drawings]<Insert dimensions>**.
 2. Extruded Glazing Stops and Applied Trim: Minimum **0.062-inch (1.6-mm)** wall thickness.
- B. Stile and Rail Doors: **1-3/4-inch- (45-mm-)** thick, glazed doors with minimum **0.125-inch- (3.2-mm-)** thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie rods that span full length of top and bottom rails.
 1. Glazing Stops and Gaskets: Snap-on, extruded-aluminum stops and preformed gaskets for glazing indicated.
 2. Muntin Bars: Horizontal tubular rail member for each door; match stile design.
- C. Sidelites: **1-3/4-inch- (45-mm-)** deep sidelites with minimum **0.125-inch- (3.2-mm-)** thick, extruded-aluminum tubular stile and rail members matching door design and finish.
 1. Glazing Stops and Gaskets: Same materials and design as for stile and rail door.
 2. Muntin Bars: Horizontal tubular rail member for each sidelite; match stile design.
- D. Glazing: As specified in **[Section 088000 "Glazing."][Section 088853 "Security Glazing.]**
- E. Electrochromic Glazing: As selected by Architect from full range of manufacturer's products.

1. Operation: Opacity [variable with applied current][or][fully on or off]. Greatest opacity results with power switched [on][or][off].

F. Miniblind Glazing: ASTM E2190.

1. Glass: ASTM C1036, Type 1, Class 1, q3.
 - a. Tint: [Clear][Gray][Bronze][Green]<Insert tint>.
 - b. Kind: Fully tempered <Insert requirements>.
2. Integral Miniblinds: Manufacturer's standard, horizontal louver blinds with aluminum slats and polyester-fiber cords; located in space between glass lites and operated by hardware located on [inside][outside] face of glass panel.
 - a. Operation: [Tilt only][Tilt, raising, and lowering].
 - b. Color: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.

G. Headers: Fabricated from minimum **0.125-inch- (3.2-mm-)** thick, extruded aluminum, and extending full width of ICU/CCU entrance units to conceal carrier assemblies and roller tracks. Provide hinged or removable access panels for service and adjustment. Secure panels to prevent unauthorized access.

1. Capacity: Capable of supporting doors up to **[100 lb (45 kg) per leaf over spans up to 14 feet (4.3 m)]<Insert load and span>** without intermediate supports.
2. Provide sag rods for spans exceeding **14 feet (4.3 m)**.

H. Carrier Assemblies and Overhead Roller Tracks: Assembly that allows vertical adjustment; consisting of nylon- or polyoxymethylene (POM)-covered, ball-bearing-center steel wheels operating on a continuous roller track or of ball-bearing-center steel wheels operating on a nylon- or POM-covered, continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly. Provide minimum of two ball-bearing roller wheels and two antirise rollers for each active leaf.

I. Brackets and Reinforcements: High-strength aluminum with nonstaining, nonferrous shims for aligning system components.

J. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.7 HARDWARE

- A. General: Provide units in sizes and types recommended by ICU/CCU entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish[**unless otherwise indicated**].
- B. Closer: BHMA A156.4, Grade 1, fully concealed spring closer, sized according to manufacturer's recommendations for door size, adjustable to comply with requirements for opening force.
- C. Limit Arm: Provide to control doors and panels in the swing mode. Swing not to exceed 90 degrees.
- D. Pulls: Recessed units on both sides of each operable door[**and surface-mounted, D-shaped pull for each swing-out panel**].[**Pulls on sliding doors to be exposed and usable from both sides when sliding doors are in fully open position.**]

Intensive Care Unit_Critical Care Unit (ICU_CCU)

Entrances

- E. Manual Flush Bolts: BHMA A156.16, Grade 1, edge mortised, lever-extension type; located at bottom of each swing-out sidelite.
- F. Positive Latch: BHMA A156.5, Grade 1, manufacturer's standard latch and strike with lever handles on each side of swinging door panels. Manual flush bolt latch at each swing-out sidelite.
- G. Deadlocks: Operated by exterior cylinder and interior thumb turn.
 - 1. Deadbolts: Laminated-steel hook, mortise type, BHMA A156.5, Grade 1.
 - 2. Cylinders: **[BHMA A156.5, Grade 1, six-pin mortise type.][As specified in Section 087100 "Door Hardware."][As specified in Section 087111 "Door Hardware (Descriptive Specification)."]<Insert requirement>**.
 - a. Keying: **[No master][Integrate into building master]** key system[, **and key all cylinders alike**].
 - b. Keys: **[Two][Three]<Insert number>** for each cylinder.
- H. Weather Stripping: Replaceable components.
 - 1. Compression Type: ASTM D2000, molded neoprene or ASTM D2287, molded PVC.
 - 2. Sliding Type: AAMA 701/702, wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- I. Weather Sweeps: Nylon brush sweep mounted to underside of door bottom.

2.8 FABRICATION

- A. General: Factory fabricate ICU/CCU entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.
 - 1. Fabricate aluminum components before finishing.
 - 2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
 - 3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws[, **finished to match framing**][, **fabricated from stainless steel**].
 - a. Where fasteners are subject to loosening or turning out from structural movements or vibration, use self-locking devices.
 - b. Reinforce members as required to receive fastener threads.
 - 4. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
- B. Framing: Provide ICU/CCU entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.
 - 1. Fabricate tubular and channel frame assemblies with welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
 - 2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
 - 3. Form profiles that are straight and free of defects or deformations.
 - 4. Provide components with concealed fasteners and anchor and connection devices.

5. Fabricate components with accurately fitted joints, with ends coped or mitered to produce hairline joints free of burrs and distortion.
 6. Provide anchorage and alignment brackets for concealed support of assembly from the building structure.
- C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
- D. Metal Cladding: Factory-fabricated and -installed metal cladding, completely covering all visible surfaces as part of prefabricated entrance assembly before shipment to Project site.
1. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
 2. Form profiles that are sharp, straight, and free of defects or deformations.
 3. Provide components with concealed fasteners and anchor and connection devices.
 4. Fabricate components with accurately fitted joints, with ends coped or mitered to produce hairline joints free of burrs and distortion.
- E. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, according to GANA's "Glazing Manual."
- F. Factory Glazing: Install **[electrochromic][and][miniblind]** glazing at the factory.
- G. Hardware: Factory install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.
1. Provide sliding weather stripping, mortised into door, at perimeter of sliding surfaces and breakaway sidelites.
- H. Electrical Grounding: Fabricate ICU/CCU entrances to be internally grounded, complying with requirements of authorities having jurisdiction.

2.9 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Extruded Bars, Rods, Profiles, and Tubes: **ASTM B221 (ASTM B221M)**.
 2. Sheet and Plate: **ASTM B209 (ASTM B209M)**.
- B. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, **[Type 304]<Insert type>**, stretcher-leveled standard of flatness, in manufacturer's standard thickness.
- C. Brass Sheet: ASTM B36/B36M, Alloy UNS No. C26000 (cartridge brass, 70 percent copper), in manufacturer's standard thickness.
- D. Bronze Sheet: ASTM B36/B36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper) or Alloy UNS No. C23000 (red brass, 85 percent copper), in manufacturer's standard thickness.
- E. Sealants and Joint Fillers: As specified in Section 079200 "Joint Sealants."
- F. Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout complying with ASTM C1107/C1107M; of consistency suitable for application.

G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

1. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25][50]<Insert value> percent.
 - a. Regional Materials: Aluminum shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
 - b. Regional Materials: Aluminum shall be manufactured within **500 miles (800 km)** of Project site.
 - c. Regional Materials: Aluminum shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
 - d. Indigenous Materials: Aluminum shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
 - e. Regional Materials: Aluminum shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.

2.10 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
- B. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**][**AA-M12C22A31, Class II, 0.010 mm**] or thicker.
- B. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**][**AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.
- D. High-Performance Organic Finish:
 1. Two-coat fluoropolymer finish complying with [**AAMA 2604**][**AAMA 2605**] and containing not less than [**50**][**70**] percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than [**50**][**70**]

percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2.12 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: ASTM A480/480A. Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.
 - 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 3. Directional Satin Finish: No. 4.
 - 4. Mirrorlike Reflective, Nondirectional Polish: No. 8.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of the Work.
- B. Examine roughing-in for[**electrical power and**] grounding systems to verify actual locations of electrical connections before automatic entrance installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install automatic entrances according to manufacturer's written instructions[, **including wiring and connection to the building's power supply**].
 - 1. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
 - 2. Where aluminum contacts dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
 - 3. Where aluminum contacts concrete or masonry, protect against corrosion by painting contact surfaces with bituminous coating.
- B. Install ICU/CCU entrances plumb, true in alignment with established lines and grades, and without warp or rack of framing members and doors. Anchor securely in place.
 - 1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
 - 2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.
 - 3. Level recesses for recessed floor tracks using shrinkage-resistant grout.

4. Air Leakage: Install entrance assemblies for [smoke-control][and][pressurized rooms] according to NFPA 105 and as indicated.
- C. Field Glazing: Install glazing as specified in [Section 088000 "Glazing."][Section 088853 "Security Glazing."]
- D. Sealants: Comply with requirements in Section 079200 "Joint Sealants" for installing sealants, fillers, and gaskets.
 1. Set framing members, floor tracks, and flashings in full sealant bed.
 2. Seal perimeter of framing members with sealant.
- E. Grounding: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.3 ADJUSTING

- A. Adjust operating hardware and moving parts to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust force to open door panels.
- C. Test grounding system for compliance with requirements of authorities having jurisdiction.
- D. Adjust smoke-control and pressurized-entrance doors for tight closure.
- E. Test and adjust [electrochromic glass][miniblinds] to operate properly.

3.4 CLEANING AND PROTECTION

- A. Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.
- B. Comply with requirements in [Section 088000 "Glazing"][Section 088853 "Security Glazing"] for cleaning and protecting glass.

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SECTION 08 42 29 33 - SWINGING AUTOMATIC ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Swinging automatic entrances.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing recessed metal frames for control mats in concrete.
2. Section 084243 "Intensive Care Unit/Critical Care Unit (ICU/CCU) Entrances" for swinging-sliding, manual ICU/CCU entrance door assemblies.
3. Section 087113 "Power Door Operators" for automatic door operators furnished separately from doors and frames.

1.2 DEFINITIONS

- A. AAADM: American Association of Automatic Door Manufacturers.
- B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.
- C. Double-Egress Doors: A pair of doors that simultaneously swing with the two doors moving in opposite directions, with no mullion between them.
- D. Double-Swing Doors: A pair of doors that swing with the two doors moving in opposite directions, with a mullion between them; each door functioning as a single-swing door.
- E. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.
- F. For automatic door terminology, refer to **[ANSI/BHMA A156.10][and][ANSI/BHMA A156.19]** for definitions of terms.

1.3 COORDINATION

- A. Coordinate sizes and locations of recesses in concrete floors for recessed control mats that control automatic entrances. Concrete, reinforcement, and formwork requirements are specified elsewhere.
- B. Templates: Distribute for doors, frames, and other work specified to be factory prepared for installing automatic entrances.
- C. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish. Coordinate hardware for automatic entrances with hardware required for rest of Project.
- D. Electrical System Roughing-in: Coordinate layout and installation of automatic entrances with

connections to power supplies[**and access-control system**][**and remote activation devices**][**and remote monitoring systems**].

- E. System Integration: Integrate sliding automatic entrances with other systems as required for a complete working installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. **<Insert requirements>**.

- B. Shop Drawings:

1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Indicate locations of activation and safety devices.
5. Include hardware schedule and indicate hardware types, functions, quantities, and locations.
6. **<Insert requirements>**.

- C. Samples for Initial Selection: Manufacturer's standard finish sheets, showing full range of available finishes for units with factory-applied **[color][and][metal-clad]** finishes.

1. Include Samples of hardware and accessories involving color or finish selection.

- D. Samples for Verification: Actual samples of finished products for each type of exposed finish required.

1. Size: **[Manufacturer's standard size]<Insert size>**.

- E. Delegated Design Submittals: For automatic entrances, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- F. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
3. Health Product Declaration (HPD): For each product.
4. Health Product Declaration (HPD): Provide HPD.
5. Cradle to Cradle: For each product, provide documentation of Cradle to Cradle certification.

6. Cradle to Cradle: For each product, provide documentation of Cradle to Cradle certification.

1.6 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of automatic entrance. **[Include emergency-exit features of automatic entrances serving as a required means of egress.]**
- B. Product Test Reports: For each type of automatic entrance, for tests performed by **[a qualified testing agency][manufacturer and witnessed by a qualified testing agency]**.
- C. Field quality control reports: For automatic entrances.
- D. Qualification Statements: For **[manufacturer][Installer][Certified Inspector]**.
- E. Delegated Design Engineer Qualifications: For automatic entrances.
- F. Sample Warranties: For automatic entrances.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For automatic entrances, safety devices, and control systems.
- B. Warranty Documentation:
 1. Manufacturers' special warranties.
 2. Installer's special warranties.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer with Company Certificate issued by AAADM indicating that manufacturer has a Certified Inspector on staff.
- B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project **[and who employs a Certified Inspector]**.
 1. Maintenance Proximity: Not more than **[two]<Insert number>** hours' normal travel time from Installer's place of business to Project site.
- C. Certified Inspector Qualifications: Certified by AAADM.
- D. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in **[state]<Insert jurisdiction>** where Project is located and who is experienced in providing engineering services of the type indicated.

1.9 WARRANTY

- A. Special Warranty: **[Manufacturer agrees][Installer agrees][Manufacturer and Installer agree]** to repair or replace components of automatic entrances that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Faulty operation of operators, controls, and hardware.
 - c. Deterioration of metals[, **metal finishes**,] and other materials beyond normal weathering and use.
 2. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: **[Five][10][20]<Insert number>** years from date of Substantial Completion.
- C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, peeling, or chipping.
 2. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain swinging **[folding][and][sliding]** automatic entrances from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Power-Operated Door Standard: ANSI/BHMA A156.10.
- B. Power-Assist and Low-Energy Door Standard: ANSI/BHMA A156.19.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design automatic entrances.

- E. Seismic Performance: Automatic entrances to withstand the effects of earthquake motions determined in accordance with **[ASCE/SEI 7]<Insert requirement>**.
- F. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone **[1][2][3][4]** for **[basic][enhanced]** protection.
 - 1. Large-Missile Test: For glazing located within **[30 ft. (9.1 m)]<Insert dimension>** of grade.
 - 2. Small-Missile Test: For glazing located between **30 ft. (9.1 m)** and **[60 ft. (18.3 m)]<Insert dimension>** above grade.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature change>**.
- H. Operating Temperature Range: Automatic entrances operate within **[minus 20 to plus 122 deg F (minus 29 to plus 50 deg C)]<Insert temperature range>**.
- I. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
 - 1. Thermal Transmittance (U-Factor):
 - a. Entrance Doors: U-factor of not more than **[0.63 Btu/sq. ft. x h x deg F (3.58 W/sq. m x K)][0.68 Btu/sq. ft. x h x deg F (3.86 W/sq. m x K)][0.77 Btu/sq. ft. x h x deg F (4.37 W/sq. m x K)][0.83 Btu/sq. ft. x h x deg F (4.71 W/sq. m x K)][0.90 Btu/sq. ft. x h x deg F (5.11 W/sq. m x K)]<Insert value>** as determined in accordance with NFRC 100.
 - 2. Solar Heat-Gain Coefficient (SHGC):
 - a. Entrance Doors: SHGC of not more than **[0.21][0.25][0.35][0.40][0.45]<Insert value>** as determined in accordance with NFRC 200.
 - 3. Air Leakage:
 - a. Commercial Glazed Swinging Entrance Doors: Air leakage of not more than **[1.0 cfm/sq. ft. (5.08 L/s per sq. m)]<Insert value>** at a static-air-pressure differential of **1.57 lbf/sq. ft. (75 Pa)** when tested in accordance with ASTM E283/E283M.
 - 4. Condensation Resistance Factor (CRF):
 - a. Entrance Doors: CRF of not less than **[57][63][68]<Insert value>** as determined in accordance with AAMA 1503.
- J. Opening Force:
 - 1. Power-Operated Doors: Not more than **50 lbf (222 N)** required to manually set door in motion if power fails, and not more than **15 lbf (67 N)** required to open door to minimum required width.
 - 2. Power-Operated Swinging Doors: Not more than **30 lbf (133 N)** required to manually open door if power fails.
 - 3. Breakaway Device for Power-Operated Doors: Not more than **50 lbf (222 N)** required for a breakaway door or panel to open.
 - 4. Power-Assist and Low-Energy Doors: Not more than **15 lbf (67 N)** required to release a latch if provided, not more than **30 lbf (133 N)** required to manually set door in motion, and not more than **15 lbf (67 N)** required to fully open door if power fails.
 - 5. Accessible, Power-Assist Interior Doors: Not more than **5 lbf (22 N)** to push or pull door to fully open position.

K. Entrapment-Prevention Force:

1. Power-Operated Swinging Doors: Not more than **40 lbf (178 N)** required to prevent stopped door in the last 10 degrees of opening from moving in the direction of opening; not more than **30 lbf (133 N)** required to prevent stopped door from moving in direction of closing.
2. Low-Energy Doors: Not more than **15 lbf (67 N)** required to prevent stopped door from closing or opening.

2.3 SWINGING AUTOMATIC ENTRANCES

A. General: Provide manufacturer's standard automatic entrances, including doors, framing, headers, door operators, controls, and accessories required for a complete installation.

B. Swinging, Power-Operated Automatic Entrances :

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[ASSA ABLOY Entrance Systems; ASSA ABLOY]**
 - b. **[Horton Automatics; Overhead Door Corporation]**
 - c. **[NABCO Entrances, Inc]**
 - d. **[STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]**
 - e. **[TORMAX USA Inc.]**
 - f. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ASSA ABLOY Entrance Systems; ASSA ABLOY]**
 - b. **[Horton Automatics; Overhead Door Corporation]**
 - c. **[NABCO Entrances, Inc]**
 - d. **[STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]**
 - e. **[TORMAX USA Inc.]**
 - f. **<Insert manufacturer's name>**
3. Configuration:
 - a. Single: Single-swinging door **[with transom]**.
 - 1) Traffic Pattern: **[One][Two]** way.
 - 2) Mounting: **[Between jambs][Surface]**.
 - b. Pair: Pair of swinging doors **[with transom]**.
 - 1) Traffic Pattern: **[One way][Two way][Double egress][Double swing]**.
 - 2) Mounting: **[Between jambs][Surface]**.
4. Operator Features:
 - a. Power opening and **[power-assist]** spring closing.

- b. Adjustable opening and closing speeds.
 - c. Adjustable hold-open time between zero and 30 seconds.
 - d. Adjustable backcheck and latching.
 - e. Obstruction recycle.
 - f. Automatic door re-open if stopped while closing.
 - g. On-off/hold-open switch to control electric power to operator[, **key operated**].
 - h. **<Insert features required>**.
 5. Controls: Activation and safety devices[**as indicated on Drawings and**] in accordance with cited ANSI/BHMA standards.
 - a. Activation Device:
 - 1) Motion Sensor: Mounted on ingress side of door header to detect pedestrians in activating zone and to open door.
 - 2) Activating Control Mat: Installed on ingress side of door to detect pedestrians in activating zone and to open door.
 - 3) Switch: [**Push-plate switch**][**Push-button switch**][**Key switch**][**Touchless switch**][**on each side of door**] to activate door operator.
 - b. Safety Device:
 - 1) Active Infrared-Based Presence Sensor: Mounted on [**door header**][**horizontal door muntin**][**guide rail**] to detect pedestrians in presence zone and to prevent door from closing; with presence sensor monitoring before each closing cycle.
 - 2) Photoelectric Beam Presence Sensor: One photoelectric beam mounted in guide rails to detect pedestrians in presence zone and to prevent door from closing; with presence sensor monitoring before each closing cycle.
 - 3) Safety Control Mat : Installed on egress side of door to detect pedestrians in presence and safety zones and to prevent door from closing; with control mat monitoring before each closing cycle.
 6. Finish: Finish framing, door(s), and header with [**clear anodic finish**][**color anodic finish**][**baked-enamel or powder-coat finish**][**high-performance organic finish**][**superior-performance organic finish**][**finish matching adjacent curtain wall**][**finish matching adjacent storefront**].
 7. Metal Cladding and Finish: Clad framing, door(s), and header with [**No. 4 directional-satin-finish stainless steel sheet**][**No. 8 mirror finish stainless steel sheet**][**satin-brass sheet**][**polished-brass sheet**][**satin-bronze sheet**][**polished-bronze sheet**][**metal sheet in finish matching Architect's sample**][**metal sheet in finish as selected by Architect from manufacturer's full range**][**metal sheet in finish matching adjacent storefront**]**<Insert finish>**.
- C. Swinging, Power-Assist and Low-Energy, Power-Operated Automatic Entrances :
 1. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:
 - a. [**Horton Automatics; Overhead Door Corporation**]
 - b. [**NABCO Entrances, Inc**]
 - c. [**STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.**]
 - d. [**TORMAX USA Inc.**]
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert**

manufacturer's name; product name or designation> or comparable product by one of the following:

- a. **[Horton Automatics; Overhead Door Corporation]**
 - b. **[NABCO Entrances, Inc]**
 - c. **[STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]**
 - d. **[TORMAX USA Inc.]**
 - e. **<Insert manufacturer's name>**
3. Operation: **[Power Assist][Low-Energy, Power Operated][Low-Energy, Power Open]**.
 4. Configuration, Single: Single-swinging door **[with transom]**.
 - a. Traffic Pattern: **[One][Two]** way.
 - b. Mounting: **[Between jambs][Surface]**.
 5. Configuration, Pair: Pair of swinging doors **[with transom]**.
 - a. Traffic Pattern: **[One way][Two way][Double egress][Double swing]**.
 - b. Mounting: **[Between jambs][Surface]**.
 6. Operator Features:
 - a. Power opening and **[power-assist]** spring closing.
 - b. Adjustable opening and closing speeds.
 - c. Adjustable hold-open time between zero and 30 seconds.
 - d. Adjustable backcheck and latching.
 - e. Obstruction recycle.
 - f. Automatic door re-open if stopped while closing.
 - g. On-off/hold-open switch to control electric power to operator **[, key operated]**.
 - h. **<Insert features required>**.
 7. Activation Device: **[Push-plate switch][Push-button switch][Key switch][Touchless switch][on each side of door]** to activate door operator.
 8. Finish: Finish framing, door(s), and header with **[clear anodic finish][color anodic finish][baked-enamel or powder-coat finish][high-performance organic finish][superior-performance organic finish][finish matching adjacent curtain wall][finish matching adjacent storefront]**.
 9. Metal Cladding and Finish: Clad framing, door(s), and header with **[No. 4 directional-satin-finish stainless steel sheet][No. 8 mirror finish stainless steel sheet][satin-brass sheet][polished-brass sheet][satin-bronze sheet][polished-bronze sheet][metal sheet in finish matching Architect's sample][metal sheet in finish as selected by Architect from manufacturer's full range][metal sheet in finish matching adjacent storefront]<Insert finish>**.

2.4 ENTRANCE COMPONENTS

- A. Framing Members: Extruded aluminum, minimum **0.125 inch (3.2 mm)** thick and reinforced as required to support imposed loads.
 1. Nominal Size: **[As indicated on Drawings][1-3/4 by 4-1/2 inches (45 by 115 mm)][1-3/4 by 6 inches (45 by 150 mm)]<Insert dimensions>**.
 2. Extruded Glazing Stops and Applied Trim: Minimum **0.062-inch (1.6-mm)** wall thickness.
- B. Stile and Rail Doors: **1-3/4-inch- (45-mm-)** thick, glazed doors with minimum **0.125-inch- (3.2-mm-)** thick, extruded-aluminum tubular stile and rail members. Mechanically fasten corners with reinforcing

brackets that are welded, or incorporate concealed tie-rods that span full length of top and bottom rails.

1. Glazing Stops and Gaskets: **[Beveled][Square]**, snap-on, extruded-aluminum stops and preformed gaskets.
 2. Stile Design: **[As indicated on Drawings][Narrow stile, 2-1/8-inch (55-mm) nominal width][Medium stile, 3-1/2-inch (90-mm) nominal width]**.
 3. Rail Design: **[As indicated on Drawings][5-inch (125-mm) nominal height][6-1/2-inch (165-mm) nominal height][10-inch (254-mm) nominal height]**.
 4. Muntin Bars: Horizontal tubular rail member for each door; match stile design and finish.
- C. Sidelite(s): **1-3/4-inch- (45-mm-)** deep sidelite(s) with minimum **0.125-inch- (3.2-mm-)** thick, extruded-aluminum tubular stile and rail members matching door design.
1. Glazing Stops and Gaskets: Same materials and design as for stile and rail door.
 2. Muntin Bars: Horizontal tubular rail members for each sidelite; match stile design.
- D. Transom: **1-3/4-inch- (45-mm-)** deep transom with minimum **0.125-inch- (3.2-mm-)** thick, extruded-aluminum tubular stile and rail members matching door design.
1. Glazing Stops and Gaskets: Same materials and design as for stile and rail door.
- E. Headers: Fabricated from minimum **0.125-inch- (3.2-mm-)** thick extruded aluminum and extending full width of automatic entrance units to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
1. Mounting: **[Surface mounted][Concealed, with one side of header flush with framing]**.
- F. Brackets and Reinforcements: High-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- G. Signage: As required by cited ANSI/BHMA standard.
1. Application Process: **[Decals][Silk-screened][Door manufacturer's standard process]<Insert requirement>**.
 2. Provide sign materials with instructions for field application after glazing is installed.

2.5 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Extrusions: **ASTM B221 (ASTM B221M)**.
 2. Sheet: ASTM B209/B209M.
- B. Steel Reinforcement Primer: Reinforcement with corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Use surface preparation methods in accordance with recommendations in SSPC-SP COM and prepare surfaces in accordance with applicable SSPC standard.
- C. Stainless Steel Bars: ASTM A276/A276M or ASTM A666, **[Type 304][Type 316]<Insert type>**.
- D. Stainless Steel Tubing: ASTM A554, **[Grade MT 304][Grade MT 316]<Insert grade>**.
- E. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, **[Type 304][Type 316]<Insert type>**,

stretcher-leveled standard of flatness, in entrance manufacturer's standard thickness.

- F. Brass Sheet: ASTM B36/B36M, Alloy UNS No. C26000 (cartridge brass, 70 percent copper), in entrance manufacturer's standard thickness.
- G. Bronze Sheet: ASTM B36/B36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper) or Alloy UNS No. C23000 (red brass, 85 percent copper), in entrance manufacturer's standard thickness.
- H. Expanded Aluminum Mesh: **[Expanded][Expanded and flattened]** aluminum sheet in accordance with the geometry of ASTM F1267.
- I. Polycarbonate Sheet: ASTM C1349, Appendix X1, Type II, coated, mar-resistant, UV-stabilized polycarbonate with coating on both surfaces.
- J. Glazing: As specified in **[Section 088000 "Glazing."][Section 088853 "Security Glazing."]**
- K. Sealants and Joint Fillers: Provide type recommended in writing by manufacturer for joint size and movement. Sealant to remain permanently elastic, nonshrinking, and nonmigrating.
- L. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- M. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
- N. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **<Insert number>** percent.

2.6 DOOR OPERATORS AND CONTROLS

- A. General: Provide operators and controls, which include activation and safety devices, in accordance with cited ANSI/BHMA standards, for condition of exposure, and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.
- B. Door Operators: Provide door operators of size recommended by manufacturer for door size, weight, and movement.
 - 1. Door Operator Performance: Door operators open and close doors and maintain them in fully closed position when subjected to Project's design wind loads.
 - 2. Electromechanical Operators: Concealed, self-contained, overhead units powered by fractional-horsepower, permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor; with solid-state microprocessor controller; complying with UL 325; and with manual operation with power off.
- C. Motion Sensors: Self-contained, K-band-frequency, microwave-scanner units; fully enclosed by their plastic housings; adjustable to provide detection-field sizes and functions required by ANSI/BHMA A156.10.
 - 1. Provide capability for switching between bi- and unidirectional detection.
 - 2. For one-way traffic, sensor on egress side is not active when doors are fully closed.
- D. Active-Infrared-based Presence Sensors: Self-contained, active-infrared scanner units; door mounted or overhead mounted; adjustable to provide detection-field sizes and functions required by ANSI/BHMA A156.10. Sensors remain active at all times.

- E. Photoelectric Beam Presence Sensors: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams are not active when doors are fully closed.
- F. Presence Sensor Monitoring: Means to verify the functionality of each presence sensor in accordance with ANSI/BHMA A156.10. A detected fault condition of the presence sensor system will cause automatic operation to cease until fault is corrected.
- G. Control Mats: **1/2-inch- (13-mm-)** thick, synthetic-rubber or flexible-plastic mat in safety-ribbed surface pattern, with extruded-aluminum frame; with pressure switches for low-voltage control wiring; and complying with performance requirements of ANSI/BHMA A156.10.
 1. Frame: **[Recessed to fit flush with floor, with concealed anchors][Surface mounted, with tapered safety edge]**.
 2. Size: As indicated, but no smaller than required by ANSI/BHMA A156.10, including Appendix A.
 3. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]**.
- H. Control Mat Monitoring: Means to verify the functionality of each safety control mat in accordance with ANSI/BHMA A156.10. A detected fault condition of the safety control mat will cause automatic operation to cease until fault is corrected.
- I. Push-Plate Switch: Momentary-contact door-control switch with flat push-plate actuator[, **with contrasting-colored, engraved message**].
 1. Configuration:
 - a. Round Push Plate: With **4-by-4-inch (100-by-100-mm)** junction box.
 - 1) Mounting: **[As indicated on Drawings][Recess mounted, semiflush in wall][Surface mounted on wall]**.
 - b. Square Push Plate: With **4-by-4-inch (100-by-100-mm)** junction box.
 - 1) Mounting: **[As indicated on Drawings][Recess mounted, semiflush in wall][Surface mounted on wall]**.
 - c. Rectangular Push Plate: With **2-by-4-inch (50-by-100-mm)** junction box.
 - 1) Mounting: **[As indicated on Drawings][Recess mounted, semiflush in wall][Recess mounted in doorjamb][Surface mounted on wall][Surface mounted on post][Surface mounted on guide rail]**.
 2. Push-Plate Mounting Height: Operational height **[as indicated on Drawings]<Insert height>**.
 3. Push-Plate Material: **[Stainless steel][Plastic]**, as selected by Architect from manufacturer's full range.
 4. Message: **[Plain face with no message.]["Push to Open."]["International symbol of accessibility.][International symbol of accessibility and "Push to Open."]**
- J. Touchless Switch: Hands-free-activation door-control switch with flat motion sensor faceplate[**with contrasting-colored, engraved message**].
 1. Configuration: **[6-inch (152.4-mm) round][4.56-by-4.56-inch (115.8-by-115.8-mm) (double gang) square][2.77-by-4.56-inch (70-by-115.8-mm) (single gang) rectangular][1.68-by-4.56-inch (42.6-by-115.8-mm) jamb-style]** faceplate.
 - a. Mounting: **[As indicated on Drawings][Recess mounted in wall][Recess mounted in**

doorjamb][Surface mounted on wall].

2. Faceplate Mounting Height: Operational height [as indicated on Drawings]<Insert height>.
3. Faceplate Material: [Stainless steel][Plastic][Stainless steel with backlight acrylic window], as selected by Architect from manufacturer's full range.
4. Message: ["Wave to Open"]["Wave to Open" and wave symbol][International symbol of accessibility][International symbol of accessibility, "Wave to Open," and wave symbol].

K. Push-Button Switch: Momentary-contact door-control switch with one red-button actuator; enclosed in nominal [2-by-4-inch (50-by-100-mm)][4-by-4-inch (100-by-100-mm)] junction box.

1. Provide faceplate engraved with "Press to Open" letters[and international symbol of accessibility] in contrasting color.
2. Provide blue plastic cover engraved with "Press Button to Open" in white letters and international symbol of accessibility.
3. Mounting: [As indicated on Drawings][Surface mounted on wall][Surface mounted on post][Surface mounted on guide rail][Recess mounted in wall].
4. Faceplate Mounting Height: Operational height [as indicated on Drawings]<Insert height>.
5. Faceplate Material: [Stainless steel][Painted metal], as selected by Architect from manufacturer's full range.

L. Key Switch: Recess-mounted, door-control switch with key-controlled actuator; enclosed in 2-by-4-inch (50-by-100-mm) junction box. Provide faceplate engraved with letters indicating switch functions.

1. Functions: [On-off, momentary contact][On-off, maintained contact][Two-way automatic, hold open, one-way exit, and off][Two-way automatic, hold open, one-way exit, off, full open, and partial open].
2. Mounting: [As indicated on Drawings][Recess mounted, semiflush in wall][Recess mounted in doorjamb][Surface mounted on wall][Surface mounted on post].
3. Faceplate Mounting Height: Operational height [as indicated on Drawings]<Insert height>.
4. Faceplate Material: [Stainless steel][Painted metal], as selected by Architect from manufacturer's full range.

M. Wireless or Remote Radio Control Switch: Auxiliary radio control system consisting of header-mounted receiver and [wall-mounted][hand-held, battery-operated] transmitter switch[for each entrance]<Insert requirement>.

1. Wall-Mounted Transmitter Switch: One red-button, momentary-contact actuator enclosed in 4-by-4-inch (100-by-100-mm) junction box. Provide blue plastic cover engraved with "Press Button to Open" in white letters and international symbol of accessibility.

N. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.7 HARDWARE

- A. General: Provide units in sizes and types recommended by automatic entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish[unless otherwise indicated].
- B. Manual Opening for Power-Operated Swinging Doors: Provide hardware that, in a power failure, allows door to open with a manual force stipulated in "Performance Requirements" Article.
- C. Breakaway Device for Power-Operated Doors: Device that allows door to swing out in direction of

egress to full 90 degrees from any operating position. Maximum force to open door is as stipulated in "Performance Requirements" Article. Interrupt powered operation of door operator while in breakaway mode.

1. Include **[one adjustable detent device mounted at the top of each breakaway panel][two adjustable detent devices mounted in each breakaway panel; one top mounted and one bottom mounted]** to control breakaway force.
 - a. Panel Closer: Factory-installed concealed hydraulic door closer.
 - b. Limit Arms: Limit swing to 90 degrees, spring loaded with adjustable friction damping.
- D. Manual Opening for Power-Assist and Low-Energy Doors: Provide hardware that, in a power failure, allows door to open with a manual force as stipulated in "Performance Requirements" Article.
- E. Hinges:
 1. Center-Pivot Sets: ANSI/BHMA A156.4, Grade 1, with exposed parts of cast-aluminum alloy.
 2. Offset Pivots: ANSI/BHMA A156.4, Grade 1, with exposed parts of cast-aluminum alloy.
 3. Butt Hinges: ANSI/BHMA A156.1, Grade 1, five-knuckle, **4-1/2-by-4-inch (114-by-102-mm)** ball-bearing butts.
 - a. Provide nonremovable pins at hinges exposed on outside of door.
 - b. Provide nonferrous hinges for doors exposed to weather.
 - c. Provide three hinges at each leaf for doors up to **36 inches (914 mm)** wide and **80 inches (2032 mm)** tall; provide four hinges at each leaf for wider or taller doors.
 4. Continuous-Geared Hinges: ANSI/BHMA A156.26, Grade 1.
- F. Deadlocks: Deadbolt operated by exterior cylinder and interior thumb turn, with minimum **1-inch- (25-mm-)** long throw bolt; ANSI/BHMA A156.5, Grade 1.
 1. Cylinders: **[ANSI/BHMA A156.5, Grade 1, six-pin mortise type.][As specified in Section 087100 "Door Hardware."][As specified in Section 087111 "Door Hardware (Descriptive Specification)."]**
 - a. Keying: **[No master][Integrate into building master]** key system.
 - b. Keys: **[Two][Three]<Insert number>** for each cylinder.
 2. Deadbolts: Laminated-steel hook, mortise type, ANSI/BHMA A156.5, Grade 1.
 3. Two-Point Locking for Swinging Doors: Mechanism in stile of active door leaf that automatically extends second lockbolt into **[header][threshold]**.
- G. Push Bars: **[As selected by Architect from manufacturer's full range of full-door-width, single][Manufacturer's standard surface-mounted, aluminum]** push bars.
- H. Pull Handles: **[As selected by Architect from manufacturer's full range of pull handles and plates][Manufacturer's standard aluminum pull handles]**.
- I. Thresholds: ANSI/BHMA A156.21, extruded-aluminum raised thresholds; with beveled edges with a slope of not more than 1:2 and a maximum height of **1/2 inch (13 mm)**. Provide cutouts as required for door operating hardware.
- J. Weather Stripping: Replaceable components.
 1. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

2. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.
3. Weather Sweeps: Nylon brush sweep mounted to underside of door bottom.

K. Finger Guards: Collapsible neoprene or PVC gasket.

2.8 ACCESSORIES

A. Guide Rails:

1. **[Aluminum][Stainless steel]**, fabricated from **[bars][or][tubing]**, minimum **30 inches (762 mm)** high, and finished to match doors unless otherwise indicated; positioned and projecting from face of door jamb for distance as indicated[, **but not less than that required by ANSI/BHMA A156.10 for type of door and direction of travel**]<Insert requirement>; with filler panel.
 - a. Filler Panel: **[Expanded aluminum mesh][Clear polycarbonate sheet][Colored polycarbonate sheet]**<Insert material>.
 - 1) Orient expanded aluminum mesh with long dimension of diamonds **[parallel to top rail][perpendicular to top rail]**.
 - 2) Color: **[Match Architect's sample][As selected by Architect from manufacturer's full range]**<Insert color>.
 - b. Provide intermediate rail in guide rail suitable for supporting photoelectric beams.
 - c. Mounting: **[As indicated on Drawings][Jamb and floor][Floor, freestanding]**.
 - d. Aluminum Finish: **[Clear anodic finish][Color anodic finish][Baked-enamel or powder-coat finish][High-performance organic finish][Superior-performance organic finish][Finish matching door and frame]**<Insert finish>.
 - e. Stainless Steel Finish: **[No. 4 directional-satin-finish stainless steel][Finish matching door and frame]**<Insert finish>.
2. See **[Section 055213 "Pipe and Tube Railings."][Section 057300 "Decorative Metal Railings.]**

2.9 FABRICATION OF SWINGING AUTOMATIC ENTRANCES

- #### A. General: Factory fabricate automatic entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.
1. Form aluminum shapes before finishing.
 2. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
 3. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws[, **finished to match framing**][, **fabricated from stainless steel**].
 - a. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - b. Reinforce members as required to receive fastener threads.
 4. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.

- B. Framing: Provide automatic entrances as prefabricated assemblies. Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site.
1. Fabricate tubular and channel frame assemblies with welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support required loads.
 2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
 3. Form profiles that are sharp, straight, and free of defects or deformations.
 4. Provide components with concealed fasteners and anchor and connection devices.
 5. Fabricate components with accurately fitted joints, with ends coped or mitered to produce hairline joints free of burrs and distortion.
 6. Fabricate exterior components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior. Provide anchorage and alignment brackets for concealed support of assembly from building structure.
 7. Allow for thermal expansion of exterior units.
- C. Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
- D. Metal Cladding: Factory-fabricated and -installed metal cladding, completely covering all visible surfaces as part of prefabricated entrance assembly before shipment to Project site.
1. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
 2. Form profiles that are sharp, straight, and free of defects or deformations.
 3. Provide components with concealed fasteners and anchor and connection devices.
 4. Fabricate components with accurately fitted joints, with ends coped or mitered to produce hairline joints free of burrs and distortion.
 5. Fabricate exterior components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior.
 6. Allow for thermal expansion at exterior entrances.
- E. Door Operators: Factory fabricated and installed in headers, including adjusting and testing.
- F. Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated, in accordance with NGA's "GANA Glazing Manual."
- G. Hardware: Factory install hardware to greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site. Cut, drill, and tap for factory-installed hardware before applying finishes.
1. Provide sliding-type weather stripping, mortised into door, at perimeter of doors[**and breakaway sidelites**].
 2. Provide compression-type weather stripping at fixed stops of exterior doors. At locations without fixed stops, provide sliding-type weather stripping retained in adjustable strip mortised into door edge.
 3. Provide weather sweeps mounted to underside of door bottoms of exterior doors.
 4. Provide finger guards at each swinging-door leaf that has clearance at hinge side greater than **1/4 inch (6 mm)** and less than **3/4 inch (19 mm)** with door in any position. Anchor guards to hinge-jamb frame.
- H. Controls:
1. General: Factory install activation and safety devices in doors and headers as required by ANSI/BHMA A156.10 for type of door and direction of travel.
 2. Install photoelectric beams in sides of guide rails, with dimension above finished floor not less than **24 inches (610 mm)**.

2.10 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**][**AA-M12C22A31, Class II, 0.010 mm**] or thicker.
- B. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**][**AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.
 - 1. Color: [**Light bronze**][**Medium bronze**][**Dark bronze**][**Champagne**][**Black**][**Match Architect's sample**][**As selected by Architect from full range of industry colors and color densities**]<Insert color>.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.
- D. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with [**AAMA 2604**][**AAMA 2605**] and containing not less than [**50**][**70**] percent PVDF resin by weight in color coat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**].
 - 2. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.
- E. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**].
 - 2. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.
- F. Superior-Performance Organic Finish, Four-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**].
 - 2. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.

- G. Superior-Performance Organic Finish, Single-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- H. Superior-Performance Organic Finish, Two-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances.
- B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic entrance installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF SWINGING AUTOMATIC ENTRANCES

- A. General: Install automatic entrances in accordance with manufacturer's written instructions and cited ANSI/BHMA A156.10 for direction of pedestrian travel, including signage, controls, wiring, and connection to the building's power supply.
 - 1. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
 - 2. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
 - 3. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous coating.
- B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.
 - 1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
 - 2. Set headers, operating brackets, and guides level and true to location with anchorage for permanent support.
 - 3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior.
 - 4. Provide thresholds **[at exterior doors][and][where indicated]**.

- C. Door Operators: Connect door operators to electrical power distribution system.
- D. Access-Control Devices: Connect access-control devices to access-control system as specified in Section 281300 "Access Control Software and Database Management."
- E. Controls: Install and adjust activation and safety devices in accordance with manufacturer's written instructions and cited ANSI/BHMA standard for direction of pedestrian travel. Connect control wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- F. Guide Rails: Install rails in accordance with ANSI/BHMA A156.10, including Appendix A, and manufacturer's written instructions unless otherwise indicated.
- G. Glazing: Install glazing as specified in [Section 088000 "Glazing."][Section 088853 "Security Glazing."]
- H. Sealants and Joint Fillers: Comply with requirements in Section 079200 "Joint Sealants" for installing sealants, fillers, and gaskets.
 - 1. Set thresholds, framing members, and flashings in full sealant bed.
 - 2. Seal perimeter of framing members with sealant.
- I. Signage: Apply signage on both sides of each door[**and breakaway sidelite**], as required by cited ANSI/BHMA standard for direction of pedestrian travel.
- J. Wiring within Automatic Entrance Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's written limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 FIELD QUALITY CONTROL

- A. Certified Inspector: [**Owner will engage**][**Engage**] a Certified Inspector to test and inspect components, assemblies, and installations, including connections.
- B. Perform the following tests and inspections[**with the assistance of a factory-authorized service representative**]:
 - 1. Test and inspect each automatic entrance, using AAADM inspection forms, to determine compliance of installed systems with applicable ANSI/BHMA standards.
 - 2. Automatic entrances will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust hardware, moving parts, door operators, and controls to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable ANSI/BHMA standards.
 - 1. Adjust exterior doors for tight closure.
- B. Readjust door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).

- C. Occupancy Adjustments: When requested within [12]<Insert number> months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to [two]<Insert number> visits to Project during other-than-normal occupancy hours for this purpose.

3.5 CLEANING

- A. Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.
1. Comply with requirements in [Section 088000 "Glazing"] [Section 088853 "Security Glazing"] for cleaning and maintaining glass.

3.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service includes [three][six][nine][12] months' full maintenance by skilled employees of automatic entrance Installer. Include [monthly][quarterly] preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper automatic entrance operation. Parts and supplies are manufacturer's authorized replacement parts and supplies.
1. Engage a Certified Inspector to perform safety inspection after each adjustment or repair and at end of maintenance period. Furnish completed inspection reports to Owner.
 2. Perform maintenance, including emergency callback service, during normal working hours.
 3. Include 24-hour-per-day, 7-day-per-week emergency callback service.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic entrances.

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Task	Specification	Specification Description
08 42 29 33	08 42 33 00	Revolving Door Entrances



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SECTION 08 42 33 00 - REVOLVING DOOR ENTRANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manual revolving door entrances.
2. Automatic revolving door entrances.
3. Manual access-control revolving door entrances.
4. Automatic access-control revolving door entrances.

B. Related Requirements:

1. Section 084113 "Aluminum-Framed Entrances and Storefronts" for adjacent aluminum entrance doors and storefront framing.

1.2 COORDINATION

- A. Recesses: Coordinate size and location of recesses in floor construction for **[recessed, floor-mounted speed-control units][pivot bearings][foot grilles][and][recessed mats]**, including anchorages for frames and supports. Furnish setting drawings, templates, and directions for installing anchorages that are to be embedded into concrete. Deliver these items to Project site in time for installation.
- B. Electrical System Roughing-in: Coordinate layout and installation of automatic entrances with connections to power supplies **[and access-control system][and remote monitoring systems]**.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Manual revolving door entrances.
2. Automatic revolving door entrances.
3. Manual access-control revolving door entrances.
4. Automatic access-control revolving door entrances.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for revolving door entrances.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

C. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Environmental Product Declaration: For each product.
3. Health Product Declaration: For each product.

4. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
5. Environmental Product Declaration: For each product.
6. Environmental Product Declaration: For each product.
7. Environmental Product Declaration: For each product.
8. Third-Party Certifications: For each product.
9. Third-Party Certified Life Cycle Assessment: For each product.

D. Shop Drawings: For revolving door entrances.

1. Include plans, elevations, sections, and attachment details.
2. Indicate enclosures, **[speed-control units][drive units]**, and other components not in manufacturer's product data.
3. Indicate locations of activation and safety devices.
4. Include diagrams for power, signal, and control wiring.

E. Samples: For each exposed product and for each color and texture specified.

1. Finishes: For each type of exposed finish required, prepared on Samples of not less than **3 by 5 inches (76 by 127 mm)**.
2. Glass Samples: For each type of tinted glass; **12 inches (305 mm)** square.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[Installer][manufacturer][Certified Inspector]**.
- B. Product Certificates: For each type of revolving door entrance.
- C. Product Test Reports: For each type of revolving door entrance, for tests performed by manufacturer and witnessed by a qualified testing agency.
- D. Field quality-control reports.
- E. Sample Warranty: For manufacturer's warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For revolving door entrances to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer with company certificate issued by AAADM indicating that manufacturer has a Certified Inspector on staff.
- B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project **[and who employs a Certified Inspector]**.
 1. Maintenance Proximity: Not more than **[two]<Insert number>** hours' normal travel time from Installer's place of business to Project site.

- C. Certified Inspector Qualifications: Certified by AAADM.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver revolving door entrance glass, decorative metalwork, and other exposed elements in padded blankets or other approved protective wrapping.
- B. Protect finish surfaces from damage during handling and installation.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of revolving door entrances that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Faulty operation of speed-control unit.
 - b. Deterioration of metals[, **metal finishes**,] and other materials beyond normal weathering and use.
 2. Warranty Period for Overhead Speed-Control Units: **[10]<Insert number>** years from date of Substantial Completion.
 3. Warranty Period for Floor Speed-Control Units: **[Five]<Insert number>** years from date of Substantial Completion.
 4. Warranty Period for Finishes: **[20]<Insert number>** years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: **[Five][10][20]<Insert number>** years from date of Substantial Completion.
- C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, peeling, or chipping.
 2. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS
2.1 PERFORMANCE REQUIREMENTS

- A. Revolving Door Entrance Standard: ANSI/BHMA A156.27.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
 - 1. Thermal Transmittance (U-Factor):
 - a. Entrance Doors: U-factor of not more than **[0.63 Btu/sq. ft. x h x deg F (3.58 W/sq. m x K)][0.68 Btu/sq. ft. x h x deg F (3.86 W/sq. m x K)][0.77 Btu/sq. ft. x h x deg F (4.37 W/sq. m x K)][0.83 Btu/sq. ft. x h x deg F (4.71 W/sq. m x K)][0.90 Btu/sq. ft. x h x deg F (5.11 W/sq. m x K)]<Insert value>** as determined in accordance with NFRC 100.
 - 2. Solar Heat-Gain Coefficient (SHGC):
 - a. Entrance Doors: SHGC of not more than **[0.21][0.25][0.35][0.40][0.45]<Insert value>** as determined in accordance with NFRC 200.
 - 3. Air Leakage:
 - a. Revolving Doors: Air leakage of not more than **[1.0 cfm/sq. ft. (5.1 L/s per sq. m)]<Insert value>** at a static-air-pressure differential of **1.57 lbf/sq. ft. (75 Pa)**.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - 1. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature change>**.
- E. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone [1][2][3][4] for **[basic][enhanced]** protection.
 - 1. Large-Missile Test: For glazing located within **[30 ft. (9.1 m)]<Insert dimension>** of grade.
 - 2. Small-Missile Test: For glazing located between **30 ft. (9.1 m)** and **[60 ft. (18.3 m)]<Insert dimension>** above grade.
- F. Seismic Performance: Revolving door entrances to withstand the effects of earthquake motions determined in accordance with **[ASCE/SEI 7]<Insert requirement>**:
- G. Regulatory Requirements: Wings to be capable of breakout to provide minimum aggregate width of **36 inches (914 mm)** when breakout force of no more than **[130 lbf (572 N)][180 lbf (801 N)]** is applied within **3 inches (76 mm)** of outer edges and **40 inches (1020 mm)** above floor. Set maximum turning speed to comply with requirements of ANSI/BHMA A156.27.
- H. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201.
 - 1. Safety-Glass Labeling: Where safety-glass labeling is indicated, permanently mark glass with certification label of the Safety Glazing Certification Council, another certification agency

acceptable to authorities having jurisdiction, or the manufacturer. Label indicates manufacturer's name, type of glass, thickness, and safety-glass standard with which glass complies.

2.2 SOURCE LIMITATIONS

- A. Obtain all components of revolving door entrances from single source from single manufacturer.

2.3 MANUAL REVOLVING DOOR ENTRANCES

- A. Manual Revolving Door Entrances : Manufacturer's standard **[three-wing][four-wing]** manual revolving door entrance, complete with center shaft, speed-control unit, wings, hardware, enclosure walls, canopy, glass and glazing, and accessories required for a complete installation.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ASSA ABLOY Entrance Systems; ASSA ABLOY]**
 - b. **[Boon Edam, Inc.]**
 - c. **[Crane Revolving Doors; dormakaba USA Inc.]**
 - d. **[Horton Automatics; Overhead Door Corporation]**
 - e. **[International Revolving Door]**
 - f. **[STANLEY Rush; STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]**
 - g. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ASSA ABLOY Entrance Systems; ASSA ABLOY]**
 - b. **[Boon Edam, Inc.]**
 - c. **[Crane Revolving Doors; dormakaba USA Inc.]**
 - d. **[Horton Automatics; Overhead Door Corporation]**
 - e. **[International Revolving Door]**
 - f. **[STANLEY Rush; STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]**
 - g. **<Insert manufacturer's name>**
 - 3. Manual Speed-Control Unit: Mechanical speed regulator that allows free rotation of wings up to a predetermined rate of speed and that engages a clutch-type brake to prevent rapid acceleration of wings.
 - a. Location: **[Recessed, floor mounted][Overhead]**.
 - b. Fold-to-Side Mechanism: Manufacturer's standard overhead carriage, guide support track, pivot mechanism, and other components necessary to permit folded wings to be moved to one side of revolving door entrance enclosure.
 - 4. Power-Assist Operation: Drive unit will provide supplemental force, reducing the rotating resistance, when activated by pushing the door. When pushing force is released, door will automatically return to home position.
 - 5. Stile-and-Rail Wings: Manufacturer's standard with **1-3/4-inch- (45-mm-)** thick, tubular stile-and-rail members.

- a. Stile Design: **[Narrow stile, 2-inch (51-mm) nominal width][Medium stile, 3-1/2-inch (89-mm) nominal width][Wide stile, 5-inch (127-mm) nominal width][As indicated on Drawings]**.
 - b. Rail Design: **[3-inch (76-mm) nominal height][4-inch (102-mm) nominal height][As indicated on Drawings]**.
 - c. Muntin Design: To match stile design.
 - d. Glass: **[Clear][Tinted]**, fully tempered float glass.
 - 1) Thickness: **[6 mm][8 mm][10 mm]<Insert dimension>**.
 - 2) Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
6. All-Glass Wings: Manufacturer's standard all-glass wings with tubular metal top and bottom rail members.
- a. Glass: **[Clear][Tinted]**, fully tempered float glass.
 - 1) Thickness: **[12 mm]<Insert dimension>**.
 - 2) Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
7. Push Bars: Manufacturer's standard **[horizontal][vertical]** push bars, finished to match wings.
- a. Shape: **[Round bars, 1 inch (25 mm) in diameter][Flat bars, 1/2 inch thick and 1-1/2 inches (13 mm thick and 38 mm) high][Manufacturer's standard]<Insert dimension>**.
8. Locks: Manufacturer's standard deadbolt locks to receive cylinders; minimum of two for each revolving door entrance, finish to match wings.
- a. Cylinders: Comply with requirements in Section 087100 "Door Hardware."
 - b. Mounting: **[Surface applied][Mortised]**.
 - c. Location: Extend bolt from **[bottom of wing into floor][top of wing into ceiling][bottom of wing into base of wall enclosure]**.
9. Enclosure Walls: Manufacturer's standard, with **1-3/4-inch- (45-mm-)** thick tubular framing members.
- a. Configuration: **[Curved][Segmented]<Insert configuration>**.
 - b. Glass: **[Clear][Tinted]**, fully tempered float glass.
 - 1) Thickness: **[6 mm][8 mm]<Insert dimension>**.
 - 2) Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
 - c. Laminated Glass: **[Clear][Tinted]** consisting of two plies of fully tempered float glass with a PVB interlayer.
 - 1) Thickness: **[Two 3 mm thick lites, 0.060-inch- (1.52-mm-) thick interlayer][Two 5 mm thick lites, 0.060-inch- (1.52-mm-) thick interlayer][Two 6 mm thick lites, 0.060-inch- (1.52-mm-) thick interlayer][Two 8 mm thick lites, 0.060-inch- (1.52-mm-) thick interlayer][As indicated]<Insert dimension>**.
 - 2) Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
 - d. Muntin Bars: Horizontal tubular rail member for each enclosure wall; match stile design.
10. Canopy: Manufacturer's standard ceiling, fascia, **[roof,]** and framing with size, layout, materials, and exposed finishes matching enclosure walls unless otherwise indicated.

- a. Metal-Clad Plywood: Fabricate from **3/4-inch- (19-mm-)** thick plywood clad with metal sheet. Provide ceiling-access panels for repairs to or maintenance of speed-control unit or overhead pivot for recessed, floor-mounted speed-control unit.
 - b. Metal: Fabricate from minimum **0.125-inch- (3.18-mm-)** thick aluminum sheet. Provide ceiling-access panels for repairs to or maintenance of speed-control unit or overhead pivot for recessed, floor-mounted speed-control unit.
 - c. Glass: **[Clear][Tinted]** laminated glass ceiling with two plies of heat-strengthened or tempered glass separated by a PVB interlayer.
 - 1) Thickness: **[Two 6 mm thick lites, 0.060-inch- (1.52-mm-) thick interlayer][6 mm thick top lite and 12 mm thick bottom lite, 0.060-inch- (1.52-mm-) thick interlayer][As indicated]<Insert dimension>**.
 - 2) Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
 - d. Ceiling Lights: Manufacturer's standard, consisting of two recessed LED fixtures within the ceiling of the revolving door entrance enclosure, complete with lamps and translucent lenses.
 - e. Canopy Roof: Manufacturer's standard construction, with material and finish matching enclosure walls where visible.
 - f. Recessed Grilles: Provide grille complete with floor pan **[and drainage fitting]** at entry segment only. Fabricate grille, using welded joints, from minimum **1/4-inch-wide by 1-inch-tall (6-mm-wide by 25-mm-tall)**, concentrically curved **[stainless steel][bronze]** bar stock with **1/4-inch (6-mm)** spacing.
- B. Materials: **[Extruded aluminum][Stainless steel clad, extruded aluminum][Copper-alloy-clad, extruded aluminum]**.
1. Main Extrusions and Tubing: Minimum wall thickness of **0.125 inch (3.18 mm)**.
 2. Cladding: Minimum **0.04 inch (1.0 mm)** thick.
- C. Fabrication: Fabricate revolving door entrance components to designs, sizes, thicknesses, and configurations indicated with profiles that are sharp, straight, and free of defects or deformations. Accurately fit joints with ends coped or mitered to produce hairline joints free of burrs and distortion. Prefit all hardware at the factory. Provide anchorage and alignment brackets for concealed support of assembly from the building structure.
1. Wings: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
 - a. Glaze wings at the factory. Comply with glazing requirements specified in this Section and in Section 088000 "Glazing." Provide minimum clearances for thickness and type of glass indicated in accordance with NGA's "GANA Glazing Manual."
 - b. Provide sliding weather stripping, mortised into stiles and rails of wings, to be adjustable and replaceable without dismantling wings.
 - c. Welded Construction: Weld reinforcement firmly in place. Weld corners. Grind and polish welds to produce an invisible joint. Mechanically finish exposed surfaces after fabrication to eliminate surface blemishes caused by welding, rolling, bending, and forming.
 - d. Mechanically Joined Construction: Joints to be tightly bolted together. Glass stops to be snap-in type where possible.
 - e. Mechanically Joined Clad Construction: Joints to be tightly bolted together to produce hairline joints. Finish material before fabrication. Carefully assemble to prevent welds or adhesives from blemishing finished surfaces. Glass stops to be snap-in type where possible.
 2. Enclosure Walls and Canopy: Fabricate tubular and channel frame assemblies in configuration indicated, with welded or mechanical joints, in accordance with manufacturer's standards and as

specified. Provide subframes as required for a complete system to support required loads.

- a. Exterior Framing: Fabricate components to drain water-passing joints and condensation and moisture occurring or migrating within the system to the exterior. Provide anchorage and alignment brackets for concealed support of assembly from the building structure. Allow for thermal expansion of exterior units.
- D. Aluminum Finishes: **[Clear anodic][Color anodic][Baked enamel or powder coat][High performance, organic]<Insert finish>**.
- 1. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.
- E. Stainless Steel Finishes: **[Directional satin finish, No. 4][Reflective, directional polish, No. 7][Mirrorlike reflective, nondirectional polish, No. 8]<Insert finish>**.
- F. Copper-Alloy Finishes: **[Buffed finish][Medium-satin finish]<Insert finish>**.

2.4 AUTOMATIC REVOLVING DOOR ENTRANCES

- A. Automatic Revolving Door Entrances : Manufacturer's standard **[two-wing][three-wing][four-wing]** automatic revolving door entrance, complete with **[center shaft][core][core with rotating glazed display case]**, drive assembly, wings, hardware, enclosure walls, canopy, glass and glazing, activation devices, safety devices, and accessories required for a complete installation.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ASSA ABLOY Entrance Systems; ASSA ABLOY]**
 - b. **[Boon Edam, Inc.]**
 - c. **[Crane Revolving Doors; dormakaba USA Inc.]**
 - d. **[Horton Automatics; Overhead Door Corporation]**
 - e. **[International Revolving Door]**
 - f. **[STANLEY Rush; STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]**
 - g. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ASSA ABLOY Entrance Systems; ASSA ABLOY]**
 - b. **[Boon Edam, Inc.]**
 - c. **[Crane Revolving Doors; dormakaba USA Inc.]**
 - d. **[Horton Automatics; Overhead Door Corporation]**
 - e. **[International Revolving Door]**
 - f. **[STANLEY Rush; STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]**
 - g. **<Insert manufacturer's name>**
 - 3. Drive Assembly: Provide an electric drive unit with speed regulator to permit and control automatic rotation of wings. Drive unit allows for manual operation of door upon loss of power.

4. Furnish power-operation equipment to suit current characteristics of building electrical service.
 4. Fold-to-Side Mechanism: Manufacturer's standard overhead carriage, guide support track, pivot mechanism, and other components necessary to permit folded wings to be moved to one side of revolving door entrance enclosure.
 5. Electric Wing Locking: Provide fail-safe electromagnetic wing lock mechanism to prevent breakout of door wings when engaged. Loss of power or signal from building fire/smoke alarm will release electromagnetic lock, allowing for breakout.
 6. Manual-Push Activation: Pushing wing activates unit and maintains rotation of wings for manufacturer's standard preset time. Provide signage on each wing visible in direction of traffic flow with instructions to start rotation.
 7. Continuous Operation: Wings revolve continuously.
 8. Signal Activation: Signal from activation device begins and maintains rotation of wings for manufacturer's standard preset time.
- a. Motion Detectors: Self-contained, K-band-frequency, microwave-scanner units with metal or plastic housing; to provide adjustable detection-field sizes, patterns, and functions required by ANSI/BHMA A156.10. Mount centered on both sides of canopy fascia.
 - b. Control Mats: **1/2-inch- (13-mm-)** thick, synthetic-rubber or flexible-plastic mat in safety-ribbed surface pattern, with extruded-aluminum frame; with pressure switches for low-voltage control wiring; and complying with performance requirements in ANSI/BHMA A156.10 including Appendix A.
 - 1) Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from full range of industry colors]<Insert color>**.
 - 2) Frame: **[Recessed to fit flush with floor; with concealed anchors][Surface mounted; with tapered safety edge]**.
 - c. Push-Plate Switch: Momentary-contact control switch with flat push plate actuator **[with contrasting-colored, engraved message]**.
 - 1) Configuration: **[4.5-inch (114-mm)]<Insert dimension>, [Round][Square]** push plate.
 - a) Mounting: **[Recess mounted, semiflush in wall][Surface mounted on wall][Surface mounted on post][As indicated on Drawings]** on right-hand side of opening.
 - 2) Configuration, Full Length: **36-inch (914-mm)** high-low push plate.
 - a) Mounting: **[Recess mounted, semiflush in wall][Surface mounted on wall][Surface mounted on post][As indicated on Drawings]** on right-hand side of opening.
 - 3) Push-Plate Material: **[Stainless steel][Plastic]** as selected by Architect from manufacturer's full range.
 - 4) Message: **["Push to Open"]<Insert message>**.
 - d. Touchless Switch: Hands-free-activated door-control switch with flat motion sensor faceplate **[with contrasting-colored, engraved message]**.
 - 1) Configuration: **[4.5-inch (114-mm)]<Insert dimension>, [Round][Square]** faceplate.
 - a) Mounting: **[Recess mounted, semiflush in wall][Surface mounted on wall][Surface mounted on post][As indicated on Drawings]** on right-hand

side of opening.

- 2) Faceplate Material: **[Stainless steel][Plastic][Stainless steel with backlight acrylic window]** as selected by Architect from manufacturer's full range.
 - 3) Message: **["Wave to Open"]["Wave to Open" and wave symbol]<Insert message>**.
- e. Push-Button Switch: Momentary-contact control switch with one red-button actuator. Provide blue plastic cover engraved with message "Press to Open" in white letters.
- 1) Mounting: **[Recess mounted, semiflush in wall][Surface mounted on wall][Surface mounted on post][As indicated on Drawings]** on right-hand side of opening.
- f. Key Switch: Recess-mounted control switch with key-controlled actuator. Provide faceplate engraved with letters indicating switch functions.
- 1) Functions: **[On-off][On-off, momentary contact]<Insert functions>**.
 - 2) Mounting: **[Recess mounted, semiflush in wall][Surface mounted on wall][Surface mounted on post][As indicated on Drawings]** on right-hand side of opening.
9. Communication System: Provide **[visual signal][and][digital field programmable voice messaging]**.
10. Stile-and-Rail Wings: Manufacturer's standard with **1-3/4-inch- (45-mm-)** thick tubular stile-and-rail members.
- a. Stile Design: **[Narrow stile, 2-inch (51-mm) nominal width][Medium stile, 3-1/2-inch (89-mm) nominal width][Wide stile, 5-inch (127-mm) nominal width][As indicated on Drawings]**.
 - b. Rail Design: **[3-inch (76-mm) nominal height][4-inch (102-mm) nominal height][As indicated on Drawings]**.
 - c. Muntin Design: To match stile design.
 - d. Glass: **[Clear][Tinted]**, fully tempered float glass.
 - 1) Thickness: **[6 mm][8 mm][10 mm]<Insert dimension>**.
 - 2) Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
 - e. Signage: Provide signage on door visible from both sides of each wing indicating "Automatic Door," location as indicated on Drawings.
11. Push Bars: Manufacturer's standard **[horizontal][vertical]** push bars, finished to match wings.
- a. Shape: **[Round bars, 1 inch (25 mm) in diameter][Flat bars, 1/2 inch thick and 1-1/2 inches (13 mm thick and 38 mm) high][Manufacturer's standard]<Insert shape>**.
12. Locking:
- a. Electric Locking: Internal electromechanical lock.
 - b. Mechanical Locking: Manufacturer's standard deadbolt locks to receive cylinders; minimum of two for each revolving door entrance, finish to match wings.
 - 1) Cylinders: Comply with requirements in Section 087100 "Door Hardware."
 - 2) Mounting: **[Surface applied][Mortised]**.
 - 3) Location: Extend bolt from **[bottom of wing into floor][top of wing into**

ceiling][bottom of wing into base of wall enclosure].

13. Enclosure Walls: Manufacturer's standard, with **1-3/4-inch- (45-mm-)** thick tubular framing members.
 - a. Configuration: **[Curved][Segmented]<Insert configuration>**.
 - b. Glass: **[Clear][Tinted]**, fully tempered float glass.
 - 1) Thickness: **[6 mm][8 mm]<Insert dimension>**.
 - 2) Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
 - c. Laminated Glass: **[Clear][Tinted]** consisting of two plies of fully tempered float glass with a PVB interlayer.
 - 1) Thickness: **[Two 3 mm thick lites, 0.060-inch- (1.52-mm-) thick interlayer][Two 5 mm thick lites, 0.060-inch- (1.52-mm-) thick interlayer][Two 6 mm thick lites, 0.060-inch- (1.52-mm-) thick interlayer][Two 8 mm thick lites, 0.060-inch- (1.52-mm-) thick interlayer][As indicated]<Insert dimension>**.
 - 2) Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
 - d. Muntin Bars: Horizontal tubular rail member for each enclosure wall; match stile design.
14. Canopy: Manufacturer's standard ceiling, fascia, **[roof,]** and framing with size, layout, materials, and exposed finishes matching enclosure walls unless otherwise indicated.
 - a. Metal-Clad Plywood: Fabricate from **3/4-inch- (19-mm-)** thick plywood clad with metal sheet. Provide ceiling-access panels for repairs to or maintenance of drive assembly.
 - b. Metal: Fabricate from minimum **0.125-inch- (3.18-mm-)** thick aluminum sheet. Provide ceiling-access panels for repairs to or maintenance of drive assembly.
 - c. Glass: **[Clear][Tinted]** laminated glass ceiling with two plies of heat-strengthened or tempered glass separated by a PVB interlayer.
 - 1) Thickness: **[Two 6 mm thick lites, 0.060-inch- (1.52-mm-) thick interlayer][6 mm thick top lite and 12 mm thick bottom lite, 0.060-inch- (1.52-mm-)thick interlayer][As indicated]<Insert dimension>**.
 - 2) Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
 - d. Ceiling Lights: Manufacturer's standard, consisting of two recessed LED fixtures within the ceiling of the revolving door entrance enclosure, complete with lamps and translucent lenses.
 - e. Canopy Roof: Manufacturer's standard construction, with material and finish matching enclosure walls where visible.
 - f. Recessed Grilles: Provide grille complete with floor pan **[and drainage fitting]** at entry quadrant only. Fabricate grille, using welded joints, from minimum **1/4-inch-wide by 1-inch-tall (6-mm-wide by 25-mm-tall)**, concentrically curved **[stainless steel][bronze]** bar stock with **1/4-inch (6-mm)** spacing.
15. Rotating Glazed Display Case: Glazed enclosure incorporated into core, with framing matching wings and with panel on one side for access to display area.
16. Safety Devices: Manufacturer's standard safety devices as required to stop or slow rotation. Provide the following:
 - a. Emergency Stop Button: Momentary-contact, red push-button switch to immediately stop wing rotation **[and reverse direction to entry position]**. Provide sign indicating "Emergency Stop," location as indicated on Drawings.

- 1) Mounting: **[Recess mounted, semiflush in wall][Surface mounted on wall][Surface mounted on post][As indicated on Drawings]** on right-hand side of opening.
 - b. Slow-Speed Operation Button: Momentary-contact push-button switch or plate to slow wing rotation by reducing rpm by one half. Include sign indicating operation, location as indicated on Drawings.
 - 1) Mounting: **[Recess mounted, semiflush in wall][Surface mounted on wall][Surface mounted on post][As indicated on Drawings]** on right-hand side of opening.
 - c. Vertical Safety Sensors:
 - 1) End Wall Sensor Strip: Compressible safety switch consisting of an impact-pressure-activated, internal-contact switch (sensor strip) encapsulated in a flexible housing. Mount on enclosure walls at vertical edge of entry.
 - 2) Entry Point Sensor: Self-contained, active infrared sensor with metal or plastic housing; to provide adjustable detection-field sizes, patterns, and functions, including presence sensor monitoring, required by ANSI/BHMA A156.27. Detectors remain active at all times. Mount recessed in canopy ceiling at right-hand side of opening.
 - d. Horizontal Safety Sensors:
 - 1) Bottom Rail Sensor Strip: Compressible safety switch consisting of an impact-pressure-activated, internal-contact switch (sensor strip) encapsulated in a flexible housing. Mount at bottom edge of each wing.
 - 2) Wing Presence Sensor: Self-contained, active infrared sensor with metal or plastic housing; to provide adjustable detection-field sizes, patterns, and functions, including presence sensor monitoring, required by ANSI/BHMA A156.27. Detectors remain active at all times. Mount **[recessed in canopy ceiling][to top rail of each door wing]**.
17. Signage: As required by ANSI/BHMA A156.27.
- a. Application Process: **[Decals][Silk-screened][Door manufacturer's standard process]<Insert requirement>**.
 - b. Provide sign materials with instructions for field application after glazing is installed.
- B. Materials: **[Extruded aluminum][Stainless steel clad, extruded aluminum][Copper-alloy-clad, extruded aluminum]**.
1. Main Extrusions and Tubing: Minimum wall thickness of **0.125 inch (3.18 mm)**.
 2. Cladding: Minimum **0.04 inch (1.0 mm)** thick.
- C. Fabrication: Fabricate revolving door entrance components to designs, sizes, thicknesses, and configurations indicated with profiles that are sharp, straight, and free of defects or deformations. Accurately fit joints with ends coped or mitered to produce hairline joints free of burrs and distortion. Prefit all hardware at the factory. Provide anchorage and alignment brackets for concealed support of assembly from the building structure.
1. Wings: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.

- a. Glaze wings at the factory. Comply with glazing requirements specified in this Section and in Section 088000 "Glazing." Provide minimum clearances for thickness and type of glass indicated in accordance with NGA's "GANA Glazing Manual."
 - b. Provide sliding weather stripping, mortised into stiles and rails of wings, to be adjustable and replaceable without dismantling wings.
 - c. Welded Construction: Weld reinforcement firmly in place. Weld corners. Grind and polish welds to produce an invisible joint. Mechanically finish exposed surfaces after fabrication to eliminate surface blemishes caused by welding, rolling, bending, and forming.
 - d. Mechanically Joined Construction: Joints to be tightly bolted together. Glass stops to be snap-in type where possible.
 - e. Mechanically Joined Clad Construction: Joints to be tightly bolted together to produce hairline joints. Finish material before fabrication. Carefully assemble to prevent welds or adhesives from blemishing finished surfaces. Glass stops to be snap-in type where possible.
2. Enclosure Walls and Ceilings: Fabricate tubular and channel frame assemblies in configuration indicated, with welded or mechanical joints, in accordance with manufacturer's standards and as specified. Provide subframes as required for a complete system to support required loads.
 - a. Exterior Framing: Fabricate components to drain water-passing joints and condensation and moisture occurring or migrating within the system to the exterior. Provide anchorage and alignment brackets for concealed support of assembly from the building structure. Allow for thermal expansion of exterior units.
- D. Aluminum Finishes: **[Clear anodic][Color anodic][Baked enamel or powder coat][High performance, organic]<Insert finish>**.
1. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.
- E. Stainless Steel Finishes: **[Directional satin finish][Reflective, directional polish][Mirrorlike reflective, nondirectional polish]<Insert finish>**.
- F. Copper-Alloy Finishes: **[Buffed finish][Medium-satin finish]<Insert finish>**.
- 2.5 MANUAL ACCESS-CONTROL REVOLVING DOOR ENTRANCES
- A. Manual Access-Control Revolving Door Entrances : Manufacturer's standard **[three-wing][four-wing]** manual access-control revolving door entrance, complete with center shaft, speed-control unit, wings, hardware, enclosure walls, canopy, glass and glazing, activation devices, safety devices, and accessories required for a complete installation.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Boon Edam, Inc.]**
 - b. **[Crane Revolving Doors; dormakaba USA Inc.]**
 - c. **[International Revolving Door]**
 - d. **[STANLEY Rush; STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert**

manufacturer's name; product name or designation> or comparable product by one of the following:

- a. **[Boon Edam, Inc.]**
 - b. **[Crane Revolving Doors; dormakaba USA Inc.]**
 - c. **[International Revolving Door]**
 - d. **[STANLEY Rush; STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]**
 - e. **<Insert manufacturer's name>**
3. Manual Operation: Valid authorization signal from access-control system or emergency system will allow door to operate by manually pushing the door counter clockwise to allow single passage only; manufacturer's standard braking system to secure door.
 4. Manual Speed-Control Unit: Mechanical speed regulator that allows free rotation of wings up to a predetermined rate of speed and that engages a clutch-type brake to prevent rapid acceleration of wings.
 - a. Location: **[Recessed, floor mounted][Overhead]**.
 5. Fold-to-Side Mechanism: Manufacturer's standard overhead carriage, guide support track, pivot mechanism, and other components necessary to permit folded wings to be moved to one side of revolving door entrance enclosure.
 6. Electric Wing Locking: Provide manufacturer's standard programmable fail-secure or fail-safe electromagnetic wing lock mechanism to prevent breakout of door wings. Fail safe: Loss of power or signal from building fire/smoke alarm will release electromagnetic lock allowing for breakout. Fail secure: Loss of power will engage electromagnetic lock, preventing breakout.
 7. Activation Devices: **[Keypads][Card readers][Biometric identity verification equipment]** as specified in **[Section 087100 "Door Hardware."][Section 281500 "Access Control Hardware Devices."]**
 - a. Mounting: **[Recess mounted, semiflush in wall][Surface mounted on wall][Surface mounted on post][As indicated on Drawings]** on right-hand side of opening.
 8. Communication System: Provide **[visual signal][and][digital field programmable voice messaging]**.
 9. Stile-and-Rail Wings: Manufacturer's standard with **1-3/4-inch- (45-mm-)** thick, tubular stile-and-rail members.
 - a. Stile Design: **[Narrow stile, 2-inch (51-mm) nominal width][Medium stile, 3-1/2-inch (89-mm) nominal width][Wide stile, 5-inch (127-mm) nominal width][As indicated on Drawings]**.
 - b. Rail Design: **[3-inch (76-mm) nominal height][4-inch (102-mm) nominal height][As indicated on Drawings]**.
 - c. Muntin Design: To match stile design.
 - d. Glass: **[Clear][Tinted]**, fully tempered float glass.
 - 1) Thickness: **[6 mm][8 mm][10 mm]<Insert dimension>**.
 - 2) Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
 10. Push Bars: Manufacturer's standard **[horizontal][vertical]** push bars, finished to match wings.
 - a. Shape: **[Round bars, 1 inch (25 mm) in diameter][Flat bars, 1/2 inch thick and 1-1/2 inches (13 mm thick and 38 mm) high][Manufacturer's standard]<Insert dimension>**.
 11. Locks: Manufacturer's standard deadbolt locks to receive cylinders; minimum of two for each

revolving door entrance, finish to match wings.

- a. Cylinders: Comply with requirements in Section 087100 "Door Hardware."
 - b. Mounting: **[Surface applied][Mortised]**.
 - c. Location: Extend bolt from **[bottom of wing into floor][top of wing into ceiling][bottom of wing into base of wall enclosure]**.
12. Enclosure Walls: Manufacturer's standard, with **1-3/4-inch- (45-mm-)** thick tubular framing members.
- a. Configuration: **[Curved][Segmented]<Insert configuration>**.
 - b. Glass: **[Clear][Tinted]**, fully tempered float glass.
 - 1) Thickness: **[6 mm][8 mm]<Insert dimension>**.
 - 2) Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
 - c. Laminated Glass: **[Clear][Tinted]** consisting of two plies of fully tempered float glass with a PVB interlayer.
 - 1) Thickness: **[Two 3 mm thick lites, 0.060-inch- (1.52-mm-) thick interlayer][Two 5 mm thick lites, 0.060-inch- (1.52-mm-) thick interlayer][Two 6 mm thick lites, 0.060-inch- (1.52-mm-) thick interlayer][Two 8 mm thick lites, 0.060-inch- (1.52-mm-) thick interlayer][As indicated]<Insert dimension>**.
 - 2) Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
 - d. Muntin Bars: Horizontal tubular rail member for each enclosure wall; match stile design.
13. Canopy: Manufacturer's standard ceiling, fascia,**[roof,]** and framing with size, layout, materials, and exposed finishes matching enclosure walls unless otherwise indicated.
- a. Metal-Clad Plywood: Fabricate from **3/4-inch- (19-mm-)** thick plywood clad with metal sheet. Provide ceiling-access panels for repairs to or maintenance of speed-control units.
 - b. Metal: Fabricate from minimum **0.125-inch- (3.18-mm-)** thick, aluminum sheet. Provide ceiling-access panels for repairs to or maintenance of speed-control units.
 - c. Ceiling Lights: Manufacturer's standard, consisting of two recessed LED fixtures within the ceiling of the revolving door entrance enclosure, complete with lamps and translucent lenses.
 - d. Canopy Roof: Manufacturer's standard constructions, with material and finish matching enclosure walls where visible.
 - e. Recessed Grilles: Provide grille complete with floor pan**[and drainage fitting]** at entry quadrant only. Fabricate, using welded joints, from minimum **1/4-inch-wide by 1-inch-tall (6-mm-wide by 25-mm-tall)**, concentrically curved **[stainless steel][bronze]** bar stock with **1/4-inch (6-mm)** spacing.
- B. Materials: **[Extruded aluminum][Stainless steel clad, extruded aluminum][Copper-alloy-clad, extruded aluminum]**.
1. Main Extrusions and Tubing: Minimum wall thickness of **0.125 inch (3.18 mm)**.
 2. Cladding: Minimum **0.04 inch (1.0 mm)** thick.
- C. Fabrication: Fabricate revolving door entrance components to designs, sizes, thicknesses, and configurations indicated with profiles that are sharp, straight, and free of defects or deformations. Accurately fit joints with ends coped or mitered to produce hairline joints free of burrs and distortion. Prefit all hardware at the factory. Provide anchorage and alignment brackets for concealed support of assembly from the building structure.

1. Wings: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
 - a. Glaze wings at the factory. Comply with glazing requirements specified in this Section and in Section 088000 "Glazing." Provide minimum clearances for thickness and type of glass indicated in accordance with NGA's "GANA Glazing Manual."
 - b. Provide sliding weather stripping, mortised into stiles and rails of wings, to be adjustable and replaceable without dismantling wings.
 - c. Welded Construction: Weld reinforcement firmly in place. Weld corners. Grind and polish welds to produce an invisible joint. Mechanically finish exposed surfaces after fabrication to eliminate surface blemishes caused by welding, rolling, bending, and forming.
 - d. Mechanically Joined Construction: Joints to be tightly bolted together. Glass stops to be snap-in type where possible.
 - e. Mechanically Joined Clad Construction: Joints to be tightly bolted together to produce hairline joints. Finish material before fabrication. Carefully assemble to prevent welds or adhesives from blemishing finished surfaces. Glass stops to be snap-in type where possible.
 2. Enclosure Walls and Ceilings: Fabricate tubular and channel frame assemblies in configuration indicated, with welded or mechanical joints, in accordance with manufacturer's standards and as specified. Provide subframes as required for a complete system to support required loads.
 - a. Exterior Framing: Fabricate components to drain water-passing joints and condensation and moisture occurring or migrating within the system to the exterior. Provide anchorage and alignment brackets for concealed support of assembly from the building structure. Allow for thermal expansion of exterior units.
- D. Aluminum Finishes: **[Clear anodic][Color anodic][Baked enamel or powder coat][High performance, organic]<Insert finish>**.
1. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.
- E. Stainless Steel Finishes: **[Directional satin finish][Reflective, directional polish][Mirrorlike reflective, nondirectional polish]<Insert finish>**.
- F. Copper-Alloy Finishes: **[Buffed finish][Medium-satin finish]<Insert finish>**.

2.6 AUTOMATIC ACCESS-CONTROL REVOLVING DOOR ENTRANCES

- A. Automatic Access-Control Revolving Door Entrances : Manufacturer's standard **[four-wing][three-wing]** automatic access-control revolving door entrance, complete with **[center shaft][core]**, drive assembly, wings, hardware, enclosure walls, canopy, glass and glazing, activation devices, safety devices, and accessories required for a complete installation.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ASSA ABLOY Entrance Systems; ASSA ABLOY]**
 - b. **[Boon Edam, Inc.]**
 - c. **[Crane Revolving Doors; dormakaba USA Inc.]**
 - d. **[Horton Automatics; Overhead Door Corporation]**

- e. **[International Revolving Door]**
 - f. **[STANLEY Rush; STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]**
 - g. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ASSA ABLOY Entrance Systems; ASSA ABLOY]**
 - b. **[Boon Edam, Inc.]**
 - c. **[Crane Revolving Doors; dormakaba USA Inc.]**
 - d. **[Horton Automatics; Overhead Door Corporation]**
 - e. **[International Revolving Door]**
 - f. **[STANLEY Rush; STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]**
 - g. **<Insert manufacturer's name>**
 3. Automatic Operation: Valid authorization signal from access-control system activates the unit and revolves the door up to one turn, then returns door wings to quarter-point position. Provide signage on door visible from both sides of each wing indicating "Automatic Door," location as indicated on Drawings.
 4. Drive Assembly: Provide an electric drive unit with speed regulator to permit and control automatic rotation of wings. Drive unit allows for manual operation of door to the emergency egress position upon loss of power. Furnish power-operation equipment to suit current characteristics of building electrical service.
 5. Fold-to-Side Mechanism: Manufacturer's standard overhead carriage, guide support track, pivot mechanism, and other components necessary to permit folded wings to be moved to one side of revolving door entrance enclosure.
 6. Electric Wing Locking: Provide manufacturer's standard programmable fail-secure or fail-safe electromagnetic wing lock mechanism to prevent breakout of door wings. Fail safe: Loss of power or signal from building fire/smoke alarm will release electromagnetic lock allowing for breakout. Fail secure: Loss of power will engage electromagnetic lock, preventing breakout.
 7. Activation Devices: **[Keypads][Card readers][Biometric identity verification equipment]** as specified in **[Section 087100 "Door Hardware."][Section 281500 "Access Control Hardware Devices."]**
 - a. Mounting: **[Recess mounted, semiflush in wall][Surface mounted on wall][Surface mounted on post][As indicated on Drawings]** on right-hand side of opening.
 8. Access-Control Operation: **[One way; access-controlled entry, free exit][One way; free entry, access-controlled exit][Two way; access-controlled entry and exit][As indicated on Drawings].**
 9. Communication System: Provide **[visual signal][and][digital field programmable voice messaging].**
 10. Stile-and-Rail Wings: Manufacturer's standard with **1-3/4-inch- (45-mm-)** thick, tubular stile-and-rail members.
 - a. Stile Design: **[Narrow stile, 2-inch (51-mm) nominal width][Medium stile, 3-1/2-inch (89-mm) nominal width][Wide stile, 5-inch (127-mm) nominal width][As indicated on Drawings].**
 - b. Rail Design: **[3-inch (76-mm) nominal height][4-inch (102-mm) nominal height][As indicated on Drawings].**
 - c. Muntin Design: To match stile design.
 - d. Glass: **[Clear][Tinted]**, fully tempered float glass.

- 1) Thickness: **[6 mm][8 mm][10 mm]<Insert dimension>**.
 - 2) Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
11. Locking:
- a. Electric Locking: Internal electromechanical lock.
 - b. Mechanical Locking: Manufacturer's standard deadbolt locks to receive cylinders; minimum of two for each revolving door entrance, finish to match wings.
 - 1) Cylinders: Comply with requirements in Section 087100 "Door Hardware."
 - 2) Mounting: **[Surface applied][Mortised]**.
 - 3) Location: Extend bolt from **[bottom of wing into floor][top of wing into ceiling][bottom of wing into base of wall enclosure]**.
12. Enclosure Walls: Manufacturer's standard, with **1-3/4-inch- (45-mm-)** thick tubular framing members.
- a. Configuration: **[Curved][Segmented]<Insert configuration>**.
 - b. Glass: **[Clear][Tinted]**, fully tempered float glass.
 - 1) Thickness: **[6 mm][8 mm]<Insert dimension>**.
 - 2) Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
 - c. Laminated Glass: **[Clear][Tinted]** consisting of two plies of fully tempered float glass with a PVB interlayer.
 - 1) Thickness: **[Two 3 mm thick lites, 0.060-inch- (1.52-mm-) thick interlayer][Two 5 mm thick lites, 0.060-inch- (1.52-mm-) thick interlayer][Two 6 mm thick lites, 0.060-inch- (1.52-mm-) thick interlayer][Two 8 mm thick lites, 0.060-inch- (1.52-mm-) thick interlayer][As indicated]<Insert dimension>**.
 - 2) Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
 - d. Muntin Bars: Horizontal tubular rail member for each enclosure wall; match stile design.
13. Canopy: Manufacturer's standard ceiling, fascia, **[roof,]** and framing with size, layout, materials, and exposed finishes matching enclosure walls unless otherwise indicated.
- a. Metal-Clad Plywood: Fabricate from **3/4-inch- (19-mm-)** thick plywood clad with metal sheet. Provide ceiling-access panels for repairs to or maintenance of speed-control unit or overhead pivot for recessed, floor-mounted speed-control units.
 - b. Metal: Fabricate from minimum **0.125-inch- (3.18-mm-)** thick, aluminum sheet. Provide ceiling-access panels for repairs to or maintenance of speed-control unit or overhead pivot for recessed, floor-mounted speed-control units.
 - c. Ceiling Lights: Manufacturer's standard, consisting of two recessed LED fixtures within the ceiling of the revolving door entrance enclosure, complete with lamps and translucent lenses.
 - d. Canopy Roof: Manufacturer's standard constructions, with material and finish matching enclosure walls where visible.
 - e. Recessed Grilles: Provide grille complete with floor pan **[and drainage fitting]** at entry quadrant only. Fabricate, using welded joints, from minimum **1/4-inch-wide by 1-inch-tall (6-mm-wide by 25-mm-tall)**, concentrically curved **[stainless steel][bronze]** bar stock with **1/4-inch (6-mm)** spacing.
14. Safety Devices: Manufacturer's standard safety devices as required to stop or slow rotation. Provide the following:

- a. Emergency Stop Button: Momentary-contact, red push-button switch to immediately stop wing rotation[**and reverse direction to entry position**]. Provide sign indicating "Emergency Stop," location as indicated on Drawings.
 - 1) Mounting: [**Recess mounted, semiflush in wall**][**Surface mounted on wall**][**Surface mounted on post**][**As indicated on Drawings**] on right-hand side of opening on secure side.
 - b. Slow-Speed Operation Button: Momentary-contact push-button switch or plate to slow wing rotation by reducing rpm by one half. Include sign indicating operation, location as indicated on Drawings.
 - 1) Mounting: [**Recess mounted, semiflush in wall**][**Surface mounted on wall**][**Surface mounted on post**][**As indicated on Drawings**] on right-hand side on each side of opening.
 - c. Vertical Safety Sensors:
 - 1) End Wall Sensor Strip: Compressible safety switch consisting of an impact-pressure-activated, internal-contact switch (sensor strip) encapsulated in a flexible housing. Mount on enclosure walls at vertical edge of entry.
 - d. Horizontal Safety Sensors:
 - 1) Bottom Rail Sensor Strip: Compressible safety switch consisting of an impact-pressure-activated, internal-contact switch (sensor strip) encapsulated in a flexible housing. Mount at bottom edge of each wing.
 - 2) Wing Presence Sensor: Self-contained, active infrared sensor with metal or plastic housing; to provide adjustable detection-field sizes, patterns, and functions, including presence sensor monitoring, required by ANSI/BHMA A156.27. Detectors remain active at all times. Mount [**recessed in canopy ceiling**][**to top rail of each door wing**].
15. Security Devices:
 - a. Anti-Tailgating: Manufacturer's standard overhead sensors to monitor passage of authorized users.
 - b. Anti-Piggybacking: Manufacturer's standard overhead sensors to monitor passage of authorized users.
 - c. **<Insert device>**.
16. Signage: As required by ANSI/BHMA A156.27.
 - a. Application Process: [**Decals**][**Silk screened**][**Door manufacturer's standard process**]**<Insert requirement>**.
 - b. Provide sign materials with instructions for field application after glazing is installed.
- B. Materials: [**Extruded aluminum**][**Stainless steel clad, extruded aluminum**][**Copper-alloy-clad, extruded aluminum**].
 1. Main Extrusions and Tubing: Minimum wall thickness of **0.125 inch (3.18 mm)**.
 2. Cladding: Minimum **0.04 inch (1.0 mm)** thick.
- C. Fabrication: Fabricate revolving door entrance components to designs, sizes, thicknesses, and configurations indicated with profiles that are sharp, straight, and free of defects or deformations. Accurately fit joints with ends coped or mitered to produce hairline joints free of burrs and distortion.

Prefit all hardware at the factory. Provide anchorage and alignment brackets for concealed support of assembly from the building structure.

1. Wings: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.
 - a. Glaze wings at the factory. Comply with glazing requirements specified in this Section and in Section 088000 "Glazing." Provide minimum clearances for thickness and type of glass indicated in accordance with NGA's "GANA Glazing Manual."
 - b. Provide sliding weather stripping, mortised into stiles and rails of wings, to be adjustable and replaceable without dismantling wings.
 - c. Welded Construction: Weld reinforcement firmly in place. Weld corners. Grind and polish welds to produce an invisible joint. Mechanically finish exposed surfaces after fabrication to eliminate surface blemishes caused by welding, rolling, bending, and forming.
 - d. Mechanically Joined Construction: Joints to be tightly bolted together. Glass stops to be snap-in type where possible.
 - e. Mechanically Joined Clad Construction: Joints to be tightly bolted together to produce hairline joints. Finish material before fabrication. Carefully assemble to prevent welds or adhesives from blemishing finished surfaces. Glass stops to be snap-in type where possible.
2. Enclosure Walls and Ceilings: Fabricate tubular and channel frame assemblies in configuration indicated, with welded or mechanical joints, in accordance with manufacturer's standards and as specified. Provide subframes as required for a complete system to support required loads.
 - a. Exterior Framing: Fabricate components to drain water-passing joints and condensation and moisture occurring or migrating within the system to the exterior. Provide anchorage and alignment brackets for concealed support of assembly from the building structure. Allow for thermal expansion of exterior units.

D. Aluminum Finishes: **[Clear anodic][Color anodic][Baked enamel or powder coat][High performance, organic]<Insert finish>**.

1. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.

E. Stainless Steel Finishes: **[Directional satin finish][Reflective, directional polish][Mirrorlike reflective, nondirectional polish]<Insert finish>**.

F. Copper-Alloy Finishes: **[Buffed finish][Medium-satin finish]<Insert finish>**.

2.7 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Extruded Bars, Rods, Profiles, and Tubes: **ASTM B221 (ASTM B221M)**.
2. Sheet and Plate: **ASTM B209 (ASTM B209M)**.

B. Stainless Steel Sheet: ASTM A240/A240M, austenitic stainless steel, **[Type 304][Type 316]**.

C. Plate, Sheet, Strip, and Bars; Bronze: ASTM B36/B36M, alloy UNS No. C28000 (muntz metal, 60 percent copper).

D. Steel: ASTM A36/A36M plate, shapes, and bars; or ASTM A1008/A1008M sheet.

- E. Fasteners: Manufacturer's standard, of same basic metal as fastened metal, unless otherwise indicated.
- F. Weather Stripping: Heavy-duty, single-piece rubber or combination of rubber and felt.
- G. Nonshrink, Nonmetallic Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout; complying with ASTM C1107/C1107M; of consistency suitable for application.
- H. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for **15-mil (0.4-mm)** dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.8 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
- D. High-Performance Organic Finish: **[Two-coat][Three-coat][Four-coat]** fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2.9 STAINLESS STEEL FINISHES

- A. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Directional Satin Finish: No. 4.
 - 2. Reflective, Directional Polish: No. 7.
 - 3. Mirrorlike Reflective, Nondirectional Polish: No. 8.

2.10 COPPER-ALLOY FINISHES

- A. Buffed Finish: M21 (Mechanical Finish: Buffed, smooth specular).
- B. Medium-Satin Finish: M32 (Mechanical Finish: Directionally textured, medium satin).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install revolving door entrances in accordance with manufacturer's written instructions and ANSI/BHMA A156.27, including signage, controls, wiring, and connections to building power supply.
 - 1. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight. Do not install damaged components.
 - 2. Where aluminum contacts dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
 - 3. Where aluminum contacts concrete or masonry, protect against corrosion by painting contact surfaces with corrosion-resistant coatings.
- B. Recessed, Floor-Mounted Speed-Control Unit: Insert control unit in rough-in floor opening set on level bed of nonshrink, nonmetallic grout. Fill annular space between control unit and sides of recess with nonshrink, nonmetallic grout. Mix and place grout to comply with grout manufacturer's written instructions.
- C. Overhead-Mounted Speed-Control Unit: Insert pivot bearing in rough-in floor opening set on level bed of nonshrink, nonmetallic grout. Fill annular space between pivot bearing and sides of recess with nonshrink, nonmetallic grout. Mix and place grout to comply with grout manufacturer's written instructions.
- D. Overhead-Mounted Drive Unit: Insert pivot bearing in rough-in floor opening set on level bed of nonshrink, nonmetallic grout. Fill annular space between pivot bearing and sides of recess with nonshrink, nonmetallic grout. Mix and place grout to comply with grout manufacturer's written instructions.
- E. Connect drive unit to electrical power-distribution system.
- F. Install revolving door entrances plumb and true, without warp or rack of framing members and wings. Anchor securely in place.
 - 1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
 - 2. Install components to drain water-passing joints, condensation occurring within framing members, and moisture migrating within the assembly to exterior.
 - 3. Cut and trim framing during installation only with approval of manufacturer.
 - a. Restore finish and remove and replace members, as directed, where cutting and trimming have impaired strength or appearance.
 - b. Do not install members that are warped, bowed, deformed, or otherwise damaged or defaced to such an extent as to impair strength or appearance. Remove and replace members that have been damaged during installation.
- G. Activation and Safety Devices: Adjust devices to provide detection field and functions in compliance with ANSI/BHMA A156.27.
- H. Sealants: Comply with requirements specified in Section 079200 "Joint Sealants" to provide weathertight installation.
 - 1. Set continuous sill members and flashings in full sealant bed.
 - 2. Seal perimeter of framing members with sealant.
- I. Signage: Apply signage as required by ANSI/BHMA A156.27.

3.3 FIELD QUALITY CONTROL

- A. Certified Inspector: **[Owner will engage][Engage]** a Certified Inspector to test and inspect components, assemblies, and installations, including connections.
- B. Perform the following tests and inspections **[with the assistance of a factory-authorized service representative]**:
 - 1. Test and inspect each revolving door entrance, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.
- C. Revolving door entrances will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust wings to provide an even, tight fit at contact points and weather stripping for smooth operation and weathertight closure. Adjust wings to operate smoothly and rotate evenly, with hardware and operators functioning properly.
 - 1. Lubricate operating hardware and other moving parts.
 - 2. Adjust **[speed-control unit][drive unit speed regulator]** for rpm no greater than maximum allowable rpm, as specified in ANSI/BHMA A156.27.
 - 3. Adjust pressure for collapse of wings for specified breakaway force.
- B. Readjust wings and **[speed-control unit][drive unit speed regulator]** after three days' use by normal traffic. Lubricate hardware and other moving parts.

3.5 CLEANING AND PROTECTION

- A. Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.
 - 1. Comply with requirements in Section 088000 "Glazing" for cleaning and maintaining glass.
- B. Limit construction traffic during remainder of construction period.

3.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service to include **[three][six][nine][12]** months' full maintenance by **[skilled employees of revolving door entrance Installer][manufacturer's authorized service representative]**. Include **[monthly][quarterly]** preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
- B. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.
 - 1. Engage a Certified Inspector to perform safety inspection after each adjustment or repair and at

-
- end of maintenance period. Furnish completed inspection reports to Owner.
 - 2. Perform maintenance, including emergency callback service, during normal working hours.
 - 3. Include 24-hour-per-day, seven-day-per-week emergency callback service.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain revolving door entrances.

END OF SECTION 08 42 33 00



Task	Specification	Specification Description
08 42 36 00	08 05 13 00	Stainless-Steel Doors and Frames



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SECTION 08 43 13 00 - ALUMINUM-FRAMED STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed storefront systems.

B. Related Requirements:

1. Section 014339 "Mockups" for preconstruction laboratory mockup testing.
2. Section 084126 "All-Glass Entrances and Storefronts" for systems without aluminum support framing.
3. Section 081116.13 "Interior Aluminum Doors and Frames" for interior aluminum framing.

1.2 ALLOWANCES

- A. **[Preconstruction laboratory mockup][source quality control][and][field quality control]** is part of testing and inspecting allowance.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1. **<Insert requirements>**.

1.4 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.
3. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
4. Environmental Product Declaration (EPD): For each product.
5. Health Product Declaration (HPD): For each product.
6. Environmental Product Declaration (EPD): For each product.
7. Health Product Declaration (HPD): For each product.

8. Environmental Product Declaration (EPD): For each product.
9. Environmental Product Declaration (EPD): For each product.
10. Environmental Product Declaration (EPD): For each product.
11. Third-Party Certifications: For each product.
12. Third-Party-Certified Life-Cycle Assessment: For each product.

C. Shop Drawings: For aluminum-framed storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed storefronts, showing the following:

- a. Joinery, including concealed welds.
- b. Anchorage.
- c. Expansion provisions.
- d. Glazing.
- e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

F. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from **12-inch (300-mm)** lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

G. Delegated Design Submittal: For aluminum-framed storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Mockup Testing Submittals:

1. Testing Program: Developed specifically for Project.
2. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.
3. Record Drawings: As-built drawings of preconstruction laboratory mockups showing changes made during preconstruction laboratory mockup testing.

B. Qualification Data:

1. For Installer[**and laboratory mockup testing agency**][**and field testing agency**].
2. For professional engineer's experience with providing delegated design engineering services of the type indicated, including documentation that engineer is licensed in the [jurisdiction][state] in which Project is located.

- C. Energy Performance Certificates: For aluminum-framed storefronts, accessories, and components, from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed storefront.
- D. Product Test Reports: For aluminum-framed storefronts, for tests performed by **[manufacturer and witnessed by a qualified testing agency][a qualified testing agency]**.
- E. Quality-Control Program: Developed specifically for Project, including fabrication and installation, in accordance with recommendations in ASTM C1401. Include periodic quality-control reports.
- F. Source quality-control reports.
- G. Field quality-control reports.
- H. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed storefronts to include in maintenance manuals.
- B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront to include in maintenance manuals. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AGM) contractors[**and that employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program**].
- B. Laboratory Mockup Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated[**and accredited by the International Accreditation Service or the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement as complying with ISO/IEC 17025**].
- C. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated[**and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025**] and acceptable to Owner and Architect.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- E. Structural-Sealant Glazing: Comply with ASTM C1401 for design and installation of storefront systems

that include structural glazing.

1.8 MOCKUPS

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
1. Build mockup of typical wall area as shown on Drawings.
 2. Testing shall be performed on mockups in accordance with requirements in "Field Quality Control" Article.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: **[Owner will engage][Engage]** a qualified testing agency to perform preconstruction testing on laboratory mockups.
1. Build preconstruction laboratory mockups at testing agency facility; use personnel, products, and methods of construction that will be used at Project site.
 2. Size and Configuration: As indicated on Drawings.
 3. Notify Architect **[seven]<Insert number>** days in advance of the dates and times when preconstruction laboratory mockups will be constructed and tested.
- B. Preconstruction Laboratory Mockup Testing: Test preconstruction laboratory mockups in accordance with requirements in "Performance Requirements" Article. Perform the following tests in the following order:
1. Structural, 50 percent: ASTM E330/E330M at 50 percent of positive test load.
 2. Air Leakage: ASTM E283.
 3. Water Penetration under Static Pressure: ASTM E331.
 4. Water Penetration under Dynamic Pressure: AAMA 501.1.
 5. Thermal Cycling: AAMA 501.5. Repeat the following:
 - a. Air Leakage: ASTM E283.
 - b. Water Penetration under Static Pressure: ASTM E331.
 6. Structural, 100 percent: ASTM E330/E330M at 100 percent of positive and negative test loads. Repeat the following:
 - a. Air Leakage: ASTM E283.
 - b. Water Penetration under Static Pressure: ASTM E331.
 - c. Water Penetration under Dynamic Pressure: AAMA 501.1.
 7. Structural, 150 percent: ASTM E330/E330M at 150 percent of positive and negative test loads.
- C. Preconstruction Adhesion and Compatibility Testing: Submit to structural glazing sealant manufacturer, for testing indicated below, Samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that is in close proximity to or is touching the structural or nonstructural sealants of a structural glazed system.

1. Compatibility: Test materials or components using ASTM C1087.
2. Adhesion: Test for adhesion or lack of adhesion of a structural sealant to the surface of another material or component using ASTM C1135.
3. Submit no fewer than **[eight]<Insert number>** pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
6. Testing will not be required if data based on previous testing of current sealant products match those submitted.

1.10 WARRANTY

- A. Special Warranty: **[Manufacturer][Installer]** agrees to repair or replace components of aluminum-framed storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals[, **metal finishes**,] and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 2. Warranty Period: **[Two][Five][10]<Insert number>** years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: **[Five][10][20]<Insert number>** years from date of Substantial Completion.
- C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D 4214.
 - c. Cracking, peeling, or chipping.
 2. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Aluminum-framed storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: **[As indicated on Drawings]<Insert loads>**.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
 - 1. Deflection Normal to Wall Plane: Limited to **[1/175 of length of span of the framing member for lengths of up to 13 feet 6 inches (4.1 m) and to 1/240 of length of span of the framing member plus 1/4 inch (6.35 mm) for lengths greater than 13 feet 6 inches (4.1 m)]<Insert deflection limit>**.
 - 2. Deflection Parallel to Glazing Plane: Limited to **[amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm)]<Insert deflection limit>**.
 - a. Operable Units: Provide a minimum **1/16-inch (1.6-mm)** clearance between framing members and operable units.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
 - 1. When tested at positive and negative wind-load design pressures, storefront assemblies do not evidence deflection exceeding specified limits.
 - 2. When tested at **[150]<Insert number>** percent of positive and negative wind-load design pressures, storefront assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding **[0.2]<Insert number>** percent of span.
 - 3. Test Durations: As required by design wind velocity, but not less than **[10]<Insert number>** seconds.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than [6.24 lbf/sq. ft. (300 Pa)][10 lbf/sq. ft. (480 Pa)][15 lbf/sq. ft. (720 Pa)]<Insert value>.
- G. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than [6.24 lbf/sq. ft. (300 Pa)][10 lbf/sq. ft. (480 Pa)][15 lbf/sq. ft. (720 Pa)]<Insert value>.
 2. Maximum Water Leakage: [In accordance with AAMA 501.1][No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation]. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.
- H. Seismic Performance: Aluminum-framed storefronts shall withstand the effects of earthquake motions determined in accordance with [ASCE/SEI 7]<Insert requirement>.
1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.6 at design displacement[and 1.5 times the design displacement].
- I. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than [0.41 Btu/sq. ft. x h x deg F (2.33 W/sq. m x K)][0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K)][0.57 Btu/sq. ft. x h x deg F (3.23 W/sq. m x K)][0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K)]<Insert value> as determined in accordance with NFRC 100.
 - b. Venting Windows: Whole window U-factor of not more than [0.37 Btu/sq. ft. x h x deg F (2.10 W/sq. m x K)][0.43 Btu/sq. ft. x h x deg F (2.44 W/sq. m x K)][0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K)][0.60 Btu/sq. ft. x h x deg F (3.40 W/sq. m x K)][0.65 Btu/sq. ft. x h x deg F (3.69 W/sq. m x K)]<Insert value> as determined in accordance with NFRC 100.
 2. Solar Heat Gain Coefficient (SHGC):
 - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than [0.26][0.35][0.40][0.45]<Insert value> as determined in accordance with NFRC 200.
 - b. Venting Windows: Whole window SHGC of not more than [0.22][0.27][0.30][0.40]<Insert value> as determined in accordance with NFRC 200.
 3. Air Leakage:
 - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than [0.06 cfm/sq. ft. (0.30 L/s per sq. m)]<Insert value> at a static-air-pressure differential of [1.57 lbf/sq. ft. (75 Pa)][6.24 lbf/sq. ft. (300 Pa)]<Insert value> when tested in accordance with ASTM E283.
 - b. Venting Windows: Whole window air leakage of not more than [0.3 cfm/sq. ft. (0.30 L/s per sq. m)]<Insert value> at a static-air-pressure differential of [6.24 lbf/sq. ft. (300 Pa)]<Insert value> when tested in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
 4. Condensation Resistance Factor (CRF):
 - a. Fixed Glazing and Framing Areas: CRF for the system of not less than [35][55][70]<Insert

- value**> as determined in accordance with AAMA 1503.
- b. Venting Windows: Whole window CRF of not less than **[45][52][55]<Insert value>** as determined in accordance with AAMA 1503.
- J. Noise Reduction: Test in accordance with ASTM E90, with ratings determined by ASTM E1332, as follows.
1. Outdoor-Indoor Transmission Class: Minimum **[26][30][34]<Insert number>**.
- K. Blast Resistance:
1. Hazard Rating: **[No Break][No Hazard][Minimal Hazard][Very Low Hazard][Low Hazard][Moderate Hazard][High Hazard]** in accordance with ASTM F2912, tested in accordance with ASTM F1642/F1642M.
 2. Performance Condition: **[1][2][3a][3b][4][5]** in accordance with GSA-TS01.
- L. Ballistic Resistance, UL 752: **[Listed and labeled as][Level 1][Level 2][Level 3][Level 4][Level 5][Level 6][Level 7][Level 8][Level 9][Level 10][Level 1-SG][Level 2-SG][Level 3-SG][Level 4-SG][Level 5-SG][Level 6-SG][Level 7-SG][Level 8-SG][Level 9-SG][Level 10-SG]** when tested in accordance with UL 752.
- M. Ballistic Resistance, ASTM F1233: **[Class/Level HG1][Class/Level HG2][Class/Level HG3][Class/Level HG4][Class/Level SMG][Class/Level R1][Class/Level R2][Class/Level R3][Class/Level R4-AP][Class/Level R5][Class/Level SH1][Class/Level SH2]** when tested in accordance with ASTM F1233.
- N. Ballistic Resistance, HPW-TP-0500.03: **[A][B][C][D][E]** when tested in accordance with HPW-TP-0500.03.
- O. Ballistic Resistance, SD-STD-01.01: **[R][SH]** when tested in accordance with SD-STD-01.01.
- P. Ballistic Resistance, NIJ STD-0108.01: **[Level I][Level IIA][Level II][Level IIIA][Level III][Level IV]** when tested in accordance with NIJ STD-0108.01.
- Q. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone **[1][2][3][4]** for **[basic][enhanced]** protection.
1. Large-Missile Test: For glazing located within **[30 feet (9.1 m)]<Insert dimension>** of grade.
 2. Small-Missile Test: For glazing located between **30 feet (9.1 m)** and **[60 feet (18.3 m)]<Insert dimension>** above grade.
- R. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
1. Temperature Change: **120 deg F (67 deg C)**, ambient; **180 deg F (100 deg C)**, material surfaces.
 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of **[180 deg F (82 deg C)]<Insert temperature>**.
 - b. Low Exterior Ambient-Air Temperature: **[0 deg F (minus 18 deg C)]<Insert temperature>**.
 - c. Interior Ambient-Air Temperature: **[75 deg F (24 deg C)]<Insert temperature>**.
- S. Structural-Sealant Joints:

1. Designed to carry gravity loads of glazing.

T. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed, aluminum-framed storefronts without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.2 ALUMINUM-FRAMED STOREFRONT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

1. **[Arcadia Inc.]**
2. **[Boyd Aluminum Mfg. Co.]**
3. **[CMI Architectural Products, Inc.]**
4. **[Coral Architectural Products; Coral Industries, Inc.]**
5. **[EFCO Corporation]**
6. **[Kawneer Company, Inc.; Arconic Corporation]**
7. **[Leed Himmel Industries, Inc.]**
8. **[Manko Window Systems, Inc.]**
9. **[Pittco Architectural Metals, Inc.]**
10. **[Trulite Glass & Aluminum Solutions, LLC.]**
11. **[Tubelite Inc.]**
12. **[U.S. Aluminum; C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
13. **[YKK AP America Inc.]**
14. **<Insert manufacturer's name>**

B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

1. **[Arcadia Inc.]**
2. **[Boyd Aluminum Mfg. Co.]**
3. **[CMI Architectural Products, Inc.]**
4. **[Coral Architectural Products; Coral Industries, Inc.]**
5. **[EFCO Corporation]**
6. **[Kawneer Company, Inc.; Arconic Corporation]**
7. **[Leed Himmel Industries, Inc.]**
8. **[Manko Window Systems, Inc.]**
9. **[Pittco Architectural Metals, Inc.]**
10. **[Trulite Glass & Aluminum Solutions, LLC.]**
11. **[Tubelite Inc.]**
12. **[U.S. Aluminum; C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
13. **[YKK AP America Inc.]**
14. **<Insert manufacturer's name>**

C. Source Limitations: Obtain all components of aluminum-framed storefront system, including framing **[spandrel panels][venting windows]** and accessories, from single manufacturer.

D. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness

required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: **[Thermally broken][Thermally improved][Nonthermal]<Insert description>**.
 2. Interior Vestibule Framing Construction: **[Nonthermal]<Insert description>**.
 3. Glazing System: **[Retained mechanically with gaskets on four sides][Retained mechanically with gaskets on two sides and structural sealant on two sides]**.
 4. Glazing Plane: **[Front]<Insert location>**.
 5. Finish: **[Clear anodic finish][Color anodic finish][Baked-enamel or powder-coat finish][High-performance organic finish][Superior-performance organic finish]**.
 6. Fabrication Method: Field-fabricated stick system.
 7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 8. Steel Reinforcement: As required by manufacturer.
- E. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- F. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- G. Insulated Spandrel Panels:
1. Comply with Section 074213.19 "Insulated Metal Wall Panels."
 2. Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.
 - a. Overall Panel Thickness: **[As indicated][1 inch (25.4 mm)]<Insert thickness>**.
 - b. Exterior Skin: Aluminum.
 - 1) Thickness: **[Manufacturer's standard for finish and texture indicated]<Insert thickness>**.
 - 2) Finish: **[Match framing system]<Insert finish>**.
 - 3) Texture: **[Smooth][Embossed]<Insert texture>**.
 - 4) Backing Sheet: **[1/8-inch- (3.2-mm-) thick tempered hardboard][0.157-inch- (4-mm-) thick cement board][0.125-inch- (3.2-mm-) thick, corrugated, high-density polyethylene]<Insert material>**.
 - c. Interior Skin: Aluminum.
 - 1) Thickness: **[Manufacturer's standard for finish and texture indicated]<Insert thickness>**.
 - 2) Finish: **[Matching storefront framing][Low-gloss, white baked enamel][Mill finish]<Insert finish>**.
 - 3) Texture: **[Smooth][Embossed]<Insert texture>**.
 - 4) Backing Sheet: **[1/8-inch- (3.2-mm-) thick tempered hardboard][0.157-inch- (4-mm-) thick cement board][1/2-inch- (12.7-mm-) thick gypsum board with proprietary fire-resistance-rated core][0.125-inch- (3.2-mm-) thick, corrugated, high-density polyethylene]<Insert material>**.
 - d. Thermal Insulation Core: Manufacturer's standard **[rigid, closed-cell, polyisocyanurate board][extruded-polystyrene board][expanded-perlite, mineral-insulation board]<Insert insulation>**.
 - e. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

- 1) Flame-Spread Index: **[25]<Insert value>** or less.
- 2) Smoke-Developed Index: **[50][450]<Insert value>** or less.

H. Venting Windows:

1. As specified in Section 085113 "Aluminum Windows."
2. Manufacturer's standard units, complying with AAMA/WDMA/CSA 101/I.S.2/A440, with self-flashing mounting fins, and as follows:
 - a. Window Type: **[Awning][Casement][As indicated on Drawings]<Insert type>**.
 - b. Minimum Performance Class: **[CW][AW]<Insert class>**.
 - c. Minimum Performance Grade: **[30][40][60][70][80][90][As indicated on Drawings]<Insert number>**.
 - d. Hardware: Manufacturer's standard; of aluminum, stainless steel, die-cast steel, malleable iron, or bronze; including the following:
 - 1) Cam handle locking system.
 - 2) Multi-point locking system.
 - 3) Pole-operated, cam handle locking system, where rail is more than **72 inches (1830 mm)** above floor.
 - 4) Rotary operator.
 - 5) Steel or bronze operating arms.
 - 6) Limit Devices: **[Concealed friction adjustor and adjustable stay bar]<Insert type>** limit devices designed to restrict sash opening.
 - a) Limit clear opening to **[4 inches (100 mm)]<Insert dimension>** for ventilation; with custodial key release.
 - e. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
 - f. Insect Screens: Provide removable insect screen on each operable exterior sash, with screen frame finished to match window unit, complying with SMA 1004 or SMA 1201, and as follows:
 - 1) Aluminum Wire Fabric: 18-by-18, **0.0445-inch-by-0.0445 inch (1.1-by-1.1-mm)**; 18-by-16, **0.0445-inch-by-0.0515 inch (1.1-by-1.3-mm)**; or 18-by-14, **0.0445-inch-by-0.0624 inch (1.1-by-1.5-mm)** mesh of 0.013-inch- (0.3-mm-) diameter, coated aluminum wire.
 - 2) Glass-Fiber Mesh Fabric: 18-by-16, **0.0445-inch-by-0.0515 inch (1.1-by-1.3-mm)** or 18-by-14, **0.0445-inch-by-0.0624 inch (1.1-by-1.5-mm)** mesh of PVC-coated, glass-fiber threads, woven and fused to form a fabric mesh; complying with ASTM D3656/D3656M.
 - 3) Fabric: Manufacturer's standard aluminum wire fabric or glass-fiber mesh fabric.
 - g. Glazing: **[Same as adjacent aluminum-framed storefront glazing]<Insert glazing>**.
 - h. Finish: **[Match adjacent aluminum-framed storefront finish]<Insert finish>**.

2.3 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: **[Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.][Comply with Section 088000 "Glazing."]**

- C. Glazing Sealants: **[As recommended by manufacturer.]****[Comply with Section 088000 "Glazing."]**
 - 1. Product Data: Verify architectural sealant has a VOC content of 250 g/L or less.
- D. Structural Glazing Sealants: ASTM C1184 chemically curing silicone formulation that is compatible with system components with which it comes in contact; specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in storefront system indicated.
 - 1. Color: **[Black]****[Gray]****[As selected by Architect from manufacturer's full range of colors]****<Insert color>**.
- E. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.
 - 1. Color: Match structural sealant.

2.4 MATERIALS

- A. Sheet and Plate: **ASTM B209 (ASTM B209M)**.
- B. Extruded Bars, Rods, Profiles, and Tubes: **ASTM B221 (ASTM B221M)**.
- C. Structural Profiles: ASTM B308/B308M.
- D. Steel Reinforcement:
 - 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.
- F. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- G. Regional Materials: Verify products are manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- H. Regional Materials: Verify products are manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, multiply the distance by 0.25 to determine the distance to Project site.

2.5 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads[, **finished to match framing system**][, **fabricated from 300 series stainless steel**].
- B. Anchors: Three-way adjustable anchors with minimum adjustment of **[1 inch (25.4 mm)]<Insert dimension>** that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- C. Concealed Flashing: **[Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials][Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, complying with ASTM A240/A240M, of type recommended by manufacturer]**.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for **30-mil (0.762-mm)** thickness per coat.
- E. Rigid PVC Filler.

2.6 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from **[exterior][interior][interior for vision glass and exterior for spandrel glazing or metal panels]**.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- F. Storefront Framing: Fabricate components for assembly using **[shear-block system][screw-spline system][head-and-sill-receptor system with shear blocks at intermediate horizontal members]<Insert system>**.

- G. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.7 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**][**AA-M12C22A31, Class II, 0.010 mm**] or thicker.
- B. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**][**AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.
1. Color: [**Light bronze**][**Medium bronze**][**Dark bronze**][**Champagne**][**Black**][**Match Architect's sample**][**As selected by Architect from full range of industry colors and color densities**]<Insert color>.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
1. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.
- D. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with [**AAMA 2604**][**AAMA 2605**] and containing not less than [**50**][**70**] percent PVDF resin by weight in color coat.
1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**].
 2. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.
- E. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**].
 2. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.
- F. Superior-Performance Organic Finish, Four-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**].
 2. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.
- G. Superior Performance Organic Finish, Single-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.

- H. Superior Performance Organic Finish, Two-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

2.8 SOURCE QUALITY CONTROL

- A. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Seal perimeter and other joints watertight unless otherwise indicated.
- G. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.
- I. Install joint filler behind sealant as recommended by sealant manufacturer.

- J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF OPERABLE UNITS

- A. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

3.4 INSTALLATION OF GLAZING

- A. Install glazing as specified in Section 088000 "Glazing."

3.5 INSTALLATION OF STRUCTURAL GLAZING

- A. Prepare surfaces that will contact structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
- B. Set glazing into framing in accordance with sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
- C. Set glazing with proper orientation, so that coatings face exterior or interior as specified.
- D. Hold glazing in place using temporary retainers of type and spacing recommended by manufacturer, until structural sealant joint has cured.
- E. Apply structural sealant to completely fill cavity, in accordance with sealant manufacturer and framing manufacturers written instructions and in compliance with local codes.
- F. Apply structural sealant at temperatures indicated by sealant manufacturer for type of sealant.
- G. Allow structural sealant to cure in accordance with manufacturer's recommendations.
- H. Clean and protect glass as indicated in Section 088000 "Glazing."

3.6 INSTALLATION OF WEATHERSEAL SEALANT

- A. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass as recommended by sealant manufacturer.
- B. Install weatherseal sealant to completely fill cavity, according to sealant manufacturer's written instructions, to produce weatherproof joints.

3.7 ERECTION TOLERANCES

- A. Install aluminum-framed storefronts to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
 - 2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
 - 3. Alignment:

- a. Where surfaces abut in line or are separated by reveal or protruding element up to **1/2 inch (12.7 mm)** wide, limit offset from true alignment to **1/16 inch (1.6 mm)**.
 - b. Where surfaces are separated by reveal or protruding element from **1/2 to 1 inch (12.7 to 25.4 mm)** wide, limit offset from true alignment to **1/8 inch (3.2 mm)**.
 - c. Where surfaces are separated by reveal or protruding element of **1 inch (25.4 mm)** wide or more, limit offset from true alignment to **1/4 inch (6 mm)**.
4. Location: Limit variation from plane to **1/8 inch in 12 feet (3.2 mm in 3.6 m)**; **1/2 inch (12.7 mm)** over total length.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
- B. Field Quality-Control Testing: Perform the following test on **[representative areas of aluminum-framed storefronts][mockups]<Insert requirements>**.
 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of **[two][three]<Insert number>** tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to **[10, 35, and 70 percent completion]<Insert requirements>**.
 2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than **0.09 cfm/sq. ft. (0.45 L/s per sq. m)** at a static-air-pressure differential of **1.57 lbf/sq. ft. (75 Pa)**.
 - a. Perform a minimum of **[two][three]<Insert number>** tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to **[10, 35, and 70 percent completion]<Insert requirements>**.
 3. Water Penetration: ASTM E1105 at a minimum **[uniform][and][cyclic]** static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than **6.24 lbf/sq. ft. (300 Pa)**, and shall not evidence water penetration.
- C. Structural-Sealant Adhesion: Test structural sealant in accordance with recommendations in ASTM C1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
 1. Test a minimum of **[two][four][six]<Insert number>** areas on each building facade.
 2. Repair installation areas damaged by testing.
- D. Aluminum-framed storefronts will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION 08 43 13 00

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Task	Specification	Specification Description
08 43 13 00	08 12 16 00	Aluminum-Framed Entrances And Storefronts
08 43 19 00	01 11 19 00	No Specification Required



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SECTION 08 44 13 00 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Glazed aluminum curtain wall systems:
 - 1. Conventionally glazed.
 - 2. Two sided, structural sealant glazed.
- B. Related Requirements:
 - 1. Section 014339 "Mockups" for preconstruction laboratory mockup testing.
 - 2. Section 019119.43 "Exterior Enclosure Commissioning."
 - 3. Section 078443 "Joint Firestopping" perimeter fire-containment systems field installed with glazed aluminum curtain walls.
 - 4. Section 079200 "Joint Sealants" for installation of joint sealants installed with glazed aluminum curtain walls and for sealants to the extent not specified in this Section.
 - 5. Section 084423 "Structural-Sealant-Glazed Curtain Walls" for four-sided structural-sealant-glazed curtain walls.
 - 6. Section 084433 "Sloped Glazing Assemblies" for sloped glazing.
 - 7. Section 088000 "Glazing" for curtain wall glazing.

1.2 ALLOWANCES

- A. **[Preconstruction laboratory mockup][Source quality-control][and][field quality-control]** testing is part of testing and inspecting allowance.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.
 - 1. **<Insert requirements>**.

1.4 ACTION SUBMITTALS

- A. Product Data:
 - 1. For each type of product.
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Sustainable Design Submittals:
 - 1. Product Data: For sealants, indicating VOC content.
 - 2. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.

3. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
 4. Environmental Product Declaration (EPD): For each product.
 5. Health Product Declaration (HPD): For each product.
 6. Environmental Product Declaration (EPD): For each product.
 7. Health Product Declaration (HPD): For each product.
 8. Environmental Product Declaration (EPD): For each product.
 9. Environmental Product Declaration (EPD): For each product.
 10. Environmental Product Declaration (EPD): For each product.
 11. Third-Party Certifications: For each product.
 12. Third-Party-Certified Life-Cycle Assessment: For each product.
- C. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 2. Include full-size isometric details of each type of vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- D. Samples for Initial Selection: For units with factory-applied color finishes.
- E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- F. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from **12-inch (300-mm)** lengths of full-size components and showing details of the following:
1. Joinery, including concealed welds.
 2. Anchorage.
 3. Expansion provisions.
 4. Glazing.
 5. Flashing and drainage.
- G. Delegated Design Submittal: For glazed aluminum curtain walls, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Mockup Testing Submittals:
1. Testing Program: Developed specifically for Project.
 2. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.
 3. Record Drawings: As-built drawings of preconstruction laboratory mockups showing changes made during preconstruction laboratory mockup testing.

B. Qualification Data:

1. For Installer[**and laboratory mockup testing agency**][**and field testing agency**].
2. For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that engineer is licensed in the [jurisdiction][state] in which Project is located.

C. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.

D. Product Test Reports: For glazed aluminum curtain walls, for tests performed by [manufacturer and witnessed by a qualified testing agency][a qualified testing agency].

E. Quality-Control Program: Developed specifically for Project, including fabrication and installation, in accordance with recommendations in ASTM C1401. Include periodic quality-control reports.

F. Source quality-control reports.

G. Field quality-control reports.

H. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

B. Maintenance Data for Structural Sealant: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AGM) contractors[**and that employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program**].

B. Laboratory Mockup Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated [**and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025**].

C. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated[**and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025**] and acceptable to Owner and Architect.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

- E. Structural-Sealant Glazing: Comply with ASTM C1401 for design and installation of structural-sealant-glazed curtain wall assemblies.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 1. Build mockup of typical wall area as shown on Drawings.
 2. Testing shall be performed on mockups in accordance with requirements in "Field Quality Control" Article.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: **[Owner will engage][Engage]** a qualified testing agency to perform preconstruction testing on laboratory mockups.
 1. Build preconstruction laboratory mockups at testing agency facility; use personnel, products, and methods of construction that will be used at Project site.
 2. Size and Configuration: As indicated on Drawings.
 3. Notify Architect **[seven]<Insert number>** days in advance of the dates and times when preconstruction laboratory mockups will be constructed and tested.
- B. Preconstruction Laboratory Mockup Testing: Test preconstruction laboratory mockups according to requirements in "Performance Requirements" Article. Perform the following tests in the following order:
 1. Structural, 50 percent: ASTM E330/E330M at 50 percent of positive test load.
 2. Air Leakage: ASTM E283.
 3. Water Penetration under Static Pressure: ASTM E331.
 4. Water Penetration under Dynamic Pressure: AAMA 501.1.
 5. Interstory Drift, 100 percent: AAMA 501.4 at 100 percent of design displacement. Repeat the following:
 - a. Air Leakage: ASTM E283.
 - b. Water Penetration under Static Pressure: ASTM E331.
 6. Vertical Interstory Movement: AAMA 501.7 at 100 percent of design displacement. Repeat the following:
 - a. Air Leakage: ASTM E283.
 - b. Water Penetration under Static Pressure: ASTM E331.
 7. Thermal Cycling: AAMA 501.5. Repeat the following:

- a. Air Leakage: ASTM E283.
 - b. Water Penetration under Static Pressure: ASTM E331.
8. Structural, 100 percent: ASTM E330/E330M at 100 percent of positive and negative test loads. Repeat the following:
 - a. Air Leakage: ASTM E283.
 - b. Water Penetration under Static Pressure: ASTM E331.
 - c. Water Penetration under Dynamic Pressure: AAMA 501.1.
 9. Structural, 150 percent: ASTM E330/E330M at 150 percent of positive and negative test loads.
 10. Interstory Drift, 150 percent: AAMA 501.4 at 150 percent of design displacement.
- C. Preconstruction Adhesion and Compatibility Testing: Submit to structural glazing sealant manufacturer, for testing indicated below, Samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that is in close proximity to or is touching the structural or nonstructural sealants of a structural glazed system.
1. Compatibility: Test materials or components using ASTM C1087.
 2. Adhesion: Test for adhesion or lack of adhesion of a structural sealant to the surface of another material or component using ASTM C1135.
 3. Submit no fewer than **[eight]**<Insert number> pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 5. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
 6. Testing will not be required if data based on previous testing of current sealant products match those submitted.

1.10 WARRANTY

- A. Special Assembly Warranty: **[Manufacturer]****[Installer]** agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals[, **metal finishes**,] and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 2. Warranty Period: **[Two]****[Five]****[10]**<Insert number> years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: **[Five][10][20]<Insert number>** years from date of Substantial Completion.
- C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, peeling, or chipping.
 2. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazed aluminum curtain walls.
- B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 1. Glazed aluminum curtain walls shall withstand movements of supporting structure, including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
 1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: **[As indicated on Drawings]<Insert loads>**.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
 1. Deflection Normal to Wall Plane: Limited to **[1/175 of length of span of the framing member for lengths of up to 13 feet 6 inches (4.1 m) and to 1/240 of length of span of the framing member plus 1/4 inch (6.35 mm) for lengths of greater than 13 feet 6 inches (4.1 m)]<Insert deflection limit>**.
 2. Deflection Parallel to Glazing Plane: Limited to **[amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm)]<Insert deflection limit>**.

- a. Operable Units: Provide a minimum **1/16-inch (1.6-mm)** clearance between framing members and operable units.
3. Cantilever Deflection: Limited to 2/175 of the unsupported length.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at **[150]<Insert number>** percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding **[0.2]<Insert number>** percent of span.
 3. Test Durations: As required by design wind velocity, but not less than **[10]<Insert number>** seconds.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
 1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than **[6.24 lbf/sq. ft. (300 Pa)][10 lbf/sq. ft. (480 Pa)][15 lbf/sq. ft. (720 Pa)]<Insert value>**.
- G. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:
 1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than **[6.24 lbf/sq. ft. (300 Pa)][10 lbf/sq. ft. (480 Pa)][15 lbf/sq. ft. (720 Pa)]<Insert value>**.
 2. Maximum Water Leakage: **[In accordance with AAMA 501.1][No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation]**. Water leakage does not include water controlled by flashing and gutters or water that is drained to exterior.
- H. Interstory Drift: Accommodate design displacement of adjacent stories indicated.
 1. Design Displacement: **[As indicated on Drawings]<Insert design displacement>**.
 2. Test Performance: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.4 at design displacement **[and 1.5 times the design displacement]**.
- I. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined in accordance with **[ASCE/SEI 7]<Insert requirement>**.
 1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.6 at design displacement **[and 1.5 times the design displacement]**.
 2. Vertical Interstory Movement: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.7 at design displacement **[and 1.5 times the design displacement]**.
- J. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:
 1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than **[0.29 Btu/sq. ft. x h x deg F (1.65 W/sq. m x K)][0.36 Btu/sq. ft. x h x deg F (2.04 W/sq. m x K)][0.38**

- Btu/sq. ft. x h x deg F (2.16 W/sq. m x K)][0.41 Btu/sq. ft. x h x deg F (2.33 W/sq. m x K)][0.46 Btu/sq. ft. x h x deg F (2.61 W/sq. m x K)][0.50 Btu/sq. ft. x h x deg F (2.84 W/sq. m x K)]<Insert value> as determined in accordance with NFRC 100.
- b. Venting Windows: Whole window U-factor of not more than [0.37 Btu/sq. ft. x h x deg F (2.10 W/sq. m x K)][0.43 Btu/sq. ft. x h x deg F (2.44 W/sq. m x K)][0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K)][0.60 Btu/sq. ft. x h x deg F (3.40 W/sq. m x K)][0.65 Btu/sq. ft. x h x deg F (3.69 W/sq. m x K)]<Insert value> as determined in accordance with NFRC 100.
2. Solar Heat Gain Coefficient (SHGC):
 - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than [0.22][0.25][0.26][0.29][0.40][0.45]<Insert value> as determined in accordance with NFRC 200.
 - b. Venting Windows: Whole-window SHGC of not more than [0.22][0.27][0.30][0.40]<Insert value> as determined in accordance with NFRC 200.
 3. Air Leakage:
 - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than [0.06 cfm/sq. ft. (0.30 L/s per sq. m)]<Insert value> at a static-air-pressure differential of [1.57 lbf/sq. ft. (75 Pa)][6.24 lbf/sq. ft. (300 Pa)]<Insert value> when tested in accordance with ASTM E283.
 - b. Venting Windows: Whole-window air leakage of not more than [0.3 cfm/sq. ft. (0.30 L/s per sq. m)]<Insert value> at a static-air-pressure differential of [6.24 lbf/sq. ft. (300 Pa)]<Insert value> when tested in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
 4. Condensation Resistance Factor (CRF):
 - a. Fixed Glazing and Framing Areas: CRF for the system of not less than [29][55][65][80]<Insert value> as determined in accordance with AAMA 1503.
 - b. Venting Windows: Whole-window CRF of not less than [45][52][55]<Insert value> as determined in accordance with AAMA 1503.
- K. Noise Reduction: Test in accordance with ASTM E90, with ratings determined by ASTM E1332, as follows:
1. Outdoor-Indoor Transmission Class: Minimum [26][30][34]<Insert number>.
 2. Sound Transmission Class: Minimum [31][34][37][40]<Insert number>.
- L. Blast Resistance:
1. Hazard Rating: [No Break][No Hazard][Minimal Hazard][Very Low Hazard][Low Hazard][Moderate Hazard][High Hazard] in accordance with ASTM F2912, tested in accordance with ASTM F1642/F1642M.
 2. Performance Condition: [1][2][3a][3b][4][5] in accordance with GSA-TS01.
- M. Ballistic Resistance, UL 752: [Listed and labeled as][Level 1][Level 2][Level 3][Level 4][Level 5][Level 6][Level 7][Level 8][Level 9][Level 10][Level 1-SG][Level 2-SG][Level 3-SG][Level 4-SG][Level 5-SG][Level 6-SG][Level 7-SG][Level 8-SG][Level 9-SG][Level 10-SG] when tested in accordance with UL 752.
- N. Ballistic Resistance, ASTM F1233: [Class/Level HG1][Class/Level HG2][Class/Level HG3][Class/Level HG4][Class/Level SMG][Class/Level R1][Class/Level R2][Class/Level R3][Class/Level R4-AP][Class/Level R5][Class/Level SH1][Class/Level SH2] when tested in

accordance with ASTM F1233.

- O. Ballistic Resistance, HPW-TP-0500.03: **[A][B][C][D][E]** when tested in accordance with HPW-TP-0500.03.
- P. Ballistic Resistance, SD-STD-01.01: **[R][SH]** when tested in accordance with SD-STD-01.01.
- Q. Ballistic Resistance, NIJ STD-0108.01: **[Level I][Level IIA][Level II][Level IIIA][Level III][Level IV]** when tested in accordance with NIJ STD-0108.01.
- R. Windborne-Debris Impact Resistance: Pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone **[1][2][3][4]** for **[basic][enhanced]** protection.
 - 1. Large-Missile Test: For glazing located within **[30 feet (9.1 m)]<Insert dimension>** of grade.
 - 2. Small-Missile Test: For glazing located between **30 feet (9.1 m)** and **[60 feet (18.2 m)]<Insert dimension>** above grade.
- S. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
 - 1. Temperature Change: **120 deg F (67 deg C)**, ambient; **180 deg F (100 deg C)**, material surfaces.
 - 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of **[180 deg F (82 deg C)]<Insert temperature>**.
 - b. Low Exterior Ambient-Air Temperature: **[0 deg F (minus 18 deg C)]<Insert temperature>**.
- T. Structural-Sealant Joints:
 - 1. Designed to carry gravity loads of glazing.
- U. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
 - 1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 - 2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.2 SOURCE LIMITATIONS

- A. Obtain all components of curtain-wall system[**and storefront system**], including framing **[spandrel panels][venting windows][entrances][sun control]<Insert component>** and accessories, from single manufacturer.

2.3 GLAZED ALUMINUM CURTAIN WALL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

1. [Arcadia Inc.]
2. [Boyd Aluminum Mfg. Co.]
3. [Bruce Wall Systems Corporation]
4. [CMI Architectural Products, Inc.]
5. [Coral Architectural Products; Coral Industries, Inc.]
6. [EFCO Corporation]
7. [EXTECH/Exterior Technologies, Inc.]
8. [Graham Architectural Products Corporation]
9. [Kawneer Company, Inc.; Arconic Corporation]
10. [OldCastle BuildingEnvelope (OBE)]
11. [Pittco Architectural Metals, Inc.]
12. [Professional Grade Aluminum Corp]
13. [Shuco USA L.L.L.P.]
14. [Tingwall Inc.]
15. [TRACO, a division of Kawneer]
16. [Trulite Glass & Aluminum Solutions, LLC.]
17. [Tubelite Inc.]
18. [U.S. Aluminum; C.R. Laurence Co., Inc.; CRH Americas, Inc.]
19. [Waltek Company, Ltd.]
20. [Wausau Window and Wall Systems; Apogee Wausau Group, Inc.]
21. [YKK AP America Inc.]
22. <Insert manufacturer's name>

- B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [Arcadia Inc.]
2. [Boyd Aluminum Mfg. Co.]
3. [Bruce Wall Systems Corporation]
4. [CMI Architectural Products, Inc.]
5. [Coral Architectural Products; Coral Industries, Inc.]
6. [EFCO Corporation]
7. [EXTECH/Exterior Technologies, Inc.]
8. [Graham Architectural Products Corporation]
9. [Kawneer Company, Inc.; Arconic Corporation]
10. [OldCastle BuildingEnvelope (OBE)]
11. [Pittco Architectural Metals, Inc.]
12. [Professional Grade Aluminum Corp]
13. [Shuco USA L.L.L.P.]
14. [Tingwall Inc.]
15. [TRACO, a division of Kawneer]
16. [Trulite Glass & Aluminum Solutions, LLC.]
17. [Tubelite Inc.]
18. [U.S. Aluminum; C.R. Laurence Co., Inc.; CRH Americas, Inc.]
19. [Waltek Company, Ltd.]
20. [Wausau Window and Wall Systems; Apogee Wausau Group, Inc.]
21. [YKK AP America Inc.]
22. <Insert manufacturer's name>

- C. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: [Thermally broken][Thermally improved][Nonthermal]<Insert description>.
2. Glazing System: [Retained mechanically with gaskets on four sides][Retained mechanically with gaskets on two sides and structural sealant on two sides].

3. Glazing Plane: **[Front]<Insert location>**.
 4. Finish: **[Clear anodic finish][Color anodic finish][Baked-enamel or powder-coat finish][High-performance organic finish][Superior-performance organic finish]**.
 5. System: **[Either stick or unitized system][Stick system][Unitized system]**.
 6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 7. Steel Reinforcement: As required by manufacturer.
- D. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
1. Include snap-on aluminum trim that conceals fasteners.
- E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- F. Insulated Spandrel Panels:
1. Comply with Section 074213.19 "Insulated Metal Wall Panels."
 2. Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.
 - a. Overall Panel Thickness: **[As indicated][1 inch (25.4 mm)]<Insert thickness>**.
 - b. Exterior Skin: Aluminum.
 - 1) Thickness: **[Manufacturer's standard for finish and texture indicated]<Insert thickness>**.
 - 2) Finish: **[Match framing system]<Insert finish>**.
 - 3) Texture: **[Smooth][Embossed]<Insert texture>**.
 - 4) Backing Sheet: **[1/8-inch- (3.2-mm-) thick, tempered hardboard][0.157-inch- (4-mm-) thick, cement board][0.125-inch- (3.2-mm-) thick, corrugated, high-density polyethylene]<Insert material>**.
 - c. Interior Skin: **[Aluminum][Manufacturer's standard galvanized-steel sheet]**.
 - 1) Thickness: **[Manufacturer's standard for finish and texture indicated]<Insert thickness>**.
 - 2) Finish: **[Matching curtain-wall framing][Low-gloss, white baked enamel][Mill finish]<Insert finish>**.
 - 3) Texture: **[Smooth][Embossed]<Insert texture>**.
 - 4) Backing Sheet: **[1/8-inch- (3.2-mm-) thick, tempered hardboard][0.157-inch- (4-mm-) thick, cement board][1/2-inch- (12.7-mm-) thick, gypsum board with proprietary fire-resistance-rated core][0.125-inch- (3.2-mm-) thick, corrugated, high-density polyethylene]<Insert material>**.
 - d. Thermal Insulation Core: Manufacturer's standard **[rigid, closed-cell, polyisocyanurate board][extruded-polystyrene board][expanded-perlite, mineral-insulation board]<Insert insulation>**.
 - e. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1) Flame-Spread Index: **[25]<Insert value>** or less.
 - 2) Smoke-Developed Index: **[50][450]<Insert value>** or less.
- G. Venting Windows:
1. As specified in Section 085113 "Aluminum Windows."
 2. Manufacturer's standard units, complying with AAMA/WDMA/CSA 101/I.S.2/A440, with self-

flashing mounting fins, and as follows:

- a. Window Type: **[Awning][Casement][As indicated on Drawings]<Insert type>**.
 - b. Minimum Performance Class: **[CW][AW]<Insert class>**.
 - c. Minimum Performance Grade: **[30][40][60][70][80][90][As indicated on Drawings]<Insert number>**.
 - d. Hardware: Manufacturer's standard; of aluminum, stainless steel, die-cast steel, malleable iron, or bronze; including the following:
 - 1) Cam handle locking system.
 - 2) Multi-point locking system.
 - 3) Pole-operated, cam handle locking system, where rail is more than **72 inches (1830 mm)** above floor.
 - 4) Rotary operator.
 - 5) Steel or bronze operating arms.
 - 6) Limit Devices: **[Concealed friction adjustor and adjustable stay bar]<Insert type>** limit devices designed to restrict sash opening.
 - a) Limit clear opening to **[4 inches (100 mm)]<Insert dimension>** for ventilation; with custodial key release.
 - e. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
 - f. Insect Screens: Provide removable insect screen on each operable exterior sash, with screen frame finished to match window unit, complying with SMA 1004 or SMA 1201, and as follows:
 - 1) Aluminum Wire Fabric: 18-by-18, **0.0445-inch-by-0.0445-inch (1.1-by-1.1-mm)**; 18-by-16, **0.0445-inch-by-0.0515-inch (1.1-by-1.3-mm)**; or 18-by-14, **0.0445-inch-by-0.0624-inch (1.1-by-1.5-mm)** mesh of **0.013-inch- (0.3-mm-)** diameter, coated aluminum wire.
 - 2) Glass-Fiber Mesh Fabric: 18-by-16, **0.0445-inch-by-0.0515-inch (1.1-by-1.3-mm)** or 18-by-14, **0.0445-inch-by-0.0624-inch (1.1-by-1.5-mm)** mesh of PVC-coated, glass-fiber threads, woven and fused to form a fabric mesh; complying with ASTM D3656/D3656M.
 - 3) Fabric: Manufacturer's standard aluminum wire fabric or glass-fiber mesh fabric.
 - g. Glazing: **[As specified in Section 088000 "Glazing"]****[Same as adjacent glazed aluminum curtain-wall glazing]<Insert glazing>**.
 - h. Finish: **[Match adjacent glazed aluminum curtain-wall finish]<Insert finish>**.
- H. Entrance Door Systems: Comply with **[Section 084113 "Aluminum-Framed Entrances and Storefronts"]****[Section 084213 "Aluminum-Framed Entrances"]**.

2.4 SUN CONTROL

- A. Sunshades: Assemblies consisting of manufacturer's standard outrigger brackets, louvers, and fascia, designed for attachment to curtain wall with mechanical fasteners.
 1. Orientation: **[Horizontal][Vertical]**.
 2. Projection from Wall: **[As indicated on Drawings][20 inches (508 mm)][25 inches (635 mm)][30 inches (762 mm)][35 inches (889 mm)]<Insert projection>**.
 3. Outriggers: **[Straight with square edges][Straight with rounded edge][Curved][Wedge]<Insert shape>**.

4. Louvers:
 - a. Number: **[Three][Four][Five]<Insert number>** louvers per unit.
 - b. Shape: **[Planar][Arched][Circular][Airfoil][Square]**.
 - c. Width: **[6 inches (152 mm)][8 inches (203 mm)][10 inches (254 mm)]<Insert dimension>**.
 - d. Mounting Angle: **[25][30][35]<Insert number>** degrees.
 5. Fasciae: **[Rectangular][Bullnose][Angular][Circular]**.
 6. Finish: **[Match adjacent glazed aluminum curtain wall]<Insert finish>**.
 7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 8. Steel Reinforcement: As required by manufacturer.
- B. Light Shelves: Light-reflecting assemblies consisting of manufacturer's standard support brackets or channels, and aluminum tray, designed for attachment to interior of curtain wall with mechanical fasteners.
1. Projection from Wall: **[As indicated on Drawings][20 inches (508 mm)][25 inches (635 mm)][30 inches (762 mm)][35 inches (889 mm)]<Insert projection>**.
 2. Finish: **[Match adjacent glazed aluminum curtain wall]<Insert finish>**.
 3. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 4. Steel Reinforcement: As required by manufacturer.

2.5 GLAZING

- A. Glazing: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: ASTM C509 or ASTM C864. **[Manufacturer's standard][Compression-type, replaceable EPDM][Extruded silicone][Comply with Section 088000 "Glazing."]<Insert type>**.
 1. Color: **[Black]<Insert color>**.
- C. Glazing Sealants: **[As recommended by manufacturer.][Comply with Section 088000 "Glazing."]**
 1. Product Data: Verify architectural sealant has a VOC content of 250 g/L or less.
- D. Structural Glazing Sealants: ASTM C1184, chemically curing silicone formulation that is compatible with system components with which it comes into contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in curtain-wall assembly indicated.
 1. Color: **[Black][Gray][As selected by Architect from manufacturer's full range of colors]<Insert color>**.
- E. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes into contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed curtain-wall manufacturers for this use.
 1. Color: Match structural sealant.

2.6 MATERIALS

- A. Sheet and Plate: **ASTM B209 (ASTM B209M)**.
- B. Extruded Bars, Rods, Profiles, and Tubes: **ASTM B221 (ASTM B221M)**.
- C. Structural Profiles: ASTM B308/B308M.
- D. Steel Reinforcement:
 - 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.
- F. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- G. Regional Materials: Verify products are manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- H. Regional Materials: Verify products are manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, multiply the distance by 0.25 to determine the distance to Project site.

2.7 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads[, **finished to match framing system**][, **fabricated from 300 series stainless steel**].
- B. Anchors: Three-way adjustable anchors with minimum adjustment of [**1 inch (25.4 mm)**]**<Insert dimension>** that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- C. Concealed Flashing: [**Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials**][**Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, ASTM A240/A240M of type recommended by manufacturer**].

- D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from [exterior][interior][interior for vision glass and exterior for spandrel glazing or metal panels].
 - 6. Provisions for safety railings mounted [on interior face of mullions][between mullions at interior].
 - 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 - 8. Components curved to indicated radii.
- D. Fabricate components to resist water penetration as follows:
 - 1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
 - 2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.
- E. Curtain-Wall Framing: Fabricate components for assembly using [manufacturer's standard assembly method][shear-block system][screw-spline system][head-and-sill-receptor system with shear blocks at intermediate horizontal members]<Insert description>.
- F. Factory-Assembled Frame Units:
 - 1. Rigidly secure nonmovement joints.
 - 2. Prepare surfaces that are in contact with structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
 - 3. Seal joints watertight unless otherwise indicated.
 - 4. Install glazing to comply with requirements in Section 088000 "Glazing."
 - 5. Install structural glazing.
 - a. Set glazing into framing in accordance with sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
 - b. Set glazing with proper orientation so that coatings face exterior or interior as specified.
 - c. Apply structural silicone sealant to completely fill cavity, in accordance with sealant manufacturers written instructions with the framing and glazing in a fully supported position.
 - d. Brace or stiffen framing and glazing in such a manner to prevent undue stresses on the glass edge seal and structural joints or movement of the glazing, until sealant is fully cured

- in accordance with manufacturer's recommendations.
- e. After structural sealant has completely cured, insert backer rod between lites of glass as recommended by sealant manufacturer.
- f. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.
- g. Clean and protect glass as indicated in Section 088000 "Glazing."
- h. Retain bracing or stiffening until erected to prevent racking of units during transportation and erection.

G. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

H. <Insert requirements>.

2.9 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, [AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm] or thicker.

B. Color Anodic Finish: AAMA 611, [AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm] or thicker.

1. Color: [Light bronze][Medium bronze][Dark bronze][Champagne][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>.

C. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.

D. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with [AAMA 2604][AAMA 2605] and containing not less than [50][70] percent PVDF resin by weight in color coat.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [for seacoast and severe environments].
2. Color and Gloss: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.

E. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [for seacoast and severe environments].
2. Color and Gloss: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.

F. Superior-Performance Organic Finish, Four-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [for seacoast and severe environments].
2. Color and Gloss: [As indicated by manufacturer's designations][Match Architect's

sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.

- G. Superior Performance Organic Finish, Single-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- H. Superior Performance Organic Finish, Two-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

2.10 SOURCE QUALITY CONTROL

- A. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
- G. Seal joints watertight unless otherwise indicated.

H. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

I. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF GLAZED ALUMINUM CURTAIN WALL SYSTEMS

- A. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

3.4 INSTALLATION OF GLAZING

- A. Install glazing as specified in Section 088000 "Glazing."

3.5 INSTALLATION OF STRUCTURAL GLAZING

- A. Prepare surfaces that will contact structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
- B. Set glazing into framing in accordance with sealant manufacturer's and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
- C. Set glazing with proper orientation, so that coatings face exterior or interior as specified.
- D. Hold glazing in place using temporary retainers of type and spacing recommended by manufacturer, until structural sealant joint has cured.
- E. Apply structural sealant to completely fill cavity, in accordance with sealant manufacturer's and framing manufacturer's written instructions and in compliance with local codes.
- F. Apply structural sealant at temperatures indicated by sealant manufacturer for type of sealant.
- G. Allow structural sealant to cure in accordance with manufacturer's recommendations.
- H. Clean and protect glass as indicated in Section 088000 "Glazing."

3.6 INSTALLATION OF WEATHERSEAL SEALANT

- A. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass, as recommended by sealant manufacturer.

- B. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.

3.7 ERECTION TOLERANCES

- A. Install glazed aluminum curtain walls to comply with the following maximum tolerances:
 - 1. Plumb: **1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).**
 - 2. Level: **1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).**
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to **1/2 inch (12.7 mm)** wide, limit offset from true alignment to **1/16 inch (1.6 mm).**
 - b. Where surfaces are separated by reveal or protruding element from **1/2 to 1 inch (12.7 to 25.4 mm)** wide, limit offset from true alignment to **1/8 inch (3.2 mm).**
 - c. Where surfaces are separated by reveal or protruding element of **1 inch (25.4 mm)** wide or more, limit offset from true alignment to **1/4 inch (6 mm).**
 - 4. Location: Limit variation from plane to **1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm)** over total length.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
- B. Test Area: Perform tests on **[one bay at least 30 feet (9.1 m), by one story][representative areas of glazed aluminum curtain walls][mockups]<Insert requirements>.**
- C. Field Quality-Control Testing: Perform the following test on **[representative areas of glazed aluminum curtain walls][mockups]<Insert requirements>.**
 - 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of **[two][three]<Insert number>** tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to **[10, 35, and 70 percent completion]<Insert requirements>.**
 - 2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than **0.09 cfm/sq. ft. (0.45 L/s per sq. m)** at a static-air-pressure differential of **1.57 lbf/sq. ft. (75 Pa).**
 - a. Perform a minimum of **[two][three]<Insert number>** tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to **[10, 35, and 70 percent completion]<Insert requirements>.**
 - 3. Water Penetration: ASTM E1105 at a minimum **[uniform][and][cyclic]** static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than **6.24 lbf/sq. ft. (300 Pa),** and shall not evidence water penetration.



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- D. Structural-Sealant Adhesion: Test structural sealant in accordance with recommendations in ASTM C1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
 - 1. Test a minimum of [two][four][six]<Insert number> areas on each building facade.
 - 2. Repair installation areas damaged by testing.
 - E. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.
 - F. Prepare test and inspection reports.

END OF SECTION 08 44 13 00

SECTION 08 44 13 00A - STRUCTURAL-SEALANT-GLAZED CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Four-sided structural-sealant-glazed curtain-wall assemblies.

B. Related Requirements:

1. Section 014339 "Mockups" for preconstruction laboratory mockup testing.
2. Section 019119.43 "Exterior Enclosure Commissioning."
3. Section 078443 "Joint Firestopping" for perimeter fire-containment systems field installed with structural-sealant-glazed curtain walls.
4. Section 079200 "Joint Sealants" for installation of joint sealants installed with structural-sealant-glazed curtain walls and for sealants to the extent not specified in this Section.
5. Section 084413 "Glazed Aluminum Curtain Walls" for conventionally glazed curtain walls and two-sided structural-sealant-glazed curtain walls.
6. Section 084433 "Sloped Glazing Assemblies" for sloped glazing.
7. Section 088000 "Glazing."

1.2 ALLOWANCES

- A. **[Preconstruction laboratory mockup][Source quality-control][and][field quality-control]** testing is part of testing and inspecting allowance.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1. **<Insert requirements>**.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.
3. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.

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4. Environmental Product Declaration (EPD): For each product.
 5. Health Product Declaration (HPD): For each product.
 6. Environmental Product Declaration (EPD): For each product.
 7. Health Product Declaration (HPD): For each product.
 8. Environmental Product Declaration (EPD): For each product.
 9. Environmental Product Declaration (EPD): For each product.
 10. Environmental Product Declaration (EPD): For each product.
 11. Third-Party Certifications: For each product.
 12. Third-Party-Certified Life-Cycle Assessment: For each product.
- C. Shop Drawings: For structural-sealant-glazed curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 2. Include full-size isometric details of each type of vertical-to-horizontal intersection of structural-sealant-glazed curtain walls, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- D. Samples for Initial Selection: For units with factory-applied color finishes.
- E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- F. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from **12-inch (300-mm)** lengths of full-size components and showing details of the following:
1. Joinery, including concealed welds.
 2. Anchorage.
 3. Expansion provisions.
 4. Glazing.
 5. Flashing and drainage.
- G. Delegated Design Submittal: For structural-sealant-glazed curtain walls, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Mockup Testing Submittals:
1. Testing Program: Developed specifically for Project.
 2. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.
 3. Record Drawings: As-built drawings of preconstruction laboratory mockups, showing changes made during preconstruction laboratory mockup testing.
- B. Qualification Data:
1. For Installer[**and laboratory mockup testing agency**][**and field testing agency**].

2. For professional engineer's experience with providing delegated design engineering services of the type indicated, including documentation that engineer is licensed in the [jurisdiction][state] in which Project is located.
- C. Energy Performance Certificates: For structural-sealant-glazed curtain walls, accessories, and components from manufacturer.
 1. Basis for Certification: NFRC-certified energy performance values for each structural-sealant-glazed curtain wall.
- D. Product Test Reports: For structural-sealant-glazed curtain walls, for tests performed by [manufacturer and witnessed by a qualified testing agency][a qualified testing agency].
- E. Quality-Control Program: Developed specifically for Project, including fabrication and installation, in accordance with recommendations in ASTM C1401. Include periodic quality-control reports.
- F. Source quality-control reports.
- G. Field quality-control reports.
- H. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For structural-sealant-glazed curtain walls to include in maintenance manuals.
- B. Maintenance Data for Structural Sealant: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C1401 recommendations for postinstallation-phase quality-control program.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AGM) contractors[**and that employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program**].
- B. Laboratory Mockup Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated [**and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025**].
- C. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated [**and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025**] and acceptable to Owner and Architect.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for

review.

- E. Structural-Sealant Glazing: Comply with ASTM C1401 for design and installation of structural-sealant-glazed curtain-wall assemblies.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area, as indicated on Drawings.
 - 2. Testing to be performed on mockups in accordance with requirements in Part 3 "Field Quality Control" Article.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: **[Owner will engage][Engage]** a qualified testing agency to perform preconstruction testing on laboratory mockups.
 - 1. Build preconstruction laboratory mockups at testing agency facility; use personnel, products, and methods of construction that will be used at Project site.
 - 2. Size and Configuration: As indicated on Drawings.
 - 3. Notify Architect **[seven]<Insert number>** days in advance of the dates and times when preconstruction laboratory mockups will be constructed and tested.
- B. Preconstruction Laboratory Mockup Testing: Test preconstruction laboratory mockups in accordance with requirements in Part 2 "Performance Requirements" Article. Perform the following tests in the following order:
 - 1. Structural, 50 percent: ASTM E330/E330M at 50 percent of positive test load.
 - 2. Air Leakage: ASTM E283.
 - 3. Water Penetration under Static Pressure: ASTM E331.
 - 4. Water Penetration under Dynamic Pressure: AAMA 501.1.
 - 5. Interstory Drift, 100 percent: AAMA 501.4 at 100 percent of design displacement. Repeat the following:
 - a. Air Leakage: ASTM E283.
 - b. Water Penetration under Static Pressure: ASTM E331.
 - 6. Vertical Interstory Movement: AAMA 501.7 at 100 percent of design displacement. Repeat the following:
 - a. Air Leakage: ASTM E283.
 - b. Water Penetration under Static Pressure: ASTM E331.
 - 7. Thermal Cycling: AAMA 501.5. Repeat the following:
 - a. Air Leakage: ASTM E283.

- b. Water Penetration under Static Pressure: ASTM E331.
 8. Structural, 100 percent: ASTM E330/E330M at 100 percent of positive and negative test loads. Repeat the following:
 - a. Air Leakage: ASTM E283.
 - b. Water Penetration under Static Pressure: ASTM E331.
 - c. Water Penetration under Dynamic Pressure: AAMA 501.1.
 9. Structural, 150 percent: ASTM E330/E330M at 150 percent of positive and negative test loads.
 10. Interstory Drift, 150 percent: AAMA 501.4 at 150 percent of design displacement.
 - C. Preconstruction Adhesion and Compatibility Testing: Submit to structural glazing sealant manufacturer, for testing indicated below, Samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that is in close proximity to or is touching the structural or nonstructural sealants of a structural glazed system.
 1. Compatibility: Test materials or components using ASTM C1087.
 2. Adhesion: Test for adhesion or lack of adhesion of a structural sealant to the surface of another material or component using ASTM C1135.
 3. Submit no fewer than **[eight]<Insert number>** pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 5. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
 6. Testing will not be required if data based on previous testing of current sealant products match those submitted.
- 1.10 WARRANTY
- A. Special Warranty: **[Manufacturer][Installer]** agrees to repair or replace components of structural-sealant-glazed curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals[, **metal finishes**,] and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 2. Warranty Period: **[Two][Five][10]<Insert number>** years from date of Substantial Completion.
 - B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: **[Five][10][20]<Insert number>** years from date of Substantial Completion.

- C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, peeling, or chipping.
 2. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design structural-sealant-glazed curtain walls.
- B. General Performance: Comply with performance requirements specified, as determined by testing of structural-sealant-glazed curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Structural-sealant-glazed curtain walls to withstand movements of supporting structure, including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- C. Structural Loads:
1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: **[As indicated on Drawings]<Insert loads>**.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
1. Deflection Normal to Wall Plane: Limited to **[1/175 of length of span of the framing member for lengths of up to 13 ft. 6 inches (4.1 m) and to 1/240 of length of span of the framing member plus 1/4 inch (6.35 mm) for lengths of greater than 13 ft. 6 inches (4.1 m)]<Insert deflection limit>**.
 2. Deflection Parallel to Glazing Plane: Limited to **[amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm)]<Insert deflection limit>**.
 - a. Operable Units: Provide a minimum **1/16-inch (1.6-mm)** clearance between framing members and operable units.

3. Cantilever Deflection: Limited to 2/175 of the unsupported length.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at **[150]<Insert number>** percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding **[0.2]<Insert number>** percent of span.
 3. Test Durations: As required by design wind velocity, but not less than **[10]<Insert number>** seconds.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than **[6.24 lbf/sq. ft. (300 Pa)][10 lbf/sq. ft. (480 Pa)][15 lbf/sq. ft. (720 Pa)]<Insert value>**.
- G. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than **[6.24 lbf/sq. ft. (300 Pa)][10 lbf/sq. ft. (480 Pa)][15 lbf/sq. ft. (720 Pa)]<Insert value>**.
 2. Maximum Water Leakage: **[In accordance with AAMA 501.1][No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation]**. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.
- H. Interstory Drift: Accommodate design displacement of adjacent stories indicated.
1. Design Displacement: **[As indicated on Drawings]<Insert design displacement>**.
 2. Test Performance: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.4 at design displacement **[and 1.5 times the design displacement]**.
- I. Seismic Performance: Structural-sealant-glazed curtain walls to withstand the effects of earthquake motions determined in accordance with **[ASCE/SEI 7]<Insert requirement>**.
1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.6 at design displacement **[and 1.5 times the design displacement]**.
 2. Vertical Interstory Movement: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.7 at design displacement **[and 1.5 times the design displacement]**.
- J. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than **[0.29 Btu/sq. ft. x h x deg F (1.65 W/sq. m x K)][0.36 Btu/sq. ft. x h x deg F (2.04 W/sq. m x K)][0.38 Btu/sq. ft. x h x deg F (2.16 W/sq. m x K)][0.41 Btu/sq. ft. x h x deg F (2.33 W/sq. m x K)][0.46 Btu/sq. ft. x h x deg F (2.61 W/sq. m x K)][0.50 Btu/sq. ft. x h x deg F (2.84 W/sq. m x K)]<Insert value>** as determined in accordance with NFRC 100.

- b. Venting Windows: Whole window U-factor of not more than [0.37 Btu/sq. ft. x h x deg F (2.10 W/sq. m x K)][0.43 Btu/sq. ft. x h x deg F (2.44 W/sq. m x K)][0.45 Btu/sq. ft. x h x deg F (2.55 W/sq. m x K)][0.60 Btu/sq. ft. x h x deg F (3.40 W/sq. m x K)][0.65 Btu/sq. ft. x h x deg F (3.69 W/sq. m x K)]<Insert value> as determined in accordance with NFRC 100.
 2. Solar Heat Gain Coefficient (SHGC):
 - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than [0.22][0.25][0.26][0.29][0.40][0.45]<Insert value> as determined in accordance with NFRC 200.
 - b. Venting Windows: Whole window SHGC of not more than [0.22][0.27][0.30][0.40]<Insert value> as determined in accordance with NFRC 200.
 3. Air Leakage:
 - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than [0.06 cfm/sq. ft. (0.30 L/s per sq. m)]<Insert value> at a static-air-pressure differential of [1.57 lbf/sq. ft. (75 Pa)][6.24 lbf/sq. ft. (300 Pa)]<Insert value> when tested in accordance with ASTM E283.
 - b. Venting Windows: Whole window air leakage of not more than [0.3 cfm/sq. ft. (0.30 L/s per sq. m)]<Insert value> at a static-air-pressure differential of [6.24 lbf/sq. ft. (300 Pa)]<Insert value> when tested in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
 4. Condensation Resistance Factor (CRF):
 - a. Fixed Glazing and Framing Areas: CRF for the system of not less than [29][55][65][80]<Insert value> as determined in accordance with AAMA 1503.
 - b. Venting Windows: Whole window CRF of not less than [45][52][55]<Insert value> as determined in accordance with AAMA 1503.
- K. Noise Reduction: Test in accordance with ASTM E90, with ratings determined by ASTM E1332, as follows.
 1. Outdoor-Indoor Transmission (OITC) Class: Minimum [26][30][34]<Insert number>.
 2. Sound Transmission Class (STC): Minimum [31][34][37][40]<Insert number>.
- L. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone [1][2][3][4] for [Basic][Enhanced] Protection.
 1. Large-Missile Test: For glazing located within [30 ft. (9.1 m)]<Insert dimension> of grade.
 2. Small-Missile Test: For glazing located between 30 ft. (9.1 m) and [60 ft. (18.2 m)]<Insert dimension> above grade.
- M. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of [180 deg F (82 deg C)]<Insert temperature>.
 - b. Low Exterior Ambient-Air Temperature: [0 deg F (minus 18 deg C)]<Insert temperature>.

N. Structural-Sealant Joints:

1. Designed to carry gravity loads of glazing.

O. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant to occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.2 SOURCE LIMITATIONS

- A. Obtain all components of structural-sealant-glazed curtain-wall system, including framing **[venting windows][sun control]** and accessories, from single manufacturer.

2.3 FOUR-SIDED STRUCTURAL-SEALANT-GLAZED CURTAIN-WALL ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

1. **[Arcadia Inc.]**
2. **[Bruce Wall Systems Corporation]**
3. **[CMI Architectural Products, Inc.]**
4. **[Kawneer Company, Inc.; Arconic Corporation]**
5. **[Shuco USA L.L.L.P.]**
6. **[Tingwall Inc.]**
7. **[Waltek Company, Ltd.]**
8. **[Wausau Window and Wall Systems; Apogee Wausau Group, Inc.]**
9. **[YKK AP America Inc.]**
10. **<Insert manufacturer's name>**

- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

1. **[Arcadia Inc.]**
2. **[Bruce Wall Systems Corporation]**
3. **[CMI Architectural Products, Inc.]**
4. **[Kawneer Company, Inc.; Arconic Corporation]**
5. **[Shuco USA L.L.L.P.]**
6. **[Tingwall Inc.]**
7. **[Waltek Company, Ltd.]**
8. **[Wausau Window and Wall Systems; Apogee Wausau Group, Inc.]**
9. **[YKK AP America Inc.]**
10. **<Insert manufacturer's name>**

- C. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Glazing System: Retained with structural sealant on four sides.
2. Finish: **[Clear anodic finish][Color anodic finish][Baked-enamel or powder-coat finish][High-**

performance organic finish][Superior-performance organic finish].

3. System: **[Unitized][Either unitized or stick].**
4. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
5. Steel Reinforcement: As required by manufacturer.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Venting Windows:

1. As specified in Section 085113 "Aluminum Windows."
2. Manufacturer's standard units, complying with AAMA/WDMA/CSA 101/I.S.2/A440, with self-flashing mounting fins, and as follows:
 - a. Window Type: **[Awning][Casement][As indicated on Drawings]<Insert type>.**
 - b. Minimum Performance Class: **[CW][AW]<Insert class>.**
 - c. Minimum Performance Grade: **[30][40][60][70][80][90][As indicated on Drawings]<Insert number>.**
 - d. Hardware: Manufacturer's standard; of aluminum, stainless steel, die-cast steel, malleable iron, or bronze; including the following:
 - 1) Cam handle locking system.
 - 2) Multipoint locking system.
 - 3) Pole-operated, cam handle locking system, where rail is more than **72 inches (1830 mm)** above floor.
 - 4) Rotary operator.
 - 5) Steel or bronze operating arms.
 - 6) Limit Devices: **[Concealed friction adjustor and adjustable stay bar]<Insert type>** limit devices designed to restrict sash opening.
 - a) Limit clear opening to **[4 inches (100 mm)]<Insert dimension>** for ventilation; with custodial key release.
 - e. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
 - f. Insect Screens: Provide removable insect screen on each operable exterior sash, with screen frame finished to match window unit, complying with SMA 1004 or SMA 1201, and as follows:
 - 1) Aluminum Wire Fabric: 18-by-18, **0.0445-inch-by-0.0445-inch (1.1-by-1.1-mm)**; 18-by-16, **0.0445-inch-by-0.0515-inch (1.1-by-1.3-mm)**; or 18-by-14, **0.0445-inch-by-0.0624-inch (1.1-by-1.5-mm)** mesh of **0.013-inch- (0.3-mm-)** diameter, coated aluminum wire.
 - 2) Glass-Fiber Mesh Fabric: 18-by-16, **0.0445-inch-by-0.0515-inch (1.1-by-1.3-mm)** or 18-by-14, **0.0445-inch-by-0.0624-inch (1.1-by-1.5-mm)** mesh of PVC-coated, glass-fiber threads, woven and fused to form a fabric mesh; complying with ASTM D3656/D3656M.
 - 3) Fabric: Manufacturer's standard aluminum wire fabric or glass-fiber mesh fabric.
 - g. Glazing: **[As specified in Section 088000 "Glazing"]**[Same as adjacent structural-sealant-glazed curtain-wall glazing]<Insert glazing>.
 - h. Finish: **[Match adjacent structural-sealant-glazed curtain-wall finish]<Insert finish>.**

2.4 SUN CONTROL

- A. Sunshades: Assemblies consisting of manufacturer's standard outrigger brackets, louvers, and fascia, designed for attachment to structural-sealant-glazed curtain-wall framing with mechanical fasteners. Verify availability of sun control options with manufacturers.
1. Orientation: **[Horizontal][Vertical]**.
 2. Projection from Wall: **[As indicated on Drawings][20 inches (508 mm)][25 inches (635 mm)][30 inches (762 mm)][35 inches (889 mm)]<Insert projection>**.
 3. Outriggers: **[Straight with square edges][Straight with rounded edge][Curved][Wedge]<Insert shape>**.
 4. Louvers:
 - a. Number: **[Three][Four][Five]<Insert number>** louvers per unit.
 - b. Shape: **[Planar][Arched][Circular][Airfoil][Square]**.
 - c. Width: **[6 inches (152 mm)][8 inches (203 mm)][10 inches (254 mm)]<Insert dimension>**.
 - d. Mounting Angle: **[25][30][35]<Insert number>** degrees.
 5. Fasciae: **[Rectangular][Bullnose][Angular][Circular]**.
 6. Finish: **[Match adjacent structural-sealant-glazed curtain wall]<Insert finish>**.
 7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 8. Steel Reinforcement: As required by manufacturer.
- B. Light Shelves: Light-reflecting assemblies consisting of manufacturer's standard support brackets or channels, and aluminum tray, designed for attachment to interior of structural-sealant-glazed curtain-wall framing with mechanical fasteners.
1. Projection from Wall: **[As indicated on Drawings][20 inches (508 mm)][25 inches (635 mm)][30 inches (762 mm)][35 inches (889 mm)]<Insert projection>**.
 2. Finish: **[Match adjacent structural-sealant-glazed curtain wall]<Insert finish>**.
 3. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 4. Steel Reinforcement: As required by manufacturer.

2.5 GLAZING

- A. Comply with Section 088000 "Glazing."
- B. Glazing Gaskets:
1. ASTM C509 or ASTM C864. **[Manufacturer's standard][Compression-type, replaceable EPDM][Extruded silicone]<Insert type>**.
 - a. Color: **[Black]<Insert color>**.
 2. Comply with Section 088000 "Glazing."
- C. Glazing Sealants:
1. As recommended by manufacturer.
 2. Comply with Section 088000 "Glazing."
 3. Product Data: Verify architectural sealant has a VOC content of 250 g/L or less.
- D. Structural Glazing Sealants: ASTM C1184, chemically curing silicone formulation that is compatible with system components with which it comes into contact, specifically formulated and tested for use as

structural sealant and approved by structural-sealant manufacturer for use in structural-sealant-glazed curtain-wall assembly indicated.

1. Color: ~~[Black]~~~~[Gray]~~**[As selected by Architect from manufacturer's full range of colors]**~~<Insert color>~~.

- E. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes into contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed curtain-wall manufacturers for this use.

1. Color: Match structural sealant.

2.6 MATERIALS

- A. Sheet and Plate: **ASTM B209 (ASTM B209M)**.
- B. Extruded Bars, Rods, Profiles, and Tubes: **ASTM B221 (ASTM B221M)**.
- C. Structural Profiles: ASTM B308/B308M.
- D. Steel Reinforcement:
 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.
- F. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- G. Regional Materials: Verify products are manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- H. Regional Materials: Verify products are manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, multiply the distance by 0.25 to determine the distance to Project site.

2.7 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 2. Reinforce members as required to receive fastener threads.

3. Use exposed fasteners with countersunk Phillips screw heads[, **finished to match framing system**][, **fabricated from 300 series stainless steel**].
- B. Anchors: Three-way adjustable anchors with minimum adjustment of [**1 inch (25.4 mm)**]**<Insert dimension>** that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- C. Concealed Flashing: [**Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials**][**Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, ASTM A240/A240M of type recommended by manufacturer**].
- D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for **30-mil (0.762-mm)** thickness per coat.

2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Physical and thermal isolation of glazing from framing members.
 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 5. Provisions for field replacement of glazing from [**exterior**][**interior**].
 6. Provisions for safety railings mounted [**on interior face of mullions**][**between mullions at interior**].
 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 8. Components curved to indicated radii.
- D. Factory-Assembled Frame Units:
 1. Rigidly secure nonmovement joints.
 2. Prepare surfaces that will contact structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
 3. Seal joints watertight unless otherwise indicated.
 4. Install structural glazing.
 - a. Set glazing into framing in accordance with sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
 - b. Set glazing with proper orientation, so that coatings face exterior or interior as specified.
 - c. Apply structural silicone sealant to completely fill cavity, in accordance with sealant manufacturers written instructions with the framing and glazing in a fully supported position.
 - d. Brace or stiffen framing and glazing in such a manner to prevent undue stresses on the

- glass edge seal and structural joints or movement of the glazing, until sealant is fully cured in accordance with manufacturer's written instructions.
- e. After structural sealant has completely cured, insert backer rod between lites of glass as recommended by sealant manufacturer.
- f. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.
- g. Clean and protect glass as indicated in Section 088000 "Glazing."
- h. Retain bracing or stiffening until erected to prevent racking of units during transportation and erection.

E. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

F. <Insert requirements>.

2.9 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, [AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm] or thicker.

B. Color Anodic Finish: AAMA 611, [AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm] or thicker.

1. Color: [Light bronze][Medium bronze][Dark bronze][Champagne][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>.

C. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.

D. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with [AAMA 2604][AAMA 2605] and containing not less than [50][70] percent PVDF resin by weight in color coat.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [for seacoast and severe environments].
2. Color and Gloss: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.

E. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [for seacoast and severe environments].
2. Color and Gloss: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.

F. Superior-Performance Organic Finish, Four-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [for seacoast and severe environments].

2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
 - G. Superior-Performance Organic Finish, Single-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
 - H. Superior-Performance Organic Finish, Two-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- 2.10 SOURCE QUALITY CONTROL
- A. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF STRUCTURAL-SEALANT-GLAZED CURTAIN WALLS

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
- G. Seal joints watertight unless otherwise indicated.

H. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

I. Install components plumb and true in alignment with established lines and grades.**J. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.****K. <Insert requirements>.****3.3 ERECTION TOLERANCES****A. Install structural-sealant-glazed curtain walls to comply with the following maximum tolerances:**

1. Plumb: **1/8 inch in 10 ft. (3.2 mm in 3 m); 1/4 inch in 40 ft. (6.35 mm in 12.2 m).**
2. Level: **1/8 inch in 20 ft. (3.2 mm in 6 m); 1/4 inch in 40 ft. (6.35 mm in 12.2 m).**
3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to **1/2 inch (12.7 mm)** wide, limit offset from true alignment to **1/16 inch (1.6 mm)**.
 - b. Where surfaces are separated by reveal or protruding element from **1/2 to 1 inch (12.7 to 25.4 mm)** wide, limit offset from true alignment to **1/8 inch (3.2 mm)**.
 - c. Where surfaces are separated by reveal or protruding element of **1 inch (25.4 mm)** wide or more, limit offset from true alignment to **1/4 inch (6 mm)**.
4. Location: Limit variation from plane to **1/8 inch in 12 ft. (3.2 mm in 3.6 m); 1/2 inch (12.7 mm)** over total length.

3.4 FIELD QUALITY CONTROL**A. Testing Agency: [Owner will engage][Engage] a qualified testing agency to perform tests and inspections.****B. Test Area: Perform tests on [one bay at least 30 ft. (9.1 m), by one story][representative areas of structural-sealant-glazed curtain walls][mockups]<Insert requirements>.****C. Field Quality-Control Testing: Perform the following test on [representative areas of structural-sealant-glazed curtain walls][mockups]<Insert requirements>.**

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect will be tested in accordance with AAMA 501.2 and will not evidence water penetration.
 - a. Perform a minimum of [**two**][**three**]**<Insert number>** tests in areas as directed by Architect.
 - b. Perform tests in each test area, as directed by Architect. Perform at least three tests, prior to [**10, 35, and 70 percent completion**]**<Insert requirements>**.

2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in Part 2 "Performance Requirements" Article but not more than **0.50 cfm/sq. ft. (2.25 L/s per sq. m)**.
 - a. Perform a minimum of **[two][three]<Insert number>** tests in areas, as directed by Architect.
 - b. Perform tests in each test area, as directed by Architect. Perform at least three tests, prior to **[10, 35, and 70 percent completion]<Insert requirements>**.
 3. Water Penetration: ASTM E1105 at a minimum **[uniform][and][cyclic]** static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in Part 2 "Performance Requirements" Article, but not less than **6.24 lbf/sq. ft. (300 Pa)**, and will not evidence water penetration.
- D. Structural-Sealant Adhesion: Test structural sealant in accordance with recommendations in ASTM C1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
1. Test a minimum of **[two][four][six]<Insert number>** areas on each building facade.
 2. Repair installation areas damaged by testing.
- E. Structural-sealant-glazed curtain walls will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 08 44 13 00A

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SECTION 08 44 13 00B - SLOPED GLAZING ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sloped glazing assemblies.

B. Related Requirements:

1. Section 014339 "Mockups" for preconstruction laboratory mockup testing.
2. Section 084413 "Glazed Aluminum Curtain Walls" for vertical curtain walls.
3. Section 088000 "Glazing" for glass requirements.

1.2 ALLOWANCES

- A. **[Preconstruction laboratory mockup][Source quality-control][and][field quality-control]** testing is part of testing and inspecting allowance.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1. **<Insert requirements>**.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.
3. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
4. Environmental Product Declaration (EPD): For each product.
5. Health Product Declaration (HPD): For each product.
6. Environmental Product Declaration (EPD): For each product.
7. Health Product Declaration (HPD): For each product.
8. Environmental Product Declaration (EPD): For each product.
9. Environmental Product Declaration (EPD): For each product.
10. Environmental Product Declaration (EPD): For each product.

11. Third-Party Certifications: For each product.
 12. Third-Party-Certified Life-Cycle Assessment: For each product.
- C. Shop Drawings: For sloped glazing assemblies. Include plans, elevations, sections, full-size details, and attachments to other work.
1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 2. Include full-size isometric details of each type of vertical-to-horizontal intersection of sloped glazing assemblies, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- D. Samples for Initial Selection: For units with factory-applied color finishes.
- E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- F. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from **12-inch (300-mm)** lengths of full-size components and showing details of the following:
1. Joinery, including concealed welds.
 2. Anchorage.
 3. Expansion provisions.
 4. Glazing.
 5. Flashing and drainage.
- G. Delegated-Design Submittal: For sloped glazing assemblies, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Mockup Testing Submittals:
1. Testing Program: Developed specifically for Project.
 2. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.
 3. Record Drawings: As-built drawings of preconstruction laboratory mockups, showing changes made during preconstruction laboratory mockup testing.
- B. Qualification Data:
1. For Installer[**and laboratory mockup testing agency**][**and field testing agency**].
 2. For professional engineer's experience with providing delegated-design engineering services of the type indicated, including documentation that engineer is licensed in the [jurisdiction][state] in which Project is located.
- C. Energy Performance Certificates: For sloped glazing assemblies, accessories, and components from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each sloped glazing assembly.

- D. Product Test Reports: For sloped glazing assemblies, for tests performed by **[manufacturer and witnessed by a qualified testing agency][a qualified testing agency]**.
- E. Quality-Control Program: Developed specifically for Project, including fabrication and installation, in accordance with recommendations in ASTM C1401. Include periodic quality-control reports.
- F. Source quality-control reports.
- G. Field quality-control reports.
- H. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sloped glazing assemblies to include in maintenance manuals.
- B. Maintenance Data for Structural Sealant: For sloped glazing assemblies with structural glazing, to include in maintenance manuals. Include ASTM C1401 recommendations for postinstallation-phase quality-control program.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AGM) contractors[**and that employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program**].
- B. Laboratory Mockup Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated [**and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025**].
- C. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated [**and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025**] and acceptable to Owner and Architect.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- E. Structural-Sealant Glazing: Comply with ASTM C1401 for design and installation of structural-sealant-glazed sloped glazing assemblies.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
1. Build mockup of typical sloped glazing area, as shown on Drawings.
 2. Testing shall be performed on mockups in accordance with requirements in Part 3 "Field Quality Control" Article.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: **[Owner will engage][Engage]** a qualified testing agency to perform preconstruction testing on laboratory mockups.
1. Build preconstruction laboratory mockups at testing agency facility; use personnel, products, and methods of construction that will be used at Project site.
 2. Size and Configuration: As indicated on Drawings.
 3. Notify Architect **[seven]<Insert number>** days in advance of the dates and times when preconstruction laboratory mockups will be constructed and tested.
- B. Preconstruction Laboratory Mockup Testing: Test preconstruction laboratory mockups in accordance with requirements in Part 2 "Performance Requirements" Article. Perform the following tests in the following order:
1. Structural, 50 percent: ASTM E330/E330M at 50 percent of positive test load.
 2. Air Leakage: ASTM E283.
 3. Water Penetration under Static Pressure: ASTM E331.
 4. Water Penetration under Dynamic Pressure: AAMA 501.1.
 5. Interstory Drift, 100 percent: AAMA 501.4 at 100 percent of design displacement. Repeat the following:
 - a. Air Leakage: ASTM E283.
 - b. Water Penetration under Static Pressure: ASTM E331.
 6. Vertical Interstory Movement: AAMA 501.7 at 100 percent of design displacement. Repeat the following:
 - a. Air Leakage: ASTM E283.
 - b. Water Penetration under Static Pressure: ASTM E331.
 7. Thermal Cycling: AAMA 501.5. Repeat the following:
 - a. Air Leakage: ASTM E283.
 - b. Water Penetration under Static Pressure: ASTM E331.
 8. Structural, 100 percent: ASTM E330/E330M at 100 percent of positive and negative test loads. Repeat the following:
 - a. Air Leakage: ASTM E283.
 - b. Water Penetration under Static Pressure: ASTM E331.

- c. Water Penetration under Dynamic Pressure: AAMA 501.1.
 - 9. Structural, 150 percent: ASTM E330/E330M at 150 percent of positive and negative test loads.
 - 10. Interstory Drift, 150 percent: AAMA 501.4 at 150 percent of design displacement.
 - C. Preconstruction Adhesion and Compatibility Testing: Submit to structural glazing sealant manufacturer, for testing indicated below, Samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that is in close proximity to or is touching the structural or nonstructural sealants of a structural glazed system.
 - 1. Compatibility: Test materials or components using ASTM C1087.
 - 2. Adhesion: Test for adhesion or lack of adhesion of a structural sealant to the surface of another material or component using ASTM C1135.
 - 3. Submit no fewer than **[eight]<Insert number>** pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
 - 6. Testing will not be required if data based on previous testing of current sealant products match those submitted.
- 1.10 WARRANTY
- A. Special Assembly Warranty: **[Manufacturer][Installer]** agrees to repair or replace components of sloped glazing assemblies that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals[, **metal finishes**,] and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: **[Two][Five][10]<Insert number>** years from date of Substantial Completion.
 - B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: **[Five][10][20]<Insert number>** years from date of Substantial Completion.
 - C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, peeling, or chipping.
2. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design sloped glazing assemblies.
- B. General Performance: Comply with performance requirements specified, as determined by testing of sloped glazing assemblies representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 1. Sloped glazing assemblies shall withstand movements of supporting structure, including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
- C. Structural Loads:
 1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: **[As indicated on Drawings]<Insert loads>**.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
 1. Deflection Normal to Wall Plane: Limited to **[1/175 of length of span of the framing member for lengths of up to 13 feet 6 inches (4.1 m) and to 1/240 of length of span of the framing member plus 1/4 inch (6.35 mm) for lengths of greater than 13 feet 6 inches (4.1 m)]<Insert deflection limit>**.
 2. Deflection Parallel to Glazing Plane: Limited to **[amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm)]<Insert deflection limit>**.
 3. Cantilever Deflection: Limited to 2/175 of the unsupported length.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at **[150]<Insert number>** percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding **[0.2]<Insert number>** percent of span.
 3. Test Durations: As required by design wind velocity, but not less than **[10]<Insert number>**

seconds.

- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
 - 1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than **[6.24 lbf/sq. ft. (300 Pa)][10 lbf/sq. ft. (480 Pa)][15 lbf/sq. ft. (720 Pa)]<Insert value>**.
- G. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:
 - 1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than **[6.24 lbf/sq. ft. (300 Pa)][10 lbf/sq. ft. (480 Pa)][15 lbf/sq. ft. (720 Pa)]<Insert value>**.
 - 2. Maximum Water Leakage: **[In accordance with AAMA 501.1][No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation]**. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.
- H. Interstory Drift: Accommodate design displacement of adjacent stories indicated.
 - 1. Design Displacement: **[As indicated on Drawings]<Insert design displacement>**.
 - 2. Test Performance: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.4 at design displacement **[and 1.5 times the design displacement]**.
- I. Seismic Performance: Sloped glazing assemblies shall withstand the effects of earthquake motions determined in accordance with **[ASCE/SEI 7]<Insert requirement>**.
 - 1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.6 at design displacement **[and 1.5 times the design displacement]**.
 - 2. Vertical Interstory Movement: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.7 at design displacement **[and 1.5 times the design displacement]**.
- J. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:
 - 1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than **[0.29 Btu/sq. ft. x h x deg F (1.65 W/sq. m x K)][0.36 Btu/sq. ft. x h x deg F (2.04 W/sq. m x K)][0.38 Btu/sq. ft. x h x deg F (2.16 W/sq. m x K)][0.41 Btu/sq. ft. x h x deg F (2.33 W/sq. m x K)][0.46 Btu/sq. ft. x h x deg F (2.61 W/sq. m x K)][0.50 Btu/sq. ft. x h x deg F (2.84 W/sq. m x K)]<Insert value>** as determined in accordance with NFRC 100.
 - 2. Solar Heat Gain Coefficient (SHGC):
 - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than **[0.25][0.30][0.40][0.45]<Insert value>** as determined in accordance with NFRC 200.
 - 3. Air Leakage:
 - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than **[0.06 cfm/sq. ft. (0.30 L/s per sq. m)]<Insert value>** at a static-air-pressure differential of **[1.57 lbf/sq. ft. (75 Pa)][6.24 lbf/sq. ft. (300 Pa)]<Insert value>** when tested in accordance with

ASTM E283.

4. Condensation Resistance Factor (CRF):

- a. Fixed Glazing and Framing Areas: CRF for the system of not less than [29][55][65][80]<Insert value> as determined in accordance with AAMA 1503.

K. Noise Reduction: Test in accordance with ASTM E90, with ratings determined by ASTM E1332, as follows:

1. Outdoor-Indoor Transmission Class (OITC): Minimum [26][30][34]<Insert number>.
2. Sound Transmission Class (STC): Minimum [31][34][37][40]<Insert number>.

L. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: **120 deg F (67 deg C)**, ambient; **180 deg F (100 deg C)**, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of [180 deg F (82 deg C)]<Insert temperature>.
 - b. Low Exterior Ambient-Air Temperature: [0 deg F (minus 18 deg C)]<Insert temperature>.

M. Structural-Sealant Joints:

1. Designed to carry gravity loads of glazing.

N. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by sloped glazing assemblies without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.2 SOURCE LIMITATIONS

- A. Obtain all components of sloped glazing assemblies[**and glazed aluminum curtain walls**], including framing and accessories, from single manufacturer.

2.3 SLOPED GLAZING ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. [EFCO Corporation]
2. [Gammans Skylight Systems]
3. [Kawneer Company, Inc.; Arconic Corporation]
4. [Linell; Mestek, Inc.]

5. [U.S. Aluminum; C.R. Laurence Co., Inc.; CRH Americas, Inc.]
6. [Waltek Company, Ltd.]
7. [Wausau Window and Wall Systems; Apogee Wausau Group, Inc.]
8. [YKK AP America Inc.]
9. <Insert manufacturer's name>

B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [EFCO Corporation]
2. [Gammans Skylight Systems]
3. [Kawneer Company, Inc.; Arconic Corporation]
4. [Linel; Mestek, Inc.]
5. [U.S. Aluminum; C.R. Laurence Co., Inc.; CRH Americas, Inc.]
6. [Waltek Company, Ltd.]
7. [Wausau Window and Wall Systems; Apogee Wausau Group, Inc.]
8. [YKK AP America Inc.]
9. <Insert manufacturer's name>

C. Framing Members: Manufacturer's standard, formed- or extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: [Thermally broken][Thermally improved][Nonthermal]<Insert description>.
2. Framing-Member Type: [Self-supporting][Skin type, supported by structural-steel members indicated].
3. Glazing System: [Field-installed pressure caps on four sides][Field-installed structural sealant at horizontal members (purlins) and pressure caps at rafters].
4. Finish: [Clear anodic finish][Color anodic finish][Baked-enamel or powder-coat finish][High-performance organic finish][Superior-performance organic finish].
5. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
6. Steel Reinforcement: As required by manufacturer.

D. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.

1. Include snap-on aluminum trim that conceals fasteners.

E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.4 GLAZING

A. Comply with Section 088000 "Glazing."

B. Glazing Gaskets:

1. ASTM C509 or ASTM C864. [Manufacturer's standard][Compression-type, replaceable EPDM][Extruded silicone]<Insert type>.
 - a. Color: [Black]<Insert color>.
2. Comply with Section 088000 "Glazing."

C. Glazing Sealants:

1. As recommended by manufacturer.

2. Comply with Section 088000 "Glazing."
3. Product Data: Verify architectural sealant has a VOC content of 250 g/L or less.
 - a. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - b. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 - c. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify the building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.
- D. Structural Glazing Sealants: ASTM C1184, chemically curing silicone formulation that is compatible with system components with which it comes into contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in sloped glazing assembly indicated.
 1. Color: [Black][Gray][As selected by Architect from manufacturer's full range of colors]<Insert color>.
- E. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes into contact; recommended by structural-sealant, weatherseal-sealant, and sloped glazing assembly manufacturers for this use.
 1. Color: Match structural sealant.

2.5 MATERIALS

- A. Sheet and Plate: **ASTM B209 (ASTM B209M).**
- B. Extruded Bars, Rods, Profiles, and Tubes: **ASTM B221 (ASTM B221M).**
- C. Structural Profiles: ASTM B308/B308M.
- D. Steel Reinforcement:
 1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
- E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.
- F. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- G. Regional Materials: Verify products are manufactured within **100 miles (160 km)** of Project site from

materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.

- H. Regional Materials: Verify products are manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, multiply the distance by 0.25 to determine the distance to Project site.

2.6 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 2. Reinforce members as required to receive fastener threads.
 3. Use exposed fasteners with countersunk Phillips screw heads[, **finished to match framing system**][, **fabricated from 300 series stainless steel**].
- B. Anchors: Three-way adjustable anchors with minimum adjustment of [**1 inch (25.4 mm)**]**<Insert dimension>** that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- C. Concealed Flashing: [**Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials**][**Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, ASTM A240/A240M of type recommended by manufacturer**].
- D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for **30-mil (0.762-mm)** thickness per coat.

2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Physical and thermal isolation of glazing from framing members.
 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 5. Provisions for field replacement of glazing from [**exterior**][**interior**].
 6. Provisions for safety railings mounted [**on interior face of mullions**][**between mullions at interior**].
 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
 8. Components curved to indicated radii.

- D. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- E. Fabricate components with internal guttering system or other means to drain water-passing joints, condensation occurring within framing members, and moisture migrating within sloped glazing assemblies to exterior.
- F. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.8 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**][**AA-M12C22A31, Class II, 0.010 mm**] or thicker.
- B. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**][**AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.
 - 1. Color: [**Light bronze**][**Medium bronze**][**Dark bronze**][**Champagne**][**Black**][**Match Architect's sample**][**As selected by Architect from full range of industry colors and color densities**]<Insert color>.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.
- D. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with [**AAMA 2604**][**AAMA 2605**] and containing not less than [**50**][**70**] percent PVDF resin by weight in color coat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**].
 - 2. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.
- E. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**].
 - 2. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.
- F. Superior-Performance Organic Finish, Four-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions [**for seacoast and severe environments**].
 - 2. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.
- G. Superior-Performance Organic Finish, Single-Coat FEVE: Fluoropolymer finish complying with AAMA

2605.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

H. Superior-Performance Organic Finish, Two-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

2.9 SOURCE QUALITY CONTROL

- A. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
- G. Seal joints watertight unless otherwise indicated.
- H. Metal Protection:
1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting

contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.

2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

- I. Install components to drain water-passing joints, condensation occurring within framing members, and moisture migrating within sloped glazing assemblies to exterior.
- J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF GLAZING

- A. Install glazing as specified in Section 088000 "Glazing."

3.4 INSTALLATION OF STRUCTURAL GLAZING

- A. Prepare surfaces that will contact structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
- B. Set glazing into framing in accordance with sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
- C. Set glazing with proper orientation, so that coatings face exterior or interior as specified.
- D. Hold glazing in place using temporary retainers of type and spacing recommended by manufacturer, until structural sealant joint has cured.
- E. Apply structural sealant to completely fill cavity, in accordance with sealant manufacturer and framing manufacturers written instructions and in compliance with local codes.
- F. Apply structural sealant at temperatures indicated by sealant manufacturer for type of sealant.
- G. Allow structural sealant to cure in accordance with manufacturer's recommendations.
- H. Clean and protect glass as indicated in Section 088000 "Glazing."

3.5 INSTALLATION OF WEATHERSEAL SEALANT

- A. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass, as recommended by sealant manufacturer.
- B. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.

3.6 ERECTION TOLERANCES

- A. Install sloped glazing assemblies to comply with the following maximum tolerances:
 1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).

2. Level: **1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).**
3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to **1/2 inch (12.7 mm)** wide, limit offset from true alignment to **1/16 inch (1.6 mm)**.
 - b. Where surfaces are separated by reveal or protruding element from **1/2 to 1 inch (12.7 to 25.4 mm)** wide, limit offset from true alignment to **1/8 inch (3.2 mm)**.
 - c. Where surfaces are separated by reveal or protruding element of **1 inch (25.4 mm)** wide or more, limit offset from true alignment to **1/4 inch (6 mm)**.
4. Location: Limit variation from plane to **1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm)** over total length.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
- B. Test Area: Perform tests on **[one bay at least 30 feet (9.1 m), by one story][representative areas of sloped glazing assemblies][mockups]<Insert requirements>**.
- C. Field Quality-Control Testing: Perform the following test on **[representative areas of sloped glazing assemblies][mockups]<Insert requirements>**.
 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of **[two][three]<Insert number>** tests in areas as directed by Architect.
 - b. Perform tests in each test area, as directed by Architect. Perform at least three tests, prior to **[10, 35, and 70 percent completion]<Insert requirements>**.
 2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in Part 2 "Performance Requirements" Article but not more than **0.09 cfm/sq. ft. (0.45 L/s per sq. m)** at a static-air-pressure differential of **1.57 lbf/sq. ft. (75 Pa)**.
 - a. Perform a minimum of **[two][three]<Insert number>** tests in areas, as directed by Architect.
 - b. Perform tests in each test area, as directed by Architect. Perform at least three tests, prior to **[10, 35, and 70 percent completion]<Insert requirements>**.
 3. Water Penetration: ASTM E1105 at a minimum **[uniform][and][cyclic]** static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in Part 2 "Performance Requirements" Article, but not less than **6.24 lbf/sq. ft. (300 Pa)**, and shall not evidence water penetration.
- D. Structural-Sealant Adhesion: Test structural sealant in accordance with recommendations in ASTM C1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
 1. Test a minimum of **[two][four][six]<Insert number>** areas on each building facade.
 2. Repair installation areas damaged by testing.
- E. Sloped glazing assemblies will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.



08 - Openings

END OF SECTION 08 44 13 00B

SECTION 08 45 23 00 - STRUCTURED-POLYCARBONATE-PANEL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Structured-polycarbonate-panel assemblies.
 - 2. Structured-polycarbonate panels.
 - 3. Aluminum framing systems.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]**<Insert location>.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum components of panel assemblies.
- B. Sustainable Design Submittals:
 - 1. Product Data: For sealants, indicating VOC content.
- C. Shop Drawings: For panel assemblies.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.
- D. Samples: In manufacturer's standard size.
 - 1. For each type of structured-polycarbonate panel.
 - 2. For each type of exposed finish for framing members.
- E. Fabrication Samples: Of each framing system intersection and adjacent panels, made from **12-inch (305-mm)** lengths of full-size framing members and showing details of the following:
 - 1. Joinery.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Structured-polycarbonate panels.
 - 5. Flashing and drainage.
- F. Delegated Design Submittal: For panel assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified **[Installer][testing agency]**.
- B. Product Test Reports: For each structured-polycarbonate-panel assembly, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For structured-polycarbonate-panel assemblies from ICC-ES.
- D. Field quality-control reports.
- E. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For panel assemblies to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical panel assemblies as shown on Drawings.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of panel assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Deterioration of metals[, **metal finishes**,] and other materials beyond normal weathering.
 - c. Water leakage.
 - 2. Warranty Period: **[Two][Five]<Insert number>** years from date of Substantial Completion.
- B. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace structured-polycarbonate panels that exhibit defects in materials or workmanship within specified warranty period.
 - 1. Defects include, but are not limited to, the following:
 - a. Delamination.
 - b. Color changes exceeding requirements.
 - c. Losses in light transmission beyond 6 percent from original when measured in accordance

with ASTM D1003.

2. Warranty Period: **[10]<Insert number>** years from date of Substantial Completion.
- C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
 2. Warranty Period: **[Five][10][20]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design structured-polycarbonate-panel assemblies.
- B. Structural Loads: **[As indicated on Drawings]<Insert loads>**.
- C. Deflection Limits:
 1. Vertical Panel Assemblies: Limited to **[1/60][1/100][1/120]<Insert deflection>** of clear span for each assembly component.
 2. Overhead Panel Assemblies: Limited to **[1/60][1/100][1/120][1/180]<Insert deflection>** of clear span for each assembly component.
- D. Structural-Test Performance: Panel assemblies tested in accordance with ASTM E330/E330M, as follows:
 1. When tested at positive and negative wind-load design pressures, assemblies do not show evidence of deflection exceeding specified deflection limits.
 2. When tested at **[150]<Insert number>** percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not show evidence of material failures, structural distress, and permanent deformation of main framing members exceeding **[0.2]<Insert number>** percent of span.
 3. Test Durations: As required by design wind velocity, but not less than **[10]<Insert number>** seconds.
- E. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone **[1][2][3][4]** for **[basic][enhanced]** protection.
 1. Large-Missile Test: For glazing located within **[30 feet (9.1 m)]<Insert dimension>** of grade.
 2. Small-Missile Test: For glazing located between **30 feet (9.1 m)** and **[60 feet (18.3 m)]<Insert dimension>** above grade.
- F. Water Penetration under Static Pressure: Provide panel assemblies that do not evidence water penetration through fixed glazing and framing areas when tested in accordance with ASTM E331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than **[6.24 lbf/sq. ft. (300 Pa)][10 lbf/sq. ft. (480 Pa)][15 lbf/sq. ft. (720 Pa)]<Insert value>**.
- G. Water Penetration under Dynamic Pressure: Provide panel assemblies that do not evidence water leakage through fixed glazing and framing areas when tested in accordance with AAMA 501.1 under

dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than [6.24 lbf/sq. ft. (300 Pa)]<Insert value>.

1. Maximum Water Leakage: [In accordance with AAMA 501.1][No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation]. Water leakage does not include water that is controlled by flashing and gutters and drained to the exterior, or water that cannot damage adjacent materials or finishes.

H. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): [120 deg F (67 deg C), ambient; 180 deg F (100 deg C)]<Insert temperature range>, material surfaces.

I. Energy Performance: Provide panel assemblies with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below[and certified and labeled in accordance with NFRC]:

1. Thermal Transmittance (U-Factor): Fixed glazing and framing areas have U-factor of not more than [0.80 Btu/sq. ft. x h x deg F (4.54 W/sq. m x K)][0.65 Btu/sq. ft. x h x deg F (3.69 W/sq. m x K)]<Insert value> as determined in accordance with NFRC 100.
2. Solar-Heat-Gain Coefficient (SHGC): Fixed glazing and framing areas have an SHGC of no greater than [0.6][0.7]<Insert value> as determined in accordance with NFRC 200.
3. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of [0.30 cfm/sq. ft. (1.50 L/s per sq. m)]<Insert value> of fixed wall area as determined in accordance with ASTM E283/E283M at a minimum static-air-pressure differential of [1.57 lbf/sq. ft. (75 Pa)][6.24 lbf/sq. ft. (300 Pa)]<Insert value>.

2.2 STRUCTURED-POLYCARBONATE-PANEL ASSEMBLIES

A. Assembly Description: Translucent assemblies that are supported by aluminum framing and glazed with structured-polycarbonate panels.

B. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. [Duo-Gard Industries, Inc]
2. [Energy-Glazed Systems, Inc.]
3. [Gallina USA, LLC]
4. [Kingspan Light + Air LLC]
5. [Major Industries, Inc.]
6. [Resolite; a division of Stabilt America]
7. [Super Sky Products Enterprises, LLC]
8. [Wasco Part of Velux Commercial; Velux America LLC]
9. <Insert manufacturer's name>

C. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [Duo-Gard Industries, Inc]
2. [Energy-Glazed Systems, Inc.]

3. [Gallina USA, LLC]
 4. [Kingspan Light + Air LLC]
 5. [Major Industries, Inc.]
 6. [Resolite; a division of Stabilt America]
 7. [Super Sky Products Enterprises, LLC]
 8. [Wasco Part of Velux Commercial; Velux America LLC]
 9. <Insert manufacturer's name>
- D. Structured-Polycarbonate Panels: Translucent, extruded-polycarbonate sheet with multiwall cellular cross section that provides isolated airspaces and that is coextruded with a UV-protective layer.
1. Cell Insulation: Fill cellular cross sections with aerogel.
 2. Panel Thickness: Nominal [5/16 inch (8 mm)][3/8 inch (10 mm)][1/2 inch (12 mm)][5/8 inch (16 mm)][1 inch (25.4 mm)]<Insert thickness>.
 3. Panel Width: As recommended in writing by manufacturer.
 4. UV Resistance: [Not required][On outer surface][On both surfaces].
 5. Color: [Transparent, colorless][White][Bronze][Gray][Green][Blue][As selected by Architect from manufacturer's full range]<Insert color>.
 6. Panel Performance:
 - a. Plastic Self-Ignition Temperature: **650 deg F (343 deg C)** or more in accordance with ASTM D1929.
 - b. Smoke-Developed Index: 450 or less in accordance with ASTM E84, or 75 or less in accordance with ASTM D2843.
 - c. Combustibility Classification: [Class CC1][Class CC2] based on testing in accordance with ASTM D635.
 - d. Roof-Covering Classification: [Class A][Class B][Class C] in accordance with ASTM E108 or UL 790.
 - e. Interior Finish Classification: [Class A][Class B][Class C] based on testing in accordance with ASTM E84.
 - f. Color Change: Not more than 3.0 units Delta E, when measured in accordance with ASTM D2244, after outdoor weathering compliant with procedures in ASTM D1435.
 - 1) Outdoor Weathering Conditions: Sixty months in Arizona or 120 months in a moderate North American climate.
 - g. Impact Resistance: No failure at impact of [200 ft. x lbf (271 J) in accordance with freefalling-ball impact test using a 3-1/2-inch- (89-mm-) diameter, 6.3-lb (2.9-kg) ball]<Insert requirements>.
 - h. Haze Factor: Greater than 90 percent when tested in accordance with ASTM D1003.
- E. Aluminum Framing Systems: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
1. Construction: [One piece, extruded aluminum][Thermally broken, extruded aluminum]<Insert description>.
 2. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B209/B209M.
 - b. Extruded Bars, Rods, Profiles, and Tubes: **ASTM B221 (ASTM B221M).**
 - c. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
 - d. Structural Profiles: ASTM B308/B308M.
 3. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.

4. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding connectors, fasteners, clips, and accessories; compatible with adjacent materials.
 - a. At closures, retainers, caps, or battens, use ASTM A193/A193M, 300 series stainless steel screws.
 - b. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - c. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
5. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
6. Anchor Bolts: ASTM A307, Grade A, galvanized steel.
7. Concealed Flashing: Corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
8. Exposed Flashing and Closures: Aluminum sheet not less than **[0.040 inch (1.02 mm)][0.050 inch (1.27 mm)][0.063 inch (1.60 mm)]<Insert dimension>** thick, finished to match framing.
9. Framing Gaskets: Manufacturer's standard gasket system with low-friction surface treatment designed specifically for retaining structured-polycarbonate panels.
10. Frame-System Sealants: As **[recommended in writing by manufacturer.][specified in Section 079200 "Joint Sealants."]**
 - a. Product Data: Verify architectural sealant has a VOC content of 250 g/L or less.
 - b. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - c. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 - d. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify the building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.
11. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for **15-mil (0.4-mm)** dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

F. Aluminum Finishes:

1. Clear Anodic Finish: AAMA 611, **[AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm]** or thicker.
2. Color Anodic Finish: AAMA 611, **[AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm]** or thicker.
 - a. Color: **[Light bronze][Medium bronze][Dark bronze][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
3. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

- a. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- 4. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- 5. Superior-Performance Organic Finish: **[Two][Three][Four]**-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

2.3 FABRICATION

- A. Fabricate aluminum components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Internal guttering systems or other means to drain water passing through joints and moisture migrating within assembly to exterior.
- B. Fabricate aluminum sill closures with weep holes and for installation as continuous component.
- C. Reinforce aluminum components as required to receive fastener threads.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF STRUCTURED-POLYCARBONATE-PANEL ASSEMBLIES

- A. General: Comply with manufacturer's written instructions.
 - 1. Do not install damaged components.
 - 2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 - 3. Rigidly secure nonmovement joints.

4. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and immobilization of moving joints.
 5. Seal joints watertight unless otherwise indicated.
- B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with corrosion-resistant coating or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
- C. Install components plumb and true in alignment with established lines and elevations.
- D. Skylight Assemblies: Install continuous aluminum sill closures with weatherproof expansion joints and locked and sealed corners. Install components to drain water passing through joints and moisture migrating within assembly to exterior.
- E. Erection Tolerances: Install panel assemblies to comply with the following maximum tolerances:
1. Alignment: Limit offset from true alignment to **1/32 inch (0.8 mm)** where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than **3 inches (76 mm)**; otherwise, limit offset to **1/8 inch (3.2 mm)**.
 2. Location and Plane: Limit variation from true location and plane to **1/8 inch in 12 feet (3.2 mm in 3.7 m)**, but no greater than **1/2 inch (12 mm)** over total length.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
1. Water-Spray Test: Before installation of interior finishes has begun, panel assemblies are to be tested in accordance with AAMA 501.2 and not show evidence of water penetration.
 2. Water Penetration under Static Pressure: Before installation of interior finishes has begun, areas are to be tested in accordance with ASTM E1105.
 - a. Test Procedures: Test under **[uniform][and][cyclic]** static-air pressure.
 - b. Static-Air-Pressure Difference: **<Insert pressure>**.
 - c. Water Penetration: None.
- B. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

END OF SECTION 08 45 23 00

SECTION 08 45 23 00A - FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes aluminum-framed assemblies incorporating fiberglass-sandwich panels as follows:
 - 1. Wall assemblies.
 - 2. Roof assemblies.
 - 3. Skylight assemblies.
 - 4. Canopy assemblies.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum components of panel assemblies.
- B. Sustainable Design Submittals:
 - 1. Product Data: For sealants, indicating VOC content.
 - 2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
- C. Shop Drawings: For panel assemblies.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.
- D. Samples: In manufacturer's standard size.
 - 1. For each type of fiberglass-sandwich panel.
 - 2. For each type of exposed finish for framing members.
- E. Fabrication Samples: Of each framing system intersection and adjacent panels, made from **12-inch (305-mm)** lengths of full-size framing members and showing details of the following:
 - 1. Joinery.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Fiberglass-sandwich panels.
 - 5. Flashing and drainage.

- F. Delegated Design Submittals: For panel assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified [Installer][manufacturer][testing agency].
- B. Product Test Reports: For each fiberglass-sandwich-panel assembly, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For fiberglass-sandwich-panel assemblies from ICC-ES.
- D. Field quality-control reports.
- E. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For panel assemblies to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: For fiberglass-sandwich panels, a qualified manufacturer whose facilities, processes, and products are monitored by an independent, accredited quality-control agency for compliance with applicable requirements in ICC-ES AC04 or ICC-ES AC177.
- B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical panel assemblies as shown on Drawings.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of panel assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Deterioration of metals[, **metal finishes**,] and other materials beyond normal weathering.

- c. Water leakage.
- 2. Warranty Period: **[Two][Five]<Insert number>** years from date of Substantial Completion.
- B. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace fiberglass-sandwich panels that exhibit defects in materials or workmanship within specified warranty period.
 - 1. Defects include, but are not limited to, the following:
 - a. Fiberbloom.
 - b. Delamination of coating, if any, from exterior face sheet.
 - c. Color change exceeding requirements.
 - d. Delamination of panel face sheets from panel cores.
 - 2. Warranty Period: **[10]<Insert number>** years from date of Substantial Completion.
- C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 - 1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
 - 2. Warranty Period: **[Five][10][20]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design fiberglass-sandwich-panel assemblies.
- B. Structural Loads: **[As indicated on Drawings]<Insert loads>**.
- C. Deflection Limits:
 - 1. Vertical Panel Assemblies: Limited to **[1/60][1/90][1/120]<Insert deflection>** of clear span for each assembly component.
 - 2. Overhead Panel Assemblies: Limited to **[1/60][1/90][1/120][1/180]<Insert deflection>** of clear span for each assembly component.
- D. Structural-Test Performance: Provide panel assemblies tested in accordance with ASTM E330, as follows:
 - 1. When tested at positive and negative wind-load design pressures, assemblies do not show evidence of deflection exceeding specified limits.
 - 2. When tested at **[150]<Insert number>** percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not show evidence of material failures, structural distress, and permanent deformation of main framing members exceeding **[0.2]<Insert number>** percent of span.
 - 3. Test Durations: As required by design wind velocity, but not less than **[10]<Insert number>** seconds.
- E. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone **[1][2][3][4]** for **[basic][enhanced]** protection.

1. Large-Missile Test: For glazing located within [30 feet (9.1 m)]<Insert dimension> of grade.
 2. Small-Missile Test: For glazing located between 30 feet (9.1 m) and [60 feet (18.3 m)]<Insert dimension> above grade.
- F. Water Penetration under Static Pressure: Provide panel assemblies that do not evidence water penetration through fixed glazing and framing areas when tested in accordance with ASTM E331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than [6.24 lbf/sq. ft. (300 Pa)][10 lbf/sq. ft. (480 Pa)][15 lbf/sq. ft. (720 Pa)]<Insert value>.
- G. Water Penetration under Dynamic Pressure: Provide panel assemblies that do not evidence water leakage through fixed glazing and framing areas when tested in accordance with AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than [6.24 lbf/sq. ft. (300 Pa)]<Insert value>.
1. Maximum Water Leakage: [According to AAMA 501.1][No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation]. Water leakage does not include water that is controlled by flashing and gutters and drained to the exterior, or water that cannot damage adjacent materials or finishes.
- H. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): [120 deg F (67 deg C), ambient; 180 deg F (100 deg C)]<Insert temperature range>, material surfaces.
- I. Energy Performance: Provide panel assemblies with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below[**and certified and labeled according to NFRC**]:
1. Thermal Transmittance (U-Factor): Fixed glazing and framing areas to have U-factor of not more than [0.80 Btu/sq. ft. x h x deg F (4.54 W/sq. m x K)][0.65 Btu/sq. ft. x h x deg F (3.69 W/sq. m x K)]<Insert value> as determined in accordance with NFRC 100.
 2. Solar Heat Gain Coefficient (SHGC): Fixed glazing and framing areas to have a SHGC of no greater than [0.6][0.7]<Insert value> as determined in accordance with NFRC 200.
 3. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of [0.30 cfm/sq. ft. (1.50 L/s per sq. m)]<Insert value> of fixed wall area as determined in accordance with ASTM E283 at a minimum static-air-pressure differential of [1.57 lbf/sq. ft. (75 Pa)][6.24 lbf/sq. ft. (300 Pa)]<Insert value>.

2.2 FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

- A. Fiberglass-Sandwich-Panel Assemblies: Translucent assemblies that are supported by aluminum framing and glazed with fiberglass-sandwich panels.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Kalwall Corporation]
 - b. [Kingspan Light + Air LLC]
 - c. [Major Industries, Inc.]

- d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Kalwall Corporation]**
 - b. **[Kingspan Light + Air LLC]**
 - c. **[Major Industries, Inc.]**
 - d. **<Insert manufacturer's name>**

2.3 FIBERGLASS-SANDWICH PANELS

- A. Fiberglass-Sandwich Panels: Uniformly colored, translucent, thermoset, fiberglass-reinforced-polymer face sheets bonded to both sides of a grid core.
 1. Core Insulation: Fill panel cores with aerogel.
- B. Panel Thickness: **[2-3/4 inches (70 mm)][1-1/2 to 1-9/16 inches (38 to 40 mm)]<Insert thickness>**.
- C. Grid Core: Mechanically interlocked, extruded-aluminum I-beams, with a minimum flange width of **7/16 inch (11.1 mm)**.
 1. Extruded Aluminum: **ASTM B221 (ASTM B221M)**, in alloy and temper recommended in writing by manufacturer.
 2. I-Beam Construction: **[One piece, extruded aluminum][Thermally broken, extruded aluminum]**.
 3. Grid Pattern: **[Inline rectangle, nominal 12 by 24 inches (305 by 610 mm)][Staggered rectangle, nominal 12 by 24 inches (305 by 610 mm)][Square, nominal 12 inches (305 mm)][As indicated on Drawings]<Insert pattern>**.
- D. Exterior Face Sheet:
 1. Thickness: **[0.070 inch (1.78 mm)][0.060 inch (1.52 mm)][0.052 inch (1.32 mm)]**.
 2. Color: **[White][Crystal][As selected by Architect from manufacturer's full range]<Insert color>**.
 3. Protective Weathering Surface: **[Manufacturer's standard][Integral, embedded-glass erosion barrier][Surface-applied, polyvinyl-fluoride film not less than 1.0 mil (0.03 mm) thick]**.
- E. Interior Face Sheet:
 1. Thickness: **[0.045 inch (1.14 mm)][0.060 inch (1.52 mm)]**.
 2. Color: **[White][Crystal][As selected by Architect from manufacturer's full range]<Insert color>**.
- F. Fiberglass-Sandwich-Panel Adhesive: Manufacturer's standard for permanent adhesion of facings to cores.
- G. Panel Strength:
 1. Maximum Panel Deflection: **3-1/2 inches (89 mm)** when a **4-by-12-foot (1.2-by-3.6-m)** panel is tested in accordance with ASTM E72 at **34 lbf/sq. ft. (1.6 kPa)**, with a maximum **0.090-inch (2.3-mm)** set deflection after five minutes.
 2. Panel Support Strength: Capable of supporting, without failure, a **300-lbf (1334-N)** concentrated load when applied to a **3-inch- (76-mm-)** diameter disk in accordance with ASTM E661.

H. Panel Performance:

1. Self-Ignition Temperature: **650 deg F (343 deg C)** or more in accordance with ASTM D1929.
2. Smoke-Developed Index: 450 or less in accordance with ASTM E84, or 75 or less in accordance with ASTM D2843.
3. Combustibility Classification: **[Class CC1][Class CC2]** based on testing in accordance with ASTM D635.
4. Roof-Covering Classification: **[Class B][Class B, Burning Brand Test][Class C]** in accordance with ASTM E108 or UL 790.
5. Interior Finish Classification: **[Class A][Class B][Class C]** based on testing in accordance with ASTM E84.
6. Color Change: Not more than 3.0 units Delta E, when measured in accordance with ASTM D2244, after outdoor weathering compliant with procedures in ASTM D1435.
 - a. Outdoor Weathering Conditions: Sixty months in southern Florida.
7. Impact Resistance: No fracture or tear at impact of **[60 ft. x lbf (81 J)][70 ft. x lbf (95 J)][230 ft. x lbf (312 J)]** by a **3-1/4-inch- (83-mm-)** diameter, **5-lb (2.3-kg)** freefalling ball in accordance with UL 972 test procedure.
8. Haze Factor: Greater than 90 percent when tested in accordance with ASTM D1003.

2.4 ALUMINUM FRAMING SYSTEMS

- A. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
 1. Construction: **[One piece, extruded aluminum][Thermally broken, extruded aluminum]<Insert description>**.
- B. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
 1. Sheet and Plate: **ASTM B209 (ASTM B209M)**.
 2. Extruded Bars, Rods, Profiles, and Tubes: **ASTM B221 (ASTM B221M)**.
 3. Extruded Structural Pipe and Tubes: **ASTM B429/B429M**.
 4. Structural Profiles: **ASTM B308/B308M**.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.
- D. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding fasteners and accessories; compatible with adjacent materials.
 1. At closures, retaining caps, or battens, use ASTM A193/A193M, 300 series stainless steel screws.
 2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
- E. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- F. Anchor Bolts: ASTM A307, Grade A, galvanized steel.

- G. Concealed Flashing: Corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- H. Exposed Flashing and Closures: Aluminum sheet not less than **[0.040 inch (1.02 mm)] [0.050 inch (1.27 mm)] [0.063 inch (1.60 mm)] <Insert dimension>** thick, finished to match framing.
- I. Framing Gaskets: **[Manufacturer's standard] <Insert requirements>**.
- J. Frame-System Sealants: As **[recommended in writing by manufacturer.] [specified in Section 079200 "Joint Sealants."]**
 - 1. Sealant shall have a VOC content of 250 g/L or less.
 - 2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 3. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 4. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 - 5. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 6. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- K. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for **15-mil (0.4-mm)** dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 FABRICATION

- A. Frame System Fabrication:
 - 1. Fabricate components that, when assembled, have the following characteristics:
 - a. Profiles that are sharp, straight, and free of defects or deformations.
 - b. Accurately fitted joints with ends coped or mitered.
 - c. Internal guttering systems or other means to drain water passing through joints, and moisture migrating within assembly to exterior.
 - 2. Fabricate sill closures with weep holes and for installation as continuous component.
 - 3. Reinforce components as required to receive fastener threads.
- B. Panel Fabrication: Factory assemble and seal panels.
 - 1. Laminate face sheets to grid core under a controlled process using heat and pressure to produce straight adhesive bonding lines that cover width of core members and that have sharp edges.
 - a. White spots indicating lack of bond at intersections of grid-core members are limited in

number to four for every **40 sq. ft. (3.7 sq. m)** of panel and limited in diameter to **3/64 inch (1.2 mm)**.

2. Fabricate with grid pattern that is symmetrical about centerlines of each panel.
3. Fabricate panel to allow condensation within panel to escape.
4. Reinforce panel corners.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**][**AA-M12C22A31, Class II, 0.010 mm**] or thicker.
- B. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**][**AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.
 1. Color: [**Light bronze**][**Medium bronze**][**Dark bronze**][**Black**][**Match Architect's sample**][**As selected by Architect from full range of industry colors and color densities**]<Insert color>.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 1. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.
- D. High-Performance Organic Finish: [**Two**][**Three**]-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent [**PVDF**][**FEVE**] resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 1. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.
- E. Superior-Performing Organic Finish: [**Three**][**Four**]-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent [**PVDF**][**FEVE**] resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 1. Color and Gloss: [**As indicated by manufacturer's designations**][**Match Architect's sample**][**As selected by Architect from manufacturer's full range**]<Insert color and gloss>.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions.
 - 1. Do not install damaged components.
 - 2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 - 3. Rigidly secure nonmovement joints.
 - 4. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and immobilization of moving joints.
 - 5. Seal joints watertight unless otherwise indicated.
- B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with corrosion-resistant coating or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
- C. Install components plumb and true in alignment with established lines and elevations.
- D. Skylight Assemblies: Install continuous aluminum sill closures with weatherproof expansion joints and locked and sealed corners. Locate weep holes at rafters. Install components to drain water passing through joints and moisture migrating within assembly to exterior.
- E. Erection Tolerances: Install panel assemblies to comply with the following maximum tolerances:
 - 1. Alignment: Limit offset from true alignment to **1/32 inch (0.8 mm)** where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than **3 inches (76 mm)**; otherwise, limit offset to **1/8 inch (3.2 mm)**.
 - 2. Location and Plane: Limit variation from true location and plane to **1/8 inch in 12 feet (3.2 mm in 3.7 m)**, but no greater than **1/2 inch (13 mm)** over total length.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
 - 1. Water-Spray Test: Before installation of interior finishes has begun, panel assemblies to be tested in accordance with AAMA 501.2 and to not show evidence of water penetration.
 - 2. Water Penetration under Static Pressure: Before installation of interior finishes has begun, areas to be tested in accordance with ASTM E1105.
 - a. Test Procedures: Test under **[uniform][and][cyclic]** static-air pressure.
 - b. Static-Air-Pressure Difference: **<Insert pressure>**.
 - c. Water Penetration: None.
- B. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

END OF SECTION 08 45 23 00A

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Task	Specification	Specification Description
08 45 23 00	08 62 00 00a	Unit Skylights
08 45 23 00	08 63 00 00	Metal-Framed Skylights



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SECTION 08 51 13 00 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum windows.

1.2 DEFINITIONS

- A. Combination Assemblies: An assembly formed by a combination of two or more separate fenestration products whose frames are mulled together utilizing a combination mullion or reinforcing mullion.
- B. Combination Mullions: A horizontal or vertical member formed by joining two or more individual fenestration units together without a mullion stiffener.
- C. Reinforcing Mullions: A horizontal or vertical member with an added continuous mullion stiffener and joining two or more individual fenestration units along the sides of the mullion stiffener.

1.3 COORDINATION

- A. Finish Matching: Coordinate all exposed exterior aluminum components and trim to ensure uniform and consistent color and appearance. Use products specified in **[this Section]<Insert Section number and title>** as a benchmark. Architect's decision will be final as to whether a proposed product matches.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Review and discuss finishing of aluminum windows that is required to be coordinated with finishing of other aluminum work for color and finish matching.
 3. Review, discuss, and coordinate interrelationship of aluminum windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
 4. Review and discuss sequence of work required to construct a watertight and weathertight exterior building envelope.
 5. Inspect and discuss condition of substrate and other preparatory work performed by other trades.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes.

- B. Shop Drawings:
 - 1. Plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.
- D. Samples for Verification: Actual sample of finished products for each type of exposed finish:
 - 1. Exposed Aluminum Finishes: **[Manufacturers' standard size][2 by 4 inches (50 by 100 mm)]<Insert dimensions>**.
 - 2. Exposed Hardware: Full-size units.
- E. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.
- F. Delegated Design Submittals: For reinforcing mullions, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- G. Sustainable Design Submittals:
 - 1. Environmental Product Declaration: For each product.
 - 2. Health Product Declaration: For each product.
 - 3. Environmental Product Declaration: For each product.
 - 4. Environmental Product Declaration: For each product.
 - 5. Environmental Product Declaration: For each product.
 - 6. Third-Party Certifications: For each product.
 - 7. Third-Party Certified Life Cycle Assessment: For each product.

1.6 INFORMATIONAL SUBMITTALS

- A. Test and Evaluation Reports:
 - 1. Product Test Reports: For each aluminum window, for tests performed by **[qualified testing agency][manufacturer and witnessed by a qualified testing agency]**.
- B. Field Quality-Control Reports: For aluminum windows.
- C. Qualification Statements: For manufacturer and Installer.
- D. Delegated Design Engineer Qualifications: For reinforcing mullions.
- E. Sample warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Warranty Documentation:
 - 1. Manufacturers' special warranties.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.
- B. Installer Qualifications: Authorized representative who is trained and approved by aluminum window manufacturer.
- C. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in [state]<Insert jurisdiction> where Project is located and who is experienced in providing engineering services of the type indicated.
- D. Testing Agency Qualifications: An FGIA-accredited testing agency for testing indicated.

1.9 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.[**See Section 014339 "Mockups" for additional construction requirements for integrated exterior mockups.**
 - 1. Build mockup [as indicated on Drawings]<Insert mockup requirements>.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver aluminum windows to Project site in original, unopened packages and store them in accordance with manufacturer's written instructions. Protect aluminum windows against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Handle aluminum windows in a manner that prevents damage before, during, and after installation.

1.11 FIELD CONDITIONS

- A. Environmental Limitations: Do not install aluminum windows outside of limits recommended in writing by manufacturer.

1.12 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures, including excessive deflection, water leakage, condensation, and air infiltration.
 - c. Faulty operation of movable sash and hardware.

- d. Deterioration of materials and finishes beyond normal weathering.
- e. Failure of insulating glass.

2. Warranty Period:

- a. Window: **[Two][Five][10]<Insert number>** years from date of Substantial Completion.
- b. Glazing Units: **[Five][10]<Insert number>** years from date of Substantial Completion.
- c. Hardware: **[Three]<Insert number>** years from date of Substantial Completion.
- d. Aluminum Finish: **[10][20]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain aluminum windows from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design reinforcing mullions.
- B. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Window Certification: FGIA certified with label attached to each window.
- C. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
 - 1. Minimum Performance Class: **[R][LC][CW][AW][As indicated on Drawings]<Insert class>**.
 - 2. Minimum Performance Grade: **[15][20][25][30][35][40][45][50][As indicated on Drawings]<Insert grade>**.
 - 3. Mull Window Systems: Evaluate and rate combination assemblies as single systems as determined by AAMA 450 in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 requirements.
- D. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
 - 1. Thermal Transmittance (U-factor): As determined in accordance with NFRC 100:
 - a. Fixed Windows: Not more than **[0.50 Btu/sq. ft. x h x deg F (2.84 W/sq. m x K)][0.45 Btu/sq. ft. x h x deg F (2.56 W/sq. m x K)][0.42 Btu/sq. ft. x h x deg F (2.38 W/sq. m x K)][0.36 Btu/sq. ft. x h x deg F (2.04 W/sq. m x K)][0.34 Btu/sq. ft. x h x deg F (1.93 W/sq. m x K)][0.29 Btu/sq. ft. x h x deg F (1.65 W/sq. m x K)][0.26 Btu/sq. ft. x h x deg F (1.48 W/sq. m x K)]<Insert value>**.
 - b. Operable Windows: Not more than **[0.62 Btu/sq. ft. x h x deg F (3.52 W/sq. m x K)][0.60 Btu/sq. ft. x h x deg F (3.41 W/sq. m x K)][0.54 Btu/sq. ft. x h x deg F (3.07 W/sq. m x K)][0.45 Btu/sq. ft. x h x deg F (2.56 W/sq. m x K)][0.42 Btu/sq. ft. x h x deg F (2.38 W/sq. m x K)][0.36 Btu/sq. ft. x h x deg F**

(2.04 W/sq. m x K)][0.32 Btu/sq. ft. x h x deg F (1.82 W/sq. m x K)]<Insert value>.

2. Solar Heat-Gain Coefficient (SHGC): As determined in accordance with NFRC 200:
 - a. Fixed Windows: Not more than [0.23][0.25][0.36][0.38][0.40]<Insert value>.
 - b. Operable Windows: Not more than [0.21][0.23][0.33][0.34][0.36]<Insert value> as determined in accordance with NFRC 200.
3. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance in accordance with AAMA 1503, showing a CRF of [45][52]<Insert value>.

E. Thermal Movements: Provide aluminum windows, including anchorage, which allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: [120 deg F (67 deg C) ambient; 180 deg F (100 deg C) material surfaces]<Insert temperature change>.

F. Outdoor-Indoor Transmission Class (OITC): Rated for not less than [22][26][30]<Insert rating> OITC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E1332.

G. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone [1][2][3] for [basic][enhanced] protection.

1. Large-Missile Test: For glazing located within [30 ft. (9.1 m)]<Insert dimension> of grade.
2. Small-Missile Test: For glazing located more than [30 ft. (9.1 m)]<Insert dimension> above grade.

H. Sustainable Design Features:

1. Adhesives: Use adhesives that comply with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
2. Adhesives: Do not use adhesives that contain urea formaldehyde.
3. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25][50]<Insert value> percent.

2.3 ALUMINUM WINDOWS

A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. [All Seasons Architectural Windows Mfg., Inc.; All Seasons Commercial Division, Inc.]
2. [All Weather Architectural Aluminum]
3. [AluminTechno, LLC]
4. [Arcadia Inc.]
5. [Boyd Aluminum Mfg. Co.]
6. [Custom Window Systems, Inc.]
7. [DeSCo Architectural, Inc.]
8. [EFCO Corporation]
9. [Gerkin Windows & Doors]

10. [Graham Architectural Products Corporation]
11. [Kawneer Company, Inc.; Arconic Corporation]
12. [Kolbe Windows & Doors]
13. [Manko Window Systems, Inc.]
14. [Mannix]
15. [OldCastle BuildingEnvelope (OBE)]
16. [Peerless Products Inc]
17. [Quaker Windows and Doors]
18. [Thermal Windows, Inc.]
19. [Wausau Window and Wall Systems; Apogee Wausau Group, Inc.]
20. [Winco Window Company, Inc.]
21. [YKK AP America Inc.]
22. <Insert manufacturer's name>

B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [All Seasons Architectural Windows Mfg., Inc.; All Seasons Commercial Division, Inc.]
2. [All Weather Architectural Aluminum]
3. [AluminTechno, LLC]
4. [Arcadia Inc.]
5. [Boyd Aluminum Mfg. Co.]
6. [Custom Window Systems, Inc.]
7. [DeSCo Architectural, Inc.]
8. [EFCO Corporation]
9. [Gerkin Windows & Doors]
10. [Graham Architectural Products Corporation]
11. [Kawneer Company, Inc.; Arconic Corporation]
12. [Kolbe Windows & Doors]
13. [Manko Window Systems, Inc.]
14. [Mannix]
15. [OldCastle BuildingEnvelope (OBE)]
16. [Peerless Products Inc]
17. [Quaker Windows and Doors]
18. [Thermal Windows, Inc.]
19. [Wausau Window and Wall Systems; Apogee Wausau Group, Inc.]
20. [Winco Window Company, Inc.]
21. [YKK AP America Inc.]
22. <Insert manufacturer's name>

C. Provide manufacturer's standard aluminum window assemblies consisting of frames, sashes, glass, hardware, fasteners, and all components and accessories as required for a complete installation.

D. Operating Types: Provide the following operating types in locations indicated on Drawings:

1. Casement: [Outswing][Inswing].
2. Projected, awning.
3. Projected, hopper.
4. Single hung.
5. Double hung.
6. Horizontal sliding.
7. Fixed.

E. Frames and Sashes: Aluminum extrusions of alloy, temper, and strength complying with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Thermally Broken Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.
- F. Glass: Clear annealed glass, ASTM C1036, Type 1, Class 1, q3.
 1. Kind: Fully tempered **[where indicated on Drawings]<Insert requirements>**.
- G. Windborne-Debris-Impact-Resistant Laminated Glass: ASTM C1172, with two plies of float glass.
 1. Float Glass: **[Annealed][Heat strengthened][Fully tempered][As required by performance requirements indicated]**.
 2. Inner Ply: Clear.
 3. Interlayer: **[0.090 inch (2.29 mm)][As required by performance requirements indicated]<Insert requirements>**.
 4. Outer Ply: **[Clear][Gray][Bronze][Green]<Insert tint>**.
 5. Low-E Coating: **[Pyrolytic on second surface][Sputtered on second surface][Sputtered on third surface][Sputtered on second or third surface]<Insert coating>**.
- H. Insulating-Glass Units: ASTM E2190.
 1. Glass: ASTM C1036, Type 1, Class 1, q3.
 - a. Tint: **[Clear][Gray][Bronze][Green]<Insert tint>**.
 - b. Kind: Fully tempered **[where indicated on Drawings]<Insert requirements>**.
 2. Lites: **[Two][Three]**.
 3. Filling: Fill space between glass lites with **[air][argon]**.
 4. Low-E Coating: **[Pyrolytic on second surface][Sputtered on second surface][Sputtered on third surface][Sputtered on second or third surface]<Insert coating>**.
 5. Integral Louver Blinds: Provide glass manufacturer's standard, horizontal louver blinds with aluminum slats and polyester fiber cords, located in space between glass lites, and operated by hardware located on inside face of sash.
 - a. Operation: **[Tilt only][Tilt, raising, and lowering]**.
 - b. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.
- I. Windborne-Debris-Impact-Resistant Insulating-Glass Units: ASTM E2190, with two lites and complying with impact-resistance requirements in "Performance Requirements" Article.
 1. Exterior Lite: ASTM C1036, Type 1, Class 1, q3.
 - a. Tint: **[Clear][Gray][Bronze][Green]<Insert tint>**.
 - b. Kind: **[Heat strengthened][Fully tempered]**.
 2. Interior Lite: ASTM C1172, clear laminated glass with two plies of float glass.
 - a. Float Glass: **[Annealed][Heat strengthened][Fully tempered][As required by performance requirements indicated]**.
 - b. Interlayer Thickness: **[0.090 inch (2.29 mm)][As required by performance requirements indicated]<Insert requirements>**.
 3. Filling: Fill space between glass lites with **[air][argon]**.
 4. Low-E Coating: **[Pyrolytic on second surface][Sputtered on second surface][Sputtered on third surface][Sputtered on second or third surface]<Insert coating>**.

- J. Glazing System: **[Manufacturer's standard factory-glazing system that produces weathertight seal]<Insert glazing requirements>**.
1. Dual Glazing System:
 - a. Interior Lite: **[Glass]<Insert type>**.
 - b. Exterior Lite: **[Glass][Insulating-glass unit]<Insert type>**.
- K. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
1. Exposed Hardware Color and Finish: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and finish>**.
- L. Window Hardware: **[Casement][and][projected]**.
1. Gear-Type Rotary Operators: Complying with AAMA 901 when tested in accordance with ASTM E405, Method A. Provide operators that function without requiring the removal of interior screens or using screen wickets.
 - a. Type and Style: **[Match Architect's sample][As selected by Architect from manufacturer's full range of types and styles]<Insert type and style>**.
 2. Hinges: **[Non-friction type, not less than two per sash]<Insert requirements>**.
 3. Lock: **[Lift-type throw, cam-action lock with keeper][Lever handle and cam-action lock with keeper][Dual lever handles, tie rod, and cam-action lock with keepers][Key-operated custodial lock with keeper and removable handle][Concealed multipoint lock operated by single lever handle or lift-type throw]<Insert requirements>**.
 4. Limit Devices: **[Concealed friction adjustor, adjustable stay bar][Concealed support arms with adjustable, limited, hold-open]<Insert type>** limit devices designed to restrict sash opening.
 - a. Limit clear opening to **[4 inches (100 mm)]<Insert dimension>** for ventilation; with custodial key release.
 5. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than **60 inches (1500 mm)** above floor; one pole operator and pole hanger per room that has operable windows more than **72 inches (1800 mm)** above floor.
- M. Hung Window Hardware:
1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
 2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. **[Provide key-operated custodial locks.]**
 3. Tilt Latch: Releasing latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.
- N. Horizontal-Sliding Window Hardware:
1. Sill Cap/Track: **[Extruded-aluminum track with natural anodized finish][Manufacturer's**

- standard]<Insert track material and finish>** of dimensions and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
- 2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. **[Provide key-operated custodial locks.]**
- 3. Roller Assemblies: Low-friction design.
- O. Weather Stripping: Provide manufacturer's standard full-perimeter weather stripping for each operable sash unless otherwise indicated.
- P. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
 - 1. Exposed Fasteners: Avoid exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.
- Q. Mullions: Provide manufacturer's standard combination and reinforcing mullions and cover plates matching window units, complete with anchors for support to structure. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide reinforcing mullions and cover plates capable of withstanding design wind loads of window units.

2.4 ACCESSORIES

- A. Dividers (False Muntins): Provide manufacturer's standard extruded-aluminum divider grilles in designs indicated for each sash lite.
 - 1. Type: **[Permanently located at exterior lite][Permanently located between insulating-glass lites]<Insert type>**.
 - 2. Pattern: **[As indicated on Drawings]<Insert pattern>**.
 - 3. Profile: **[As selected by Architect from manufacturer's full range]<Insert profile>**.
- B. Subsills: **[Thermally broken][Nonthermal]**, extruded-aluminum subsills in configurations indicated on Drawings.
- C. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.
- D. Panning Trim: Profiles in sizes and configurations indicated on Drawings.
- E. Nail Fins: Manufacturer's standard mounting flanges with holes pre-punched for mechanical fasteners.

2.5 INSECT SCREENS

- A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.
 - 1. Type and Location: **[Full, inside for outswing][Full, inside for projected, awning][Full, outside for inswing][Full, outside for projected, hopper][Full, outside for double-hung][Half, outside for single-hung][Full, outside for sliding][Half, outside for sliding]** sashes.
- B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
 - 1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.

- C. Glass-Fiber Mesh Fabric: **[18-by-14 (1.1-by-1.4-mm) or 18-by-16 (1.0-by-1.1-mm)][20-by-20 (0.85-by-0.85-mm) or 20-by-30 (0.85-by-0.42-mm)]**<Insert type> mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D3656/D3656M.

1. Mesh Color: **[Manufacturer's standard]**<Insert color>.

- D. Aluminum Wire Fabric: **18-by-16 (1.1-by-1.3-mm)** mesh of **0.011-inch- (0.28-mm-)** diameter, coated aluminum wire.

1. Wire-Fabric Finish: **[Natural bright][Charcoal gray][Black]**<Insert finish>.

2.6 FABRICATION

- A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
- B. Glaze aluminum windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
- E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.
- F. Window Assemblies: **[Bow][Bay][Combination]**. Provide window units in configuration indicated on Drawings. Provide window frames, sashes, hardware, and other trim and components necessary for a complete, secure, and weathertight installation, including the following:
1. Combination and reinforcing mullions with interior and exterior trim.
 2. Interior and exterior extension and trim.
 3. Exterior head and sill casings and trim.
- G. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA AMP 500 "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

- B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - 1. Color: [Light bronze][Medium bronze][Dark bronze][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>.
- C. Baked-Enamel or Powder-Coat Finish: [AAMA 2603][AAMA 2604] except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Color and Gloss: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.
- D. Organic Coatings:
 - 1. High-Performance Fluoropolymer Finish: Two coats complying with [AAMA 2604,][AAMA 2605,] containing not less than [50][70] percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.
 - 2. Superior-Performance Fluoropolymer Finish: [Three][Four] coats complying with AAMA 2605, containing not less than [50][70] percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: [As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, [vapor retarders,]air and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Mullions: Install combination and reinforcing mullions for combination assemblies in accordance with manufacturer's written instructions.
- D. Install windows and components to drain water passing joints and condensation to the exterior.
- E. Separate aluminum from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
 - 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing Services: Testing and inspection of installed windows as follows:
 - 1. Testing Methodology: Testing of windows for air infiltration and water resistance in accordance with AAMA 502.
 - 2. Air-Infiltration Testing:
 - a. Test Pressure: As required to determine compliance in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 for performance class indicated.
 - b. Allowable Air-Leakage Rate: **[1.5]<Insert number>** times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
 - 3. Water-Resistance Testing:
 - a. Test Pressure: **[Two-thirds]<Insert number>** times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
 - b. Allowable Water Infiltration: No water penetration.
 - 4. Testing Extent: **[One][Three]<Insert number or description>** window(s) of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows will be tested **[immediately after installation][at 5, 50, and 90 percent completion]<Insert test schedule>**.
 - 5. Test Reports: Prepared in accordance with AAMA 502.
- C. Tests and Inspections:
 - 1. Windows will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

3.5 CLEANING AND PROTECTION

- A. Clean exposed surfaces immediately after installing windows using manufacturer's written instructions. Avoid damaging finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- C. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.

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SECTION 08 51 13 00a - ALUMINUM REPLACEMENT WINDOWS

DESCRIPTION OF WORK

This specification covers the furnishing and installation of materials for aluminum replacement windows. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

GENERAL

Definitions

1. Window Types: ANSI/AAMA 101.
 - a. Horizontal Slider (HS): Primary horizontally operating window.
 - b. Single Hung (SH): Primary vertically operating window with only one operable sash.
 - c. Double Hung (DH): Primary vertically operating window with two operable sashes.
 - d. Thermally Improved: Primary window with thermal break between interior and exterior metal surfaces both at frame and sash or panel members.
 - 1) Single Window Construction: Provide insulating glass.
 - 2) Thermally improved aluminum windows may use members with thermal breaks or be of dual window construction (i.e., primary-secondary (storm) or primary-primary).
 - e. Dual Window Construction (DW):
 - 1) Primary-Secondary: Primary window with either interior or exterior secondary (storm) window.
 - 2) Primary-Primary: Combination of two primary windows employing common frame.
2. Type of Stainless Steel Screens (Frames and Screening): Medium, and Heavy Types: As defined by and comply with requirements of ANSI/SMA 6001.
3. Supply and Delivery Only: Include supply and delivery to site(s) FOB destination freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by the Owner.

System Description

4. Performance Requirements: Comply with following:
 - a. Aluminum Replacement Windows: HUD UM 39a.
 - b. Aluminum Replacement Windows: ANSI/AAMA 101 (Including test size requirements):
 - 1) Horizontal Sliding Windows: HS C35.
 - a) Water Resistance: ASTM E 547, no leakage at 251.4 Pa (5.25 PSF) test pressure.
 - 2) Single Hung and Double Hung Windows: DH C35.
 - a) Water Resistance: ASTM E 547, no leakage at 251.4 Pa (5.25 PSF) test pressure.
 - 3) Single Hung and Double Hung Windows: DH C45.
 - a) Water Resistance: ASTM E 547, no leakage at 323.4 Pa (6.75 PSF) test pressure.
 - 4) Air Infiltration: ASTM E 283, Not exceed 0.049 cu m/s/mm (0.34 CFM/ft) of crack length of operable sash at 75 Pa (1.57 PSF) test pressure.
 - 5) Dual Window Construction: DW.
 - c. Aluminum Replacement Windows: ASTM F 588, Annex A1, forced entry resistance performance level 10.
 - d. Thermally Improved Windows: AAMA 1504:
 - 1) Thermal Transmittance (U-Value): Maximum U70, 3.97 W/sq. m C (0.70 BTU/HR.FT.F) if not otherwise scheduled.

- 2) Condensation Resistance Factor (CRF): Minimum CRF C50 if not otherwise scheduled.
- e. Sealed Insulating Glass: Tested and certified in accordance with HUD UM 82 complying with ASTM E 774, Class C.

Submittals

- 5. Product Data:
- 6. Shop Drawings:
 - a. Include window elevations, installation details, anchorage details, clearance between frame and rough opening, hardware, glazing, and accessories.
- 7. Samples: Submit full set of finish color samples for color selection.
 - a. For Supply and Deliver Only Contract: Submit one full size sample of each type of aluminum replacement window with specified finish for acceptance. Include sample of trickle ventilator.
- 8. Quality Assurance/Control Submittals:
 - a. Certificates: Manufacturer's written third party certification that aluminum windows meet or exceed HUD UM 39a, HUD 82, and ANSI/AAMA 101 and other specified requirements.
 - b. Manufacturer's installation instructions.
- 9. Closeout Submittals
 - a. Operation and maintenance data.
 - b. Special warranty.

Quality Assurance

- 10. Regulatory Requirements:
 - a. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
 - b. Egress Requirements: Comply with applicable codes and regulations.
 - c. Provide emergency egress, single point locking release, and bit key lock fire entry from exterior as and where required by applicable codes and regulations.
 - d. Accessibility:
 - 1) Architectural Barriers Act of 1968 as amended (42 USC 4151-4157) and HUD implementing regulations (24 CFR Part 40).
 - a) Uniform Federal Accessibility Standards (UFAS).
 - 2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
 - 3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
 - 4) Americans with Disabilities Act of 1990 (ADA) (42 USC §§ 12101, et seq.) and implementing regulations (28 CFR Part 35).
- 11. Certifications: Comply with HUD UM 39a, HUD UM 82, ANSI Z34.1 and HUD 24 CFR 200.935.
- 12. Mock-ups: For Supply and Install Contract: Install one full size mock-up of each type of aluminum replacement window with specified finish for acceptance.
 - a. Location
 - b. Approved Mock-up: Standard for rest of work.
 - c. Approved Mock-up: May remain part of completed project.

Delivery, Storage, And Handling

- 13. Packing, Shipping, Handling, and Unloading: Pack materials at manufacturing plant to prevent damage during shipping.
 - a. Aluminum Replacement Windows: Label in accordance with HUD UM 39a attached signifying compliance with ANSI/AAMA 101 performance requirements.
 - b. Thermally Improved Windows: Label in accordance with HUD UM 39a attached signifying compliance with specified AAMA 1504 performance requirements.
- 14. Acceptance at Site: Inspect aluminum replacement windows upon delivery. Replace damaged or defective materials before installation.
- 15. Storage and Protection: Store aluminum replacement windows in manner to protect from weather and other damage.

Project Conditions

16. Field Measurements: Field measure openings for aluminum replacement windows before start of fabrication.

Scheduling And Sequencing

17. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

Warranty

18. Special Warranty: Provide one year written covering materials and installation for aluminum replacement windows.
 - a. Warranty: Include coverage of inserts, hardware, and latches.
 - 1) Screening and glazing not included.
 - 2) Defects resulting from vandalism not included.
 - b. For Supply and Delivery Only Contract:
 - 1) Contractor: Agrees to supply and deliver to the Owner, free of charge, any required replacement parts that can be readily installed by the Owner without special tools.
 - 2) Contractor: Agrees to supply and deliver free of charge, complete replacement window, when defective part or parts cannot be installed without use of special tools.
 - c. For Supply and Install Contract:
 - 1) Contractor: Agrees to supply and install, free of charge, any required replacement parts or complete replacement window.

PRODUCTS

Aluminum Replacement Windows

19. General: Type(s) and size(s) indicated, specified, or scheduled with necessary hardware, anchors and equipment.

Materials

20. Aluminum Materials:
 - a. Extruded Aluminum: ASTM B 221, Alloy 6063-T5 or stronger.
 - b. Aluminum Alloys: Commercial quality and of proper alloy for window construction, free from defects impairing strength and/or durability.
 - 1) Wrought Aluminum Alloys: Alloying Elements: ANSI/AAMA 101.
 - c. Window Members, Including Muntins: Aluminum except as allowed by ANSI/AAMA 101.
 - 1) Sill Members: Minimum 2.0 mm (0.078 inch) thick.
 - d. Interlocks and mating fins may vary by tapering at maximum projected distance of 8 mm (5/16 inch) from edge.
 - 1) Other appendages may taper providing design results in net area of at least that calculated by using prescribed wall thickness for appendage length.
 - e. Edge or Corner: May be eased with radius not to exceed wall thickness permitted for member.
 - f. Glazing Legs, Channels or Glazing Bead Retainers, Serrated or Not: Minimum 1.3 mm (0.050 inch) thick for distance of not more than 13 mm (1/2 inch) each leg.
21. Other Metal Materials:
 - a. Carbon Steel (reinforcing members): ASTM A 36, zinc coated in accordance with ASTM B 633 or cadmium coated in accordance with ASTM B 766.
 - b. Stainless Steel: ASTM A 167, Type 302.
 - c. Welding Filler Rods: AWS A5.3.
22. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
 - a. Glass: ASTM C 1036, Type 1, Class 1, Glazing B Quality.
 - b. Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type 1, Class 1, Glazing B Quality.
 - c. Plastic: Extruded polycarbonate clear sheets, minimum 4.5 mm (0.177 inch) thick with following characteristics:
 - 1) Impact Resistance: ASTM D 256, Method A, 12-18 foot-pound per inch.

- 2) Elongation/Modulus of Elasticity: ASTM D 638, 110 percent maximum/340,000 PSI.
- 3) Heat Deflection: ASTM D 648, 132.2 degrees C (270 degrees F) at 264 PSI.
- 4) Abrasion Resistance: Coated on both surfaces to produce abrasion resistance of 3-19 percent maximum haze increase for 500 revolutions of CS-1 OF wheel per ASTM D 1044.
- d. Insulating Glass Units: HUD UM 82 and ASTM E 774, Class CBA.
- e. Glass Thickness: Determined in accordance with ANSI/AAMA 101 Appendix, minimum 3 mm (1/8 inch) (DS).
 - 1) Design Wind Pressures: Determined in accordance with applicable codes and regulations.
- f. Glass: Labeled to show name of manufacturer and type.
23. Glazing Materials: Particularly suited for use with aluminum and not require painting.
 - a. Make adequate provisions for use of glazing compound, if applicable.
 - b. Remove material from glazing surfaces to which glazing compound will not readily adhere.
 - c. Windows: May be either factory or field glazed by either channel-type gaskets or back-bedding materials.
 - d. Glazing Clips: Not required when face stops are used.
24. Glazing Beads or Retainers: Material compatible with aluminum, and 6 required to retain glass, of sufficient strength and fixation to serve this purpose.
 - a. Thickness of Glazing Beads: Optional except as otherwise specified.
25. Screens: Provide windows with screens as indicated, specified, or scheduled in manufacturer's standard approved design, applicable to specific aluminum windows.
 - a. Screen Frames: Extruded aluminum frames of suitable alloy and of sufficient rigidity, crossbraces, as required, to lie flat against window and to prevent excessive bow in frame members and sag in screening.
 - 1) Frame Corners: Firmly joined in secure and rigid manner.
 - 2) Screen Spline: Aluminum or a material compatible with aluminum.
 - b. Screening: One of following as indicated, specified, or scheduled:
 - 1) Vinyl Coated Fibrous Glass Yam: ASTM D 3656, Class 1, 18 by 16 mesh, 0.29 mm (0.0115 inch) diameter yam.
 - 2) Polyvinylidene Chloride or Polypropylene Filament: FS L-S-12513, Type I or III, Class 1 or 2, 18 by 18 mesh, 0.31 mm (0.012 inch) or 0.38 mm (0.015 inch) diameter filament.
 - 3) Aluminum: FS RR-W-365, Type VII, 18 x 16 or 18 by 18 regular, 0.28 mm (0.011 inch) diameter wire.
 - 4) Stainless Steel: Type 304 stainless steel:
 - a) Medium: ANSI/SMA 6001 Medium Type, 12 x 12 mesh 0.58 mm (0.023 inch) diameter wire.
 - b) Heavy: ANSI/SMA 6001 Heavy Type, 12 x 12 mesh 0.71 mm (0.028 inch) diameter wire, high tensile strength.
 - c) Screen Frames: ANSI/SMA 6001 performance requirements, minimum 1.6 mm (0.062 inch) aluminum extruded 6063-T5 alloy designed to accept stainless steel wire cloth.
 - d) Emergency Egress Windows: Design screen to be opened from interior only (to allow for egress to exterior).
 - c. Screening: Fastened to frame in manner to permit replacement of screening.
 - d. Screens: Provide with fastening devices, suited particularly for application to specific window made of aluminum or materials compatible with aluminum and of sufficient strength to perform satisfactorily.
 - e. Assembled Screen with Insect Screening and Spline in Place: Outside dimension as measured from midpoint of opposite framing members shall not vary more than 4.8 mm (3/16 Inch) from outside dimension as measured at extreme ends of framing members.
 - f. Screens: Comply with applicable fire codes for egress and fireman access.
 - 1) Provide single point release as and where required by applicable codes and regulations.

- 2) Provide bit key lock fire entry from exterior if required by applicable codes and regulations.
- g. Window Screens: Include warning label indicating that screen will not stop child from falling out of window in accordance with SMA 7001.

Accessories

- 26. Hardware: Designed to perform functions for which it is intended and securely attached to window.
- 27. Thermal Break Material: Urethane, PVC, ISP, vinyl, or other material suitable for application that is compatible with aluminum.
- 28. Fasteners: Comply with ANSI/AAMA 101.
- 29. Panning and Receptor Systems: Extruded aluminum designed to fit existing openings, to receive windows, and to withstand wind forces as required by applicable codes and regulation.
 - a. Exterior Trim System: Designed to withstand expansion/contraction forces of trim material.
 - b. Interior Snap Trim: Provide manufacturer's standard interior trim package.
 - c. Extruded Aluminum Minimum Thickness: 1.57 mm (0.062 inches).
- 30. Thermal Insulation: Unfaced fiberglass batt insulation in accordance with ASTM C 665, Type 1.
 - a. Vapor Barrier: ASTM D 4397, 4 mil polyethylene sheeting with pressure sensitive adhesive sealing tape.
- 31. Joint Sealants:
 - a. Exterior Joint Sealant: AAMA 800, Type 808.3 Exterior Perimeter Sealing Compound.
 - b. Back-up Material: Standard preformed and precompressed foam material, round rod or semi-circular type, permanently elastic, mildew resistant, nonmigratory, nonstaining, and compatible with joint substrates and with sealant.
 - 1) Materials impregnated with oil, solvents, or bituminous materials not allowed.
 - 2) Provide type as recommended by sealant manufacturer for particular installation.
 - 3) Material: Neoprene, butyl, polyurethane, vinyl, or polyethylene rod.
 - c. Interior Joint Sealant: ASTM C 834, latex acrylic.

Fabrication

- 32. Windows: Assembled in secure manner to perform as specified and to provide neat, weather tight construction.
 - a. Make permanent watertight joints at junctions of sill and jamb members.
 - b. Joint Sealant at Mechanically Fixed Joints: AAMA 800, Type 803.3.
 - c. Welding or Brazing Flux: Completely removed immediately upon completion of welding or brazing operation.
- 33. Mullions and Structural Members: Mullion (whether joined by integral mullions, independent mullions, or by combination of frame members): Capable of withstanding load outlined under Uniform Load in ANSI/AAMA 101, Section 2 without deflecting more than 1/175th of its span.
- 34. Fin Trim or Installation Fins: Aluminum or other suitable material compatible with aluminum and of sufficient strength and thickness to assure satisfactory installation.
 - a. Nailing grooves and/or break off score lines in extrusions are acceptable.
 - b. Applied fins or fin trim may be assembled to windows by interlocking with frame members or with fasteners located not over 400 mm (16 inches) OC.
- 35. Thermally Improved Windows: Single window construction with thermal breaks and insulating glass units or dual window construction.
 - a. Thermal Break in Two Frame or One Frame Windows: Not bridged by any screws, fasteners, panning, etc., that would allow excessive heat transfer through window frame.
 - b. Do not make structural connection in loading bearing member into thermal break material.
- 36. Sills: Provide weep holes in sill of glazing pocket to provide means for water to flow to exterior.
- 37. Trickle Ventilators: Type which fits within glazing channels of sash frame, and contains gasketed channel to accept sealed insulating glass used in window sash.
 - a. Ventilator: Installed in top rail of upper sash, accurately sized to extend full width of sash, properly fit sash, and sash frame above and insulating glass below.
 - b. Ventilator: Consist of two piece aluminum housing connected by, and separated by, PVC extrusion forming thermal break.

- c. Gasketed Shutter: Operate Internal flap to open and close ventilator.
- d. Unit: Complete with fly-screen.
- e. Color: Selected from manufacturers standard colors.
- 38. Secondary Windows (Storm Windows): Comply with Division 8 Section "Aluminum Storm Windows."
- 39. Windows: Comply with applicable fire codes for egress.

Finishes

- 40. Finish:
 - a. Aluminum: Provide one of following finishes as specified or scheduled:
 - 1) Pigmented Organic Coating: Factory applied pigmented organic coating, AAMA 603.8.
 - a) Color: As selected from manufacturers standard colors.
 - 2) High Performance Organic Coating: Factory applied pigmented organic coating, AAMA 605.2.
 - a) Color: As selected from manufacturer's standard colors.
 - 3) Color Anodized: Factory applied anodic coating, AAMA 608.1, Class 1.
 - a) Color: As scheduled.
 - 4) Clear Anodized: Factory applied anodic coating, AAMA 607.1, Class 1.
 - b. Exposed Surfaces of Aluminum Members: Clean and free from serious surface blemishes.
 - c. Dress and finish exposed welded joints.
- 41. Protective Coatings:
 - a. Steel Subframes: Insulate surfaces of steel from direct contact with aluminum surfaces by heavy coat or alkali-resistant bituminous paint or zinc-chromate prime coat, or other coating suitable for this purpose.
 - b. Wood Subframes: Properly treat with preservative which will not promote corrosion of aluminum.
 - c. Steel or Wood Subframes: Do not leave exposed on exterior of building.

Source Quality Control

- 42. Fabrication Tolerances: Wall Thickness, Cross-sectional Size and Overall Size: In accordance with ANSI/AAMA 101.
- 43. Testing: Performed under Third Party Administrator who is in compliance with HUD UM 39a, ANSI Z34.1, and HUD 24 CFR 200.935.

EXECUTION**Examination**

- 44. Site Verification of Conditions:
 - a. Field Measurements: Verify field measurements are as indicated on Shop Drawings.
 - b. Existing Conditions: Examine openings before beginning installation.
 - c. Do not proceed with installation until conditions are satisfactory.

Preparation

- 45. Protection: Protect adjacent elements from damage and disfiguration in accordance with Detailed Scope of Work.
 - a. Contractor: Responsible for damage to grounds, plantings, buildings and any other facilities or property caused by construction operations.
 - b. Adequately enclose and protect against weather any interior space where installation is incomplete at end of working day.
 - c. Repair or replace damaged elements in accordance with Detailed Scope of Work.
- 46. Existing Windows: Remove existing windows and debris from site in accordance with Detailed Scope of Work.
- 47. Preparation: Prepare openings and existing frames in accordance with ASTM E 737.

- a. Existing Window Jambs: Prepare as necessary to provide for straight, plumb, level, tight and aesthetically appealing installation of new windows.
- b. Preparatory Work: Include, but not limited to repair of jambs, filling holes and/or dents, removing peeling and scaling paint, etc.

Installation

- 48. General: Install In accordance with ASTM E 737 except as modified by ANSI/AAMA 101 Appendix, manufacturer's recommendations, Reference Standards, and approved Shop Drawings.
 - a. Securely fasten windows in place to straight, plumb and level condition, without distortion of window or window frame, and make final adjustments for proper operation and satisfactory weatherstrip contact and seal.
 - b. Make proper allowance for expansion/contraction movement of aluminum.
 - c. Panning and Receptor Systems: Install to ensure watertight seal at joints with existing opening and with new replacement window.
 - 1) Thermal Insulation: Fill voids in panning system with thermal insulation.
 - 2) Vapor Barrier: Apply vapor barrier on inside between panning and existing opening. Seal laps and terminations with pressure sensitive tape.
 - d. Comply with applicable codes and regulations regarding egress requirements and fireman entry.
- 49. Joint Sealants: Apply in accordance with manufacturers recommendations.
 - a. Surfaces to be Sealed: Clean, dry and free of any foreign matter that would degrade adhesion. Remove existing calking and joint sealants from areas to receive new joint sealant.
 - b. Prime cleaned surfaces in accordance with sealant manufacturer's recommendations.
 - c. Protect surfaces adjacent to joints by masking tape before applying sealant. Remove tape upon finishing sealing work.
 - d. Seal joints between perimeter of window frame and underlying or surrounding construction at
 - e. Exterior and interior with joint sealant to accomplish weather-tight installation. Maximum Width of Sealed Joint: 13 mm (1/2 inch).
- 50. Dissimilar Materials: Isolate materials from incompatible materials as necessary to prevent deterioration and galvanic action.
 - a. Separate dissimilar metals with bituminous paint, suitable sealant, nonabsorptive plastic or elastomeric tape. or gasket between surfaces.
 - b. Coat aluminum in direct contact with concrete, masonry, steel, or other non-compatible materials with bituminous paint, zinc chromate primer, or other suitable insulating material.

Field Quality Control

- 51. Owners Field Testing: the Owner may have field testing of windows conducted by its own testing agency in accordance with AAMA 502.
 - a. Tests: May include, but not limited to:
 - 1) Field Testing (Hose Test) for Water Leakage: AAMA 501.2.
 - 2) Field Testing (Air Pressure Difference) for Water Leakage: AAMA 502, Test Method B.
 - a) Field Testing for Air Leakage: ASTM E 783.
 - b) Field Testing for Water Determination: ASTM E 1105.
 - b. Test Pressures: Comply with specified performance requirements.
 - c. Contractor: Provide incidental labor facilities necessary to facilitate inspections and tests.
 - d. Costs of Testing:
 - 1) By the Owner: Successful initial tests.
 - 2) By Contractor: Initial tests with failures and subsequent tests as required because of test failures. Costs shall include costs of the Owner and other consultants for observations of tests and corrective work.
 - e. Corrective Measures: Meet standards of quality of specified window and subject to acceptance of the Owner.

Adjusting And Cleaning

52. Adjusting: At completion of job, check, adjust, and lubricate hardware as required and leave windows and hardware in proper operating condition.
53. Cleaning: Comply with requirements of Detailed Scope of Work.
 - a. Clean windows after installation is completed to remove foreign matter and surface blemishes.
 - b. Scratched or Abraded Surfaces: Touch-up with rust inhibitor primer and enamel paint compatible with factory finish.

Protection

54. Installed Work: Protect windows from damage after installation.

END OF SECTION 08 51 13 00a

SECTION 08 51 19 00 - STAINLESS STEEL WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Stainless steel windows.

B. Related Requirements:

1. Section 081113 "Hollow Metal Doors and Frames" for borrowed-lite interior steel windows.
2. Section 085123.13 "Hot-Rolled Steel Windows" for steel windows fabricated from hot-rolled members.
3. Section 085123.23 "Cold-Rolled Steel Windows" for steel windows fabricated from cold-rolled members.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1. Review requirements for cold-rolled, stainless steel windows, including, but not limited to, the following:
 - a. Coordinating cold-rolled, stainless steel windows with other exterior wall components, including anchorage, glazing, flashing, weeping, air barriers, sealants, and protection of finishes.
 - b. Sequencing work to construct a watertight and weathertight exterior building enclosure.
 - c. **<Insert agenda items>**.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions.

B. Shop Drawings:

1. Plans, elevations, sections, and details.
2. Detail attachments to other work, and between units, if any.
3. Hardware and required clearances.
4. Mullion details, including reinforcement and stiffeners.
5. Flashing details.
6. Glazing details.
7. Accessories.
8. **<Insert requirements>**.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available

colors or finishes for each type of exposed finish.

1. Include available color or finish selections for hardware and accessories.

- D. Samples for Verification: Actual sample of finished products for each type of cold-rolled stainless steel window including weather stripping, glazing bead, and hardware.

1. Size: **[Manufacturers' standard size]**<Insert size>.

- E. Product Schedule: For stainless steel windows. **[Use same designations indicated on Drawings.]**

- F. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating percentage of postconsumer and preconsumer recycled content and cost.

1.4 INFORMATIONAL SUBMITTALS

- A. Test and Evaluation Reports:

1. Product Test Reports: For each stainless steel window, for tests performed by a qualified testing agency.

- B. Field Quality-Control Reports: For stainless steel windows.

- C. Qualification Statements: For **[Installer][manufacturer][and][testing agency]**.

- D. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For stainless steel windows.

- B. Warranty Documentation:

1. Manufacturers' special warranties.
2. Installer's special warranties.

1.6 QUALITY ASSURANCE

- A. Qualifications:

1. Manufacturers: A manufacturer capable of fabricating stainless steel windows that meets performance requirements indicated and of documenting performance by labels, test reports, and calculations.
2. Installers: **[Fabricator of products][Entity that employs installers and supervisors who are trained and approved by manufacturer][Authorized representative who is trained and approved by manufacturer]**.

1.7 MOCKUPS

- A. Build mockups [to verify selections made under Sample submittals][to demonstrate aesthetic effects][and][to set quality standards for fabrication and installation].
 - 1. Build mockup [as indicated on Drawings]<Insert mockup requirements>.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 FIELD CONDITIONS

- A. <Insert requirements>.

1.9 WARRANTY

- A. Special Warranty: [Manufacturer agrees][Installer agrees][Manufacturer and Installer agree] to repair or replace components of stainless steel windows that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including <Insert type of failure>.
 - b. Faulty operation of <Insert components>.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal [weathering][use].
 - d. <Insert conditions relating to specified products>.
 - e. <Insert failure modes>.
 - 2. Warranty Period: [Two][Three]<Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain stainless steel windows from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. SWI Standards: Comply with applicable requirements in SWI's "Architect's Guide to Steel Windows and Doors" and "Specifications - Formed Cold Rolled Sections," except where more stringent requirements are indicated.
- B. Structural Wind Loads: As indicated on Drawings.
- C. Deflection Limits: Design glass framing system to limit deflection of glass edges in a direction perpendicular to glass plane to less than 1/175 of glass-edge length for each individual glazing lite or 3/4 inch (19 mm), whichever is less, at design pressures.

- D. Structural: Test in accordance with ASTM E330/E330M as follows:
1. When tested at positive and negative wind-load design pressures, stainless steel windows do not evidence deflection exceeding specified limits.
 2. When tested at **[150]<Insert number>** percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding **[0.2]<Insert number>** percent of span.
 3. Test Durations: As required by design wind velocity, but not less than **[10]<Insert number>** seconds.
- E. Air Leakage for Weather-Stripped Sash: Not more than **[0.37 cfm/ft. (0.18 L/s/m)]<Insert value>** of sash crack length at a differential pressure across the windows of **[6.24 lbf/sq. ft. (298 Pa)]<Insert value>** when tested in accordance with ASTM E283/E283M.
- F. Water Penetration for Weather-Stripped Sash: No leakage for 15 minutes when window is subjected to a rate of flow of **5 gal./h/sq. ft. (0.05 L/s/sq. m)** with a differential pressure across the window of **[2.86 lbf/sq. ft. (137 Pa)]<Insert value>** when tested in accordance with ASTM E331.
- G. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of **[0.80 Btu/sq. ft. x h x deg F (4.54 W/sq. m x K)][0.27 Btu/sq. ft. x h x deg F (1.53 W/sq. m x K)][0.32 Btu/sq. ft. x h x deg F (1.82 W/sq. m x K)][0.36 Btu/sq. ft. x h x deg F (2.04 W/sq. m x K)][0.43 Btu/sq. ft. x h x deg F (2.44 W/sq. m x K)]<Insert value>**.
- H. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of **[0.70][0.40][0.25][0.19][0.15]<Insert value>**.
- I. Condensation Resistance: Provide stainless steel windows with a CR of **[33][34][35]<Insert number>** minimum, determined in accordance with NFRC 500.
- J. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C) material surfaces]<Insert temperature change>**.
- K. Forced-Entry Resistance: Comply with Performance **[Grade 10]<Insert grade>** requirements when tested in accordance with ASTM F588.
- L. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone **[1][2][3][4]** for **[basic][enhanced]** protection.
1. Large-Missile Test: For glazing located within **[30 ft. (9.1 m)]<Insert dimension>** of grade.
 2. Small-Missile Test: For glazing located between **30 ft. (9.1 m)** and **[60 ft. (18.3 m)]<Insert dimension>** above grade.

2.3 STAINLESS STEEL WINDOWS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[Optimum Window Mfg Corp]**
 2. **<Insert manufacturer's name>**

- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Optimum Window Mfg Corp]**
 2. **<Insert manufacturer's name>**
- C. Provide manufacturer's standard stainless steel window assemblies consisting of frames, sashes, hardware, fasteners, and all components and accessories as required for a complete installation.
- D. Operating Types: Provide the following window operating types in locations indicated on Drawings:
1. Casement: **[Outswing][Inswing]**.
 2. Hung: **[Double][Single]**.
 3. Horizontal sliding.
 4. Projected: **[Awning][Hopper]**.
 5. Fixed.
- E. Frames and Sashes: Mechanically formed from cold-rolled, ASTM A240/A240M, austenitic stainless steel sheet, **[Type 304][Type 316]<Insert type>**. Comply with SWI specifications for combined weight of frame and sash members and front-to-back depth of frame or sash members.
1. Thermal Construction: Provide thermally **[improved][or][broken]** frame and sash members designed to isolate interior and exterior surfaces for improved thermal performance.
- F. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- G. Window Finish: **[Directional Satin Finish: ASTM A480/A480M, No. 4][Dull Satin Finish: ASTM A480/A480M, No. 6][Mirror Finish: ASTM A480/A480M, No. 8][Cold-Rolled, Bright Finish: ASTM A480/A480M, No. 2B]**.
- H. Mullions: Formed of cold-rolled, stainless steel matching window units; with anchors for support to structure and for installation of window units and having sufficient strength to withstand design pressure indicated. Provide mullions of profile indicated and with cover plates. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections.
- I. Muntins: Cold-rolled, stainless steel, T-shaped sections mechanically fastened to perimeter frame with cross-notched intersections.
- J. Sill Cap/Track: Designed to comply with performance requirements indicated and to drain to the exterior.
- K. Glazing Stops: Provide **[screw-applied][snap-on]** glazing stops; coordinate with Section 088000 "Glazing" and with glazing system indicated. Provide glazing stops to match panel frames. Finish glazing stops to match window units if fabricated of steel; otherwise, provide manufacturer's standard finish.
- L. Weather Stripping: Manufacturer's standard compressible weather stripping, complying with AAMA 701/702, ASTM C509, or ASTM C864 and designed for permanently resilient sealing under compression and for complete concealment when sash is closed.
- M. Hardware, General: Provide manufacturer's standard **[nonremovable], [solid-bronze][malleable-iron][die-cast-metal]** hardware, with operating components of stainless steel, carbon steel complying with AAMA 907, brass, bronze, or other corrosion-resistant material designed to smoothly operate, tightly close, and securely lock stainless steel window sash; and sized to accommodate sash weight and dimensions.

N. Casement Window Hardware:**1. Operation:**

- a. Gear-Type Rotary Operator: Complying with AAMA 901 when tested in accordance with ASTM E405, Test Method A; located on jamb at sill.

- 1) Provide operating device that opens and closes sashes simultaneously, securely closing them at both jambs without use of additional manually controlled locking devices.
- 2) Roto Operator Handle Type and Style: **[As selected by Architect from manufacturer's full range of types and styles]<Insert type and style>.**

- b. Manually operated push/pull.

2. Hinges:

- a. Friction Hinges: Concealed, four-bar friction hinges with adjustable slide shoes complying with AAMA 904; two per sash.
- b. Friction Hinges for Emergency Escape and Rescue: Standard-duty, concealed, four-bar friction egress hinges with adjustable slide shoes; two per sash where indicated. Provide hinge designed to achieve 90-degree sash opening.
- c. Butt Hinges: Heavy-duty, three-knuckle butt hinges with nylon bushings; two per sash.
- d. Extension Hinges or Pivots: Nonfriction type; two per sash.

3. Locks:

- a. Type: **[Cam handle with keeper][Lift-type, locking handle with keeper][Custodial cam-action lock with keeper][Linear operator with standard concealed multipoint lock][Linear operator with concealed multipoint lock with captive locking strike and head]<Insert type>.**

- 1) Style: **[As selected by Architect from manufacturer's full range of styles]<Insert style>.**

4. Control Devices:

- a. Limit Device: Adjustable, concealed **[friction adjustor/stay-bar][friction adjustor/stay-bar with release key or tool].**

O. Hung Window Hardware:**1. Balances:**

- a. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
- b. Counterbalance and Pulley: Two per sash to operate in unison with stainless steel cable sash cord.
 - 1) Single-Hung Upper Sash Retainer: Manufacturer's standard.

2. Locks and Latches:

- a. Type: **[Cam-action sweep lock and keeper on meeting rail; one per sash][Cam-action**

sweep lock and keeper on meeting rail; two per sash]<Insert type>.

- 1) Style: **[Manufacturer's standard][As selected by Architect from manufacturer's full range of styles]<Insert style>.**

3. Handles:

- a. Type: **[Lift][Pull-down]** handle; **[one][two]** per sash.

- 1) Style: Manufacturer's standard.

P. Horizontal-Sliding Window Hardware:

1. Rollers: Steel, lubricated, ball-bearing rollers.
2. Lock:

- a. Type: **[Manufacturer's standard, designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and to operate from the inside only]<Insert type>.**

3. Control Device:

- a. Limit Device: Manufacturer's standard.

4. Handle:

- a. Pull Handle: Manufacturer's standard.

Q. Projected Window Hardware:

1. Operation:

- a. Operating Device: **[Gear-type rotary complying with AAMA 901 when tested in accordance with ASTM E405, Test Method A][Push-bar-type][, underscreen]** sash operator located at sill.

- 1) Style: **[As selected by Architect from manufacturer's full range of styles]<Insert style>.**

- b. Manually operated push/pull.

2. Hinges:

- a. Concealed, four-bar friction hinges with adjustable slide shoes complying with AAMA 904; two per sash.
- b. Balance arms with adjustable, nonabrasive friction pivots; two per sash.
- c. Balance arms with adjustable, nonabrasive friction shoes; two per sash.

- 1) Provide sash operation that permits cleaning of the outside glass face from the interior.
- 2) Provide jamb-mounted, sliding, brass friction shoes with screw adjusters.

3. Locks:

- a. Type: **[Cam handle with keeper][Custodial cam-action lock with keeper][Linear**

operator with standard concealed multipoint lock][Linear operator with concealed multipoint lock with captive locking strike and head][Pole-operated spring catch lock][Pole-operated ring cam handle with keeper]<Insert type>.

- 1) Style: **[As selected by Architect from manufacturer's full range of styles]<Insert style>**.
- 2) Pole Operators: Tubular-shaped, anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than **60 inches (1500 mm)** above floor; one pole operator and pole hanger per room that has operable windows more than **72 inches (1800 mm)** above floor.

4. Control Device:

- a. Limit Device: Adjustable, concealed **[friction adjustor/stay-bar][friction adjustor/stay-bar with release key or tool][support arms with adjustable, limited hold-open]**.

2.4 INSECT SCREENS

- A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, fully integrated with window. Locate screens on **[inside][outside]** of window and provide for each operable exterior sash. Comply with SMA 1201.
- B. Stainless Steel Screen Frames: Fabricate frames of tubular-shaped, nonmagnetic stainless steel members of **0.02-inch (0.5-mm)** minimum wall thickness; in **[ASTM A480/A480M, No. 2B cold-rolled, bright finish][finish to match cold-rolled, stainless steel window]**.
- C. Glass-Fiber Mesh Fabric: Complies with ASTM D3656/D3656M, **[18-by-14 or 18-by-16][20-by-20 or 20-by-30]** count per **sq. in. (645 sq. mm)** mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration.
 1. Mesh Color: **[Gray]<Insert color>**.
- D. Aluminum Wire Fabric: 18-by-16 count per **sq. in. (645 sq. mm)** mesh of **0.011-inch- (0.28-mm-)** diameter, coated aluminum wire.
 1. Wire-Fabric Finish: **[Natural bright][Charcoal gray][Black]**.
- E. Stainless Steel Wire Fabric: **[18-by-16][18-by-18]** count per **sq. in. (645 sq. mm)** mesh of **0.009-inch- (0.2-mm-)** minimum diameter, nonmagnetic stainless steel wire, Type 304 or 316.
- F. Wickets: Provide **[sliding][or][hinged]** wickets, framed and trimmed for a tight fit and durability during handling.

2.5 INSTALLATION ACCESSORIES

- A. Fasteners: Provide fasteners of bronze, brass, stainless steel, or other metal that are warranted by manufacturer to be noncorrosive and compatible with trim, hardware, anchors, and other components of stainless steel windows.
 1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

- B. Anchors, Clips, and Window Accessories: Provide units of stainless steel, hot-dip zinc-coated steel, bronze, brass, or iron complying with ASTM A123/A123M. Provide units with sufficient strength to withstand design pressure indicated.
 - 1. Windborne-Debris-Impact Resistance: Provide anchors and clips of same design used to pass windborne-debris-impact-resistance testing.
- C. Sealant: For sealants required within fabricated windows, provide manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.

2.6 GLAZING

- A. Glass and Glazing System: See Section 088000 "Glazing" for glass units and glazing requirements for stainless steel windows.

2.7 FABRICATION

- A. Fabricate stainless steel windows of type and in sizes indicated to comply with SWI standards. Include a complete system for assembly of components and anchorage of window units.
- B. Provide units that are reglazable without dismantling framing.
- C. Prepare windows for field glazing.
- D. Subframes and Operable Sash: Miter or cope corners, and **[mechanically fasten and seal joints][or][weld and dress joints smooth]**.
- E. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
- F. Provide weep holes and internal water passages to conduct infiltrating water to the exterior.
- G. Provide water-shed members above **[casement][horizontal-sliding]** sash.

2.8 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of

the Work.

- B. Verify rough-opening dimensions, levelness of sill plate, and clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF STAINLESS STEEL WINDOWS

- A. SWI Publication: Comply with applicable requirements in SWI's "Guidelines on How to Install Steel Windows," except where more stringent requirements are indicated.
- B. Comply with manufacturer's written installation instructions for installing windows, hardware, operators, accessories, and other components.
- C. Windborne-Debris-Impact Resistance: Anchor stainless steel windows required to have windborne-debris resistance to structure using method, anchor type, and anchor spacing identical to that used in windborne-debris-impact-resistance testing.
- D. Install windows level, plumb, square, true to line, without distortion or impediment to thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- E. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.
- F. Install windows and components to drain condensation, water-penetrating joints, and moisture migrating within windows to the exterior.
- G. Install field glazing as specified in Section 088000 "Glazing."

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
 - 1. Test windows for air leakage and water penetration in accordance with AAMA 502, Test Method **[A][B]**, by applying same test pressures required for performance.
 - 2. Testing Extent: **[Three][Three mockup]<Insert number or description>** windows as selected by Architect and a qualified independent testing and inspecting agency. Test windows immediately after installation.
 - 3. Windows will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust operating sashes, screens, hardware, and accessories for a tight fit at contact points and

weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts as recommended in writing by manufacturer.

3.5 CLEANING AND PROTECTION

- A. Clean exposed stainless steel surfaces immediately after installing windows. Comply with manufacturer's written instructions for final cleaning and maintenance. Avoid damaging protective coatings and finishes.
- B. Protect window surfaces from contact with contaminating substances resulting from construction operations. Remove contaminants immediately in accordance with manufacturer's written instructions.

END OF SECTION 08 51 19 00

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SECTION 08 51 69 00 - METAL STORM WINDOWS

DESCRIPTION OF WORK

This specification covers the furnishing and installation of materials for aluminum storm windows. Products shall be as directed by the Owner. Installation procedures shall be in accordance with the product manufacturer's recommendations. Demolition and removal of materials shall be as required to support the work.

GENERAL

Definitions

1. Aluminum Storm Window Configuration and Performance Classes: ANSI/AAMA 1002.10:
 - a. VWE (15): Vertically operating insulating storm window for external application, Performance Class 15.
 - b. VWE (45): Vertically operating insulating storm window for external application, Performance Class 45.
 - c. HWE (15): Horizontally operating insulating storm window for external application, Performance Class 15.
 - d. FWE (15): Fixed removable insulating storm window for exterior application, Performance Class 15.
 - e. FWI (15): Fixed removable insulation window for internal application, Performance Class 15.
 - f. HWI (15): Horizontally operating insulating window for internal application, Performance Class 15.
2. Type of Stainless Steel Screens (Frames and Screening): Medium, and Heavy Types: As defined by and comply with requirements of ANSI/SMA 6001.
3. Supply and Delivery Only: Include supply and delivery to site(s) FOB destination Freight prepaid. Unless otherwise specified or scheduled, unloading and handling at site is by the Owner.

System Description

4. Performance Requirements: Comply with following:
 - a. Storm Windows: HUD UM 39a.
 - b. Storm Windows: ANSI/SMA 6001.
 - 1) Exterior Mounted Aluminum storm Windows for Normal Usage: Specification FWE, HWE, or VWE as applicable and Performance Class 15.
 - 2) Interior Mounted Aluminum Storm Windows for Normal Usage: Specification FWI, HWI, or VWI as applicable and Performance Class 15.
 - 3) High Rise Storm Windows: Specification VWE and Performance Class 45.

Submittals

5. Product Data.
6. Shop Drawings:
 - a. Indicate fabrication of parts, metal thickness, installation details, fastening and sealing.
 - b. Include sections of typical members and details of latching devices.
7. Samples: Submit full set of finish color samples for color selection.
 - a. For Supply and Deliver Only Contract: Submit one full size sample of each type of storm window with specified finish for acceptance.
8. Quality Assurance/Control Submittals:
 - a. Certificates: Manufacturer's written third party certification that storm windows meet or exceed HUD UM 39a, ANSI/AAMA 1102.10, and other specified requirements.
 - b. Manufacturer's installation instructions.

9. Closeout Submittals:
 - a. Operation and maintenance data.
 - b. Special warranty.

Quality Assurance

10. Regulatory Requirements:
 - a. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
 - b. Egress Requirements: Comply with applicable codes and regulations.
 - c. Provide emergency egress, single point locking release, and bit key lock fire entry from exterior as and where required by applicable codes and regulations.
 - d. Accessibility:
 - 1) Architectural Barriers Act of 1968 as amended (42 USC 4152-4157) and HUD implementing regulations (24 CFR Part 40).
 - a) Uniform Federal Accessibility Standards (UFAS).
 - 2) Section 504 of the Rehabilitation Act of 1973 as amended (29 USC 794) and HUD implementing regulations 24 CFR Part 8.
 - 3) Fair Housing Accessibility Guidelines (24 CFR Chapter 1).
 - 4) Americans with Disabilities Act of 1990 (ADA) (28 CFR Part 35).
11. Certifications: Comply with HUD UM 39a, ANSI Z34.1, and HUD 24 CFR 200.935.
12. Mock-ups: For Supply and Install Contract: Install one full size mock-up of each type of storm window with specified finish for acceptance.
 - a. Location: As directed.
 - b. Approved Mock-up: Standard for rest of work.
 - c. Approved Mock-up: May remain part of completed project.

Delivery, Storage, And Handling

13. Packing, Shipping, Handling, and Unloading: Pack materials at manufacturing plant to prevent damage during shipping.
 - a. Aluminum Storm Windows: Label in accordance with HUD UM 39a attached signifying compliance with ANSI/AAMA 1002.10 performance requirements.
14. Acceptance at Site: Inspect storm windows upon delivery. Replace damaged or defective materials before installation.
15. Storage and Protection: Store storm windows in manner to protect from weather and other damage.

Project Conditions

16. Field Measurements: Field measure openings for storm windows before start of fabrication.

Scheduling And Sequencing

17. Scheduling and Completion: Comply with requirements of Detailed Scope of Work.

Warranty

18. Special Warranty: Provide one year written covering materials and installation for storm windows.
 - a. Warranty: Include coverage of inserts, hardware, and latches.
 - 1) Screening and glazing riot included.
 - 2) Defects resulting from vandalism not included.
 - b. For Supply and Delivery Only Contract:
 - 1) Contractor: Agrees to supply and deliver to the Owner, free of charge, any required replacement parts that can be readily installed by the Owner without special tools.
 - 2) Contractor: Agrees to supply and deliver free of charge, complete replacement window, when defective part or parts cannot be installed without use of special tools.
 - c. For Supply and Install Contract:
 - 1) Contractor: Agrees to supply and install, free of charge, any required replacement parts or complete replacement window.

PRODUCTS

Aluminum Storm Windows

19. General: Type(s) and size(s) indicated, specified, or scheduled with necessary hardware, anchors, and equipment.
20. Materials: ANSI/AAMA 1002.10.
 - a. Extruded Aluminum: ASTM B 221, Alloy 60630-TS or stronger.
 - b. Carbon Steel (reinforcing members): ASTM A 36, zinc coated in accordance with ASTM B 633 or cadmium coated in accordance with ASTM B 766.
 - c. Stainless Steel: ASTM A 167, Type 302.
 - d. Anti-galling Devices: Manufacturers standard non-corrosive material compatible with aluminum.
 - e. Channel Gaskets: Manufacturer's standard flexible vinyl.
 - f. Welding Filler Rods: AWS A5.3.
21. Glazing Materials: Comply with CPSC 16 CFR 1201 or ANSI Z97.1.
 - a. Glass: ASTM C 1036, Type 1, Class 1, Glazing B Quality.
 - b. Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type 1, Class 1, Glazing B Quality.
 - c. Plastic: Extruded polycarbonate clear sheets, minimum 4.5 mm (0.177 inch) thick with following characteristics:
 - 1) Impact Resistance: ASTM D 256, Method A, 12-18 foot-pound per inch.
 - 2) Elongation/Modulus of Elasticity: ASTM D 638, 110 percent maximum/340,000 PSI.
 - 3) Heat Deflection: ASTM D 648, 132.2 degrees C (270 degrees F) at 264 PSI.
 - 4) Abrasion Resistance: Coated on both surfaces to produce abrasion resistance of 3-19 percent maximum haze increase for 500 revolutions of CS-1 OF wheel per ASTM D 1044.
 - d. Glass Thickness: Determined in accordance with ANSI/AAMA 1002.10 Appendix, minimum 3 mm (1/8 inch) (DS).
 - 1) Design Wind Pressures: Determined in accordance with applicable codes and regulations.
 - e. Glass: Labeled to show name of manufacturer and type.
22. Insert Insect Screens: Provide storm windows with Screens as indicated, specified, or scheduled in manufacturer's standard approved design, applicable to specific storm windows.
 - a. Screen Frames: Roll form aluminum frames of suitable alloy and of sufficient rigidity, crossbraces, as required, to lie flat against window and to prevent excessive bow in frame members and sag in screening.
 - 1) Frame Corners: Firmly joined in secured and rigid manner.
 - b. Screening: One of following as indicated, specified, or scheduled:
 - 1) Vinyl Coated Fibrous Glass Yam: ASTM D 3656, Class 1, 18 by 16 mesh, 0.29 mm (0.0115 inch) diameter yam.
 - 2) Polyvinylidene Chloride or Polypropylene Filament: FS L-S-12513, Type I or III, Class 1 or 2, 18 by 18 mesh, 0.31 mm (0.012 inch) or 0.38 mm (0.015 inch) diameter filament.
 - 3) Aluminum: FS RR-W-365, Type VII, 18 x 16 or 18 by 18 regular, 0.28 mm (0.011 inch) diameter wire.
 - 4) Stainless Steel Medium: ANSI/SMA 6001 Medium Type, 12 x 12 mesh type 304 stainless steel 0.58 mm (0.023 inch) diameter wire.
 - 5) Stainless Steel Heavy: ANSI/SMA 6001 Heavy Type, 12 x 12 mesh type 304 high tensile strength stainless steel 0.71 mm (0.028 inch) diameter wire.
 - c. Screening: Fastened to frame in manner to permit replacement of screening.
 - d. Screens: Provide with fastening devices, suited particularly for application to specific window made of aluminum or materials compatible with aluminum and of sufficient strength to perform satisfactorily.
 - e. Screens: Comply with applicable fire codes for egress and fireman access.
 - 1) Provide single point release as and where required by applicable codes and regulations.

- 2) Provide bit key lock fire entry from exterior if required by applicable codes and regulations.
- f. Window Screens: Include warning label indicating that screen will not stop child from falling out of window in accordance with SMA 7001.

Accessories

- 23. Joint Sealant: AAMA 800, Type 808.3 Exterior Perimeter Sealing Compound.

Fabrication

- 24. General:
 - a. Storm Windows: Conform to approved Shop Drawings.
 - b. Storm Windows: Assembled securely to assure neat, weather resistant construction.
 - c. Glazed Sash: Fabricated to permit reglazing without special tools.
 - d. Remove flux and grind welds, flush with exposed surfaces, and polish to blend with ad surfaces.
 - e. Sills: Provide weep holes to provide means for water to flow to exterior.
 - f. Inserts:
 - 1) Removable to inside.
 - 2) Not operable or removable from outside when in closed and latched position.
 - 3) Glass Inserts: Weatherstripped to prevent metal-to-metal contact with main frame.
 - g. Storm Windows: Comply with applicable fire codes for egress.
- 25. Vertically Sliding Storm Windows: Provide following features:
 - a. Aluminum two-track or triple-track, self-storing, vertical-sliding combination storm and screen units with two glass insert panels and one screen insert panel, and two-track storm windows.
 - b. Master Frame: Afford clearance for operation of prime window hardware.
 - c. Equip units over 1 143 mm (45 inches) wide, 2 032 mm (80 inches) high or 3 175 mm (125 united inches) with extruded aluminum tie bar to ensure rigidity to main frame.
 - d. Provide self-activating locks or latches designed to hold sash secure in locked and ventilating positions.
- 26. Horizontally Operating Storm Windows: Provide following features:
 - a. Aluminum triple track, self-storing, horizontally operating, combination storm and screen unit.
 - b. Glass Insert Panels: Operable and slide on rollers, rigid PVC or nylon glides.
 - c. Equip with security lock to latch closed when in locked position.
 - d. Master Frame: Afford clearance for operation of prime window hardware.
 - e. Fixed Aluminum Vertical Tie Bar at Meeting Rails of Inserts: Ensure rigidity to main frame.
- 27. Fixed Picture Storm Windows: Provide following features:
 - a. Divider on Storm Windows: Locate over meeting rail or prime window.
 - b. When window is larger than 1500 mm (60 inches) in height or width, separate glass area into sections with one or more aluminum muntins to join pieces of glass.
 - c. Picture Windows: Fixed but removable inserts either from inside or from outside.
 - 1) Glazing: Wrapped around marine type vinyl or drop in.

Finishes

- 28. Finish:
 - a. Aluminum Finish: Provide one of following as specified or scheduled:
 - 1) Factory applied pigmented organic coating. AAMA 603-8.
 - a) Color: As selected from manufacturer's standard colors.
 - 2) Clear Anodized: Factory applied anodic coating, AAMA 607.1, Class 1.
 - b. Exposed Surfaces of Aluminum Members: Clean and free from serious surface blemishes.
 - c. Dress and finish exposed welded joints.

Source Quality Control

29. Testing: Performed under Third Party Administrator who is in compliance with HUD UM 39a, ANSI Z34.1, and HUD 24 CFR 200.935.

EXECUTION

Examination

30. Site Verification of Conditions: indicated on Shop Drawings.
- a. Field Measurements: Verify field measurements are as
 - b. Existing Conditions: Examine openings before beginning installation.
 - c. Verify that surfaces to receive storm windows are clean.
 - d. Do not proceed with installation until conditions are satisfactory.

Preparation

31. Protection: Protect adjacent elements from damage and disfiguration in accordance with Detailed Scope of Work.
- a. Contractor: Responsible for damage to grounds, plantings, buildings and any other facilities or property caused by construction operations.
 - b. Repair or replace damaged elements in accordance with Detailed Scope of Work.
32. Existing Storm Windows: Remove existing storm windows and debris from site in accordance with Detailed Scope of Work.
33. Preparation: Prepare openings and existing frames in accordance with ASTM E 737.
- a. Prime Window Jambs of Existing Prime Windows: Prepare as necessary to provide for straight, plumb, level, tight and aesthetically appealing installation of new storm windows.
 - b. Preparatory Work: Include, but not limited to repair of jambs, filling holes and/or dents, removing peeling and scaling paint, etc.

Installation

34. General: Install in accordance with ASTM E 737, manufacturer's recommendations, Reference Standards, and approved Shop Drawings.
- a. Securely fasten storm windows in place to straight, plumb and level condition, without distortion of window or window frame, and make final adjustments for proper operation and satisfactory weatherstrip contact and seal.
 - b. Comply with applicable codes and regulations regarding egress requirements and fireman entry.
35. Joint Sealants: Apply in accordance with manufacturers recommendations.
- a. Surfaces to be Sealed: Clean, dry and free of any foreign matter that would degrade adhesion. Remove existing calking and joint sealants from areas to receive new joint sealant.
 - b. Prime cleaned surfaces in accordance with sealant manufacturers recommendations.
 - c. Protect surfaces adjacent to joints by masking tape before applying sealant. Remove tape upon finishing sealing work.
 - d. Seal joints between perimeter of window frame and underlying or surrounding construction with joint sealant to accomplish weather-tight installation.
 - e. Maximum Width of Sealed Joint: 13 mm (1/2 Inch).
36. Dissimilar Materials: Isolate materials from incompatible materials as necessary to prevent deterioration.
- a. Separate dissimilar metals with bituminous paint, suitable sealant, nonabsorptive plastic or elastomeric tape, or gasket between surfaces.
 - b. Coat aluminum in direct contact with concrete, masonry, steel, or other non-compatible materials with bituminous paint, zinc chromate primer, or other suitable insulating material.

Adjusting And Cleaning

37. Adjusting: At completion of job, check, adjust, and lubricate hardware as required and leave storm windows and hardware in proper operating condition.
38. Cleaning: Comply with requirements of Detailed Scope of Work.

08 - Openings



- a. Clean storm windows after installation is completed to remove foreign matter and surface blemishes.
- b. Scratched or Abraded Surfaces: Touch-up with rust inhibitor primer and enamel paint compatible with factory finish.

Protection

- 39. Installed Work: Protect storm windows from damage after installation

END OF SECTION 08 51 69 00



Task	Specification	Specification Description
08 51 69 00	08 51 13 00	Aluminum Windows



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SECTION 08 52 00 00 - WOOD WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Unclad wood windows.
2. Aluminum-clad wood windows.
3. Vinyl-clad wood windows.
4. Fiberglass-clad wood windows.

1.2 DEFINITIONS

- A. Combination Assemblies: Assemblies formed by a combination of two or more separate fenestration products whose frames are mullied together using a combination mullion or reinforcing mullion.
- B. Combination Mullions: Horizontal or vertical members formed by joining two or more individual fenestration units together without a mullion stiffener.
- C. Reinforcing Mullions: Horizontal or vertical members with an added continuous mullion stiffener and joining two or more individual fenestration units along the sides of the mullion stiffener.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Review, discuss, and coordinate interrelationship of wood windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
 3. Review and discuss sequence of work required to construct a watertight and weathertight exterior building envelope.
 4. Inspect and discuss condition of substrate and other preparatory work performed by other trades.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes.
- B. Shop Drawings:
1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, window rough openings, and details of installation, including anchor, flashing, and sealant installation.

- C. Samples for Initial Selection: For units with factory-applied finishes, manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.
 - 1. Include Samples of hardware and accessories involving color selection.
- D. Samples for Verification: Actual sample of finished products for each type of exposed finish:
 - 1. Exposed Finishes: **[Manufacturers' standard size][2 by 4 inches (50 by 100 mm)]<Insert dimensions>**.
 - 2. Exposed Hardware: Full-size units.
- E. Product Schedule: For wood windows. Use same designations indicated on Drawings.
- F. Delegated Design Submittals: For **[reinforcing mullions]<Insert product or system>**, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- G. Sustainable Design Submittals:
 - 1. Chain-of-Custody Qualification Data: For manufacturer and vendor.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each wood window, for tests performed by **[qualified testing agency][manufacturer and witnessed by a qualified testing agency]**.
- B. Field Quality-Control Reports: For wood windows.
- C. Qualification Statements: For manufacturer and Installer.
- D. Delegated Design Engineer Qualifications: For **[reinforcing mullions]<Insert product or system>**.
- E. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Warranty Documentation:
 - 1. Manufacturers' special warranties.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating hinged wood-framed glass doors that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.
- B. Installer Qualifications: **[Entity that employs installers and supervisors who are trained and approved by manufacturer][Authorized representative who is trained and approved by manufacturer]**.
- C. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in **[state]<Insert jurisdiction>** where Project is located and who is experienced in providing engineering

services of the type indicated.

- D. Testing Agency Qualifications: WDMA-accredited testing agency for testing indicated.
- E. Vendor Qualifications: Provide proof of use of vendors that are certified for chain of custody by an FSC-accredited certification body.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution. [**See Section 014339 "Mockups" for additional construction requirements for integrated exterior mockups.**]
 - 1. Build mockup [as indicated on Drawings]<Insert mockup requirements>.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wood windows to Project site in original, unopened packages and store them in accordance with manufacturer's written instructions. Protect wood windows against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Handle wood windows in a manner that prevents damage before, during, and after installation.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install wood windows outside of limits recommended in writing by manufacturer.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures, including excessive deflection, water leakage, and air infiltration.
 - c. Faulty operation of movable sash and hardware.
 - d. Deterioration of materials and finishes beyond normal weathering.
 - e. Failure of insulating glass.
 - 2. Warranty Period:
 - a. Window: [Two][Five][10]<Insert number> years from date of Substantial Completion.
 - b. Glazing Units: [Five][10]<Insert number> years from date of Substantial Completion.
 - c. Hardware: [Three]<Insert number> years from date of Substantial Completion.
 - d. Aluminum-Cladding Finish: [10][20]<Insert number> years from date of Substantial

- Completion.
- e. Vinyl Cladding: Lifetime warranty.
- f. Fiberglass Cladding: [10]<Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain wood windows from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design [reinforcing mullions]<Insert product or system>.
- B. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Window Certification: WDMA certified with label attached to each window.
- C. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
 - 1. Minimum Performance Class: [R][LC][CW][As indicated on Drawings]<Insert class>.
 - 2. Minimum Performance Grade: [15][20][25][30][35][40][45][50][As indicated on Drawings]<Insert grade>.
 - 3. Mulled Window Systems: Evaluate and rate combination assemblies as single systems as determined by AAMA 450 in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 requirements.
- D. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
 - 1. Thermal Transmittance (U-factor): As determined in accordance with NFRC 100:
 - a. Fixed Windows: Not more than [0.50 Btu/sq. ft. x h x deg F (2.84 W/sq. m x K)][0.45 Btu/sq. ft. x h x deg F (2.56 W/sq. m x K)][0.42 Btu/sq. ft. x h x deg F (2.38 W/sq. m x K)][0.36 Btu/sq. ft. x h x deg F (2.04 W/sq. m x K)][0.29 Btu/sq. ft. x h x deg F (1.65 W/sq. m x K)][0.26 Btu/sq. ft. x h x deg F (1.48 W/sq. m x K)]<Insert value>.
 - b. Operable Windows: Not more than [0.62 Btu/sq. ft. x h x deg F (3.52 W/sq. m x K)][0.60 Btu/sq. ft. x h x deg F (3.41 W/sq. m x K)][0.54 Btu/sq. ft. x h x deg F (3.07 W/sq. m x K)][0.45 Btu/sq. ft. x h x deg F (2.56 W/sq. m x K)][0.42 Btu/sq. ft. x h x deg F (2.38 W/sq. m x K)][0.36 Btu/sq. ft. x h x deg F (2.04 W/sq. m x K)][0.32 Btu/sq. ft. x h x deg F (1.82 W/sq. m x K)]<Insert value>.
 - 2. Solar Heat-Gain Coefficient (SHGC): As determined in accordance with NFRC 200:
 - a. Fixed Windows: Not more than [0.23][0.25][0.36][0.38][0.40]<Insert value>.
 - b. Operable Windows: Not more than [0.21][0.23][0.33][0.34][0.36]<Insert value> as

determined in accordance with NFRC 200.

3. Condensation-Resistance Factor (CRF): Provide windows tested for thermal performance in accordance with AAMA 1503, showing a CRF of [45][52]<Insert value>.
- E. Outdoor-Indoor Transmission Class (OITC): Rated for not less than [22][26][30]<Insert rating> OITC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E1332.
- F. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone [1][2][3] for [basic][enhanced] protection.
 1. Large-Missile Test: For glazing located within [30 ft. (9.1 m)]<Insert dimension> of grade.
 2. Small-Missile Test: For glazing located more than [30 ft. (9.1 m)]<Insert dimension> above grade.

2.3 WOOD WINDOWS, GENERAL

- A. Provide manufacturer's standard wood window assemblies consisting of frames, sashes, glass, hardware, fasteners, and all components and accessories as required for a complete installation.

2.4 UNCLAD WOOD WINDOWS

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 1. [JELD-WEN, Inc.]
 2. [Kolbe Windows & Doors]
 3. [Marvin]
 4. [Pella Corporation]
 5. [Ply-Gem]
 6. [Sierra Pacific Windows; Sierra Pacific Industries]
 7. [Weather Shield Mfg., Inc]
 8. <Insert manufacturer's name>
- B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 1. [JELD-WEN, Inc.]
 2. [Kolbe Windows & Doors]
 3. [Marvin]
 4. [Pella Corporation]
 5. [Ply-Gem]
 6. [Sierra Pacific Windows; Sierra Pacific Industries]
 7. [Weather Shield Mfg., Inc]
 8. <Insert manufacturer's name>
- C. Operating Types: Provide the following operating types in locations indicated on Drawings:
 1. Casement: Project out.
 2. Awning: Project out.
 3. Hopper: Project in.
 4. Single hung.

5. Double hung.
6. Horizontal sliding.
7. Fixed.

D. Exterior Surfaces: **[Manufacturer's standard paint-grade wood species][Pine]<Insert species>**.

1. Visible Finger Joints: **[Allowed][Not allowed]**.
2. Finish: **[Manufacturer's standard factory-applied primer][Manufacturer's standard factory-applied color-coated finish][Unfinished]<Insert requirements>**.

a. Color: **[As selected by Architect from manufacturer's full range]<Insert color>**.

E. Interior Surfaces: **[Manufacturer's standard wood species][Pine][Mahogany][Fir][Alder][Oak][Cherry]<Insert species>**.

1. Visible Finger Joints: **[Allowed][Not allowed]**.
2. Finish: **[Unfinished][Manufacturer's standard factory-applied primer for field painting][Manufacturer's standard factory-applied color-coated finish][Manufacturer's standard factory-applied stain and transparent finish]<Insert finish>**.

a. Color: **[As selected by Architect from manufacturer's full range]<Insert color>**.

2.5 ALUMINUM-CLAD WOOD WINDOWS

A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

1. **[Andersen Windows, Inc.; Andersen Corporation]**
2. **[JELD-WEN, Inc.]**
3. **[Kolbe Windows & Doors]**
4. **[Marvin]**
5. **[Pella Corporation]**
6. **[Ply-Gem]**
7. **[Sierra Pacific Windows; Sierra Pacific Industries]**
8. **[Weather Shield Mfg., Inc]**
9. **<Insert manufacturer's name>**

B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

1. **[Andersen Windows, Inc.; Andersen Corporation]**
2. **[JELD-WEN, Inc.]**
3. **[Kolbe Windows & Doors]**
4. **[Marvin]**
5. **[Pella Corporation]**
6. **[Ply-Gem]**
7. **[Sierra Pacific Windows; Sierra Pacific Industries]**
8. **[Weather Shield Mfg., Inc]**
9. **<Insert manufacturer's name>**

C. Operating Types: Provide the following operating types in locations indicated on Drawings:

1. Casement: Project out.

2. Awning: Project out.
3. Hopper: Project in.
4. Single hung.
5. Double hung.
6. Horizontal sliding.
7. Fixed.

D. Exterior Surfaces: [Manufacturer's standard aluminum cladding]<Insert requirements>.

1. Baked-Enamel or Powder-Coat Finish: AAMA 2603, except with a minimum dry-film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and curing finish.
 - a. Color and Gloss: **[As indicated by manufacturer's designation][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
2. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with **[AAMA 2604][AAMA 2605]** and containing not less than **[50][70]** percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: **[As indicated by manufacturer's designation][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

E. Interior Surfaces: [Manufacturer's standard wood species][Pine][Fir][Alder][Oak][Cherry][Mahogany]<Insert species>.

1. Visible Finger Joints: **[Allowed][Not allowed]**.
2. Finish: **[Unfinished][Manufacturer's standard factory-applied primer for field painting][Manufacturer's standard factory-applied color-coated finish][Manufacturer's standard factory-applied stain and transparent finish]<Insert finish>.**
 - a. Color: **[As selected by Architect from manufacturer's full range]<Insert color>.**

2.6 VINYL-CLAD WOOD WINDOWS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 1. **[Andersen Windows, Inc.; Andersen Corporation]**
 2. **[Sierra Pacific Windows; Sierra Pacific Industries]**
 3. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 1. **[Andersen Windows, Inc.; Andersen Corporation]**
 2. **[Sierra Pacific Windows; Sierra Pacific Industries]**
 3. **<Insert manufacturer's name>**
- C. Operating Types: Provide the following operating types in locations indicated on Drawings:

1. Casement: Project out.
2. Awning: Project out.
3. Hopper: Project in.
4. Single hung.
5. Double hung.
6. Horizontal sliding.
7. Fixed.

D. Exterior Surfaces: Manufacturer's standard vinyl-cladding.

1. Color: **[As selected by Architect from manufacturer's full range]**<Insert color>.

E. Interior Surfaces: **[Manufacturer's standard wood species]**[Pine][Oak][Maple]<Insert species>.

1. Visible Finger Joints: **[Allowed]**[Not allowed].
2. Finish: **[Unfinished]**[Manufacturer's standard factory-applied color-coated white finish]<Insert finish>.

2.7 FIBERGLASS-CLAD WOOD WINDOWS

A. Manufacturers: Subject to compliance with requirements, **[provide products by the following]**[provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. **[Andersen Windows, Inc.; Andersen Corporation]**
2. **[Kolbe Windows & Doors]**
3. **<Insert manufacturer's name>**

B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

1. **[Andersen Windows, Inc.; Andersen Corporation]**
2. **[Kolbe Windows & Doors]**
3. **<Insert manufacturer's name>**

C. Operating Types: Provide the following operating types in locations indicated on Drawings:

1. Casement: Project out.
2. Awning: Project out.
3. Hopper: Project in.
4. Single hung.
5. Double hung.
6. Horizontal sliding.
7. Fixed.

D. Exterior Surfaces: Manufacturer's standard fiberglass-clad frame.

1. Color: **[As selected by Architect from manufacturer's full range]**<Insert color>.

E. Interior Surfaces: **[Manufacturer's standard wood species]**[Pine][Oak][Maple]<Insert species>.

1. Visible Finger Joints: **[Allowed]**[Not allowed].
2. Finish: **[Unfinished]**[Manufacturer's standard factory-applied color-coated white

finish]<Insert finish>.

2.8 WINDOW COMPONENTS

- A. Frames and Sashes: Fine-grained wood lumber complying with AAMA/WDMA/CSA 101/I.S.2/A440; kiln dried to a moisture content of not more than 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than **1/32 inch (0.8 mm)** deep by **2 inches (51 mm)** wide; water-repellent preservative treated.

2.9 GLASS AND GLAZING

- A. True Divided Lites: Fabricate glazing with true muntins resulting in individually glazed lites; provide muntin configuration and profile indicated on Drawings.
- B. Glass: Clear annealed glass, ASTM C1036, Type 1, Class 1, q3.
1. Kind: Fully tempered [**where indicated on Drawings**]**<Insert requirements>.**
- C. Windborne-Debris-Impact-Resistant Laminated Glass: ASTM C1172 with two plies of float glass.
1. Float Glass: [**Annealed**][**Heat strengthened**][**Fully tempered**][**As required by performance requirements indicated**].
 2. Inner Ply: Clear.
 3. Interlayer: [**0.090 inch (2.29 mm)**][**As required by performance requirements indicated**]**<Insert requirements>.**
 4. Outer Ply: [**Clear**][**Gray**][**Bronze**][**Green**]**<Insert tint>.**
 5. Low-E Coating: [**Pyrolytic on second surface**][**Sputtered on second surface**][**Sputtered on third surface**][**Sputtered on second or third surface**]**<Insert coating>.**
- D. Insulating-Glass Units: ASTM E2190.
1. Glass: ASTM C1036, Type 1, Class 1, q3.
 - a. Tint: [**Clear**][**Gray**][**Bronze**][**Green**]**<Insert tint>.**
 - b. Kind: Fully tempered [**where indicated on Drawings**]**<Insert requirements>.**
 2. Lites: [**Two**][**Three**].
 3. Filling: Fill space between glass lites with [**air**][**argon**].
 4. Low-E Coating: [**Pyrolytic on second surface**][**Sputtered on second surface**][**Sputtered on third surface**][**Sputtered on second or third surface**]**<Insert coating>.**
- E. Windborne-Debris-Impact-Resistant Insulating-Glass Units: ASTM E2190 with two lites and complying with impact-resistance requirements in "Performance Requirements" Article.
1. Exterior Lite: ASTM C1036, Type 1, Class 1, q3.
 - a. Tint: [**Clear**][**Gray**][**Bronze**][**Green**]**<Insert tint>.**
 - b. Kind: [**Heat strengthened**][**Fully tempered**].
 2. Interior Lite: ASTM C1172 clear laminated glass with two plies of float glass.
 - a. Float Glass: [**Annealed**][**Heat strengthened**][**Fully tempered**][**As required by performance requirements indicated**].

- b. Interlayer Thickness: **[0.090 inch (2.29 mm)]****[As required by performance requirements indicated]****<Insert requirements>**.
 - 3. Filling: Fill space between glass lites with **[air]****[argon]**.
 - 4. Low-E Coating: **[Pyrolytic on second surface]****[Sputtered on second surface]****[Sputtered on third surface]****[Sputtered on second or third surface]****<Insert coating>**.
- F. Glazing System: **[Manufacturer's standard factory-glazing system that produces weathertight seal]****<Insert glazing requirements>**.
 - 1. Dual-Glazing System:
 - a. Interior Lite: **[Glass]****<Insert type>**.
 - b. Exterior Lite: **[Glass]****[Insulating-glass unit]****<Insert type>**.

2.10 HARDWARE

- A. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
 - 1. Exposed Hardware Color and Finish: **[As indicated by manufacturer's designations]****[Match Architect's sample]****[As selected by Architect from manufacturer's full range]****<Insert color and finish>**.
- B. Projected Window Hardware:
 - 1. Gear-Type Rotary Operators: Complying with AAMA 901 when tested in accordance with ASTM E405, Method A. Provide operators that function without requiring the removal of interior screens or using screen wickets.
 - a. Type and Style: **[Match Architect's sample]****[As selected by Architect from manufacturer's full range of types and styles]****<Insert type and style>**.
 - 2. Hinges: **[Manufacturer's standard type for sash weight and size indicated]****[Stainless steel hinges with stainless steel-reinforced, sliding nylon shoes]****<Insert description>**.
 - 3. Single-Handle Locking System: Operates positive-acting arms that pull sash into locked position. Provide one arm on sashes up to **29 inches (735 mm)** tall and two arms on taller sashes.
 - 4. Limit Devices: **[Concealed friction adjuster, adjustable stay bar]****[Concealed support arms with adjustable, limited, hold-open]****<Insert type>** limit devices designed to restrict sash opening.
 - a. Limit clear opening to **[4 inches (100 mm)]****<Insert dimension>** for ventilation; with custodial key release.
 - 5. Operator Stud Cover: Matching operator handle finish. Provide in locations where operator handle is removed for controlled access.
 - 6. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than **60 inches (1500 mm)** above floor; one pole operator and pole hanger per room that has operable windows more than **72 inches (1800 mm)** above floor.
- C. Hung Window Hardware:

1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. **[Provide custodial locks.]**
3. Tilt Hardware: Releasing tilt latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.

D. Horizontal-Sliding Window Hardware:

1. Sill Cap/Track: **[Extruded-aluminum track with natural anodized finish][Rigid PVC or other weather-resistant plastic track with manufacturer's standard integral color][Manufacturer's standard]<Insert track material and finish>** of dimensions and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. **[Provide custodial locks.]**
3. Roller Assemblies: Low-friction design.

E. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

F. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Avoid exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

G. Mullions: Provide manufacturer's standard combination and reinforcing mullions and cover plates matching window units, complete with anchors for support to structure. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide reinforcing mullions and cover plates capable of withstanding design wind loads of window units.

2.11 ACCESSORIES

A. Dividers (False Muntins): Provide divider grilles in designs indicated for each sash lite.

1. Quantity and Type: **[One per sash, removable from exposed surface of interior lite][Two per sash, removable from exposed surfaces of interior and permanently located at exterior lite][Two per sash, permanently located at exterior and interior lites][One permanently located between insulating-glass lites][Three per sash, two permanently located at exterior and interior lites and one permanently located between insulating-glass lites]<Insert requirements>**.
2. Material: **[Manufacturer's standard]<Insert material>**.
3. Pattern: **[As indicated on Drawings]<Insert pattern>**.
4. Profile: **[As selected by Architect from manufacturer's full range]<Insert profile>**.
5. Color: **[As selected by Architect from manufacturer's full range]<Insert color>**.

B. Integral Horizontal Louver Blinds: Manufacturer's standard, horizontal louver blinds located between glazing units in a dual-glazed system. Provide blinds with aluminum slats and polyester fiber cords that are operated by hardware located on inside face of sash.

1. Operation: **[Tilt only][Tilt, raising, and lowering]**.
2. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.

C. Integral Fabric Shades: Manufacturer's standard, cellular pleated shades located between glazing units

in a dual-glazed system. Provide shades with multiple fabric layers forming accordion folds that enclose airspaces between the fabric layers, with polyester fiber cords that are operated by hardware located on inside face of sash.

1. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>.**

D. Jamb Extensions: **[Stain-grade Pacific Hemlock]<Insert description>.**

E. Nail Fins: Manufacturer's standard mounting flanges with holes prepunched for mechanical fasteners.

2.12 INSECT SCREENS

A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

1. Type and Location: **[Full, inside for project-out][Full, outside for double-hung][Half, outside for single-hung][Full, outside for sliding][Half, outside for sliding]** sashes.

B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.
2. Finish for Interior Screens: Baked-on organic coating in **[color selected by Architect from manufacturer's full range]<Insert color>.**
3. Finish for Exterior Screens: **[Baked-on organic coating in color selected by Architect from manufacturer's full range][Matching color and finish of cladding]<Insert finish>.**

C. Glass-Fiber Mesh Fabric: **[18-by-14 (1.1-by-1.4-mm) or 18-by-16 (1.0-by-1.1-mm)][20-by-20 (0.85-by-0.85-mm) or 20-by-30 (0.85-by-0.42-mm)]<Insert type>** mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D3656/D3656M.

1. Mesh Color: **[Manufacturer's standard]<Insert color>.**

D. Aluminum Wire Fabric: **18-by-16 (1.1-by-1.3-mm)** mesh of **0.011-inch- (0.28-mm-)** diameter, coated aluminum wire.

1. Wire-Fabric Finish: **[Natural bright][Charcoal gray][Black]<Insert finish>.**

2.13 FABRICATION

A. Fabricate wood windows in sizes indicated. Include a complete system for installing and anchoring windows.

B. Glaze wood windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Window Assemblies: **[Bow][Bay][Combination]**. Provide window units in configuration indicated. Provide window frames, sashes, hardware, and other trim and components necessary for a complete,

secure, and weathertight installation, including the following:

1. Combination and reinforcing mullions with interior and exterior trim.
 2. Interior and exterior extension and trim.
 3. Clear **[pine][birch]** head and seat boards.
 4. Top and bottom plywood platforms.
 5. Exterior head and sill casings and trim.
 6. Support brackets.
- E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF WOOD WINDOWS

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.
- B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Mullions: Install combination and reinforcing mullions for combination assemblies in accordance with manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing Services: Testing and inspecting of installed windows must take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance to be performed in accordance with AAMA 502.
2. Air-Infiltration Testing:
 - a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
 - b. Allowable Air-Leakage Rate: **[1.5]<Insert number>** times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
3. Water-Resistance Testing:
 - a. Test Pressure: **[Two-thirds]<Insert number>** times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
 - b. Allowable Water Infiltration: No water penetration.
4. Testing Extent: **[One][Three]<Insert number or description>** window(s) of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows to be tested **[immediately after installation][at 5, 50, and 90 percent completion]<Insert test schedule>**.
5. Test Reports: Prepared in accordance with AAMA 502.
6. Windows will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- B. Clean exposed surfaces immediately after installing windows using manufacturer's written instructions. Remove excess sealants, glazing materials, dirt, and other substances.
 1. Keep protective films and coverings in place until final cleaning.
- C. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.
- D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.

END OF SECTION 08 52 00 00



Task	Specification	Specification Description
08 52 11 00	08 52 00 00	Wood Windows
08 52 13 00	08 52 00 00	Wood Windows
08 52 16 00	08 52 00 00	Wood Windows
08 52 66 00	08 52 00 00	Wood Windows



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SECTION 08 53 13 00 - VINYL WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Vinyl windows.

1.2 DEFINITIONS

- A. Combination Assemblies: An assembly formed by a combination of two or more separate fenestration products whose frames are mulled together utilizing a combination mullion or reinforcing mullion.
- B. Combination Mullions: A horizontal or vertical member formed by joining two or more individual fenestration units together without a mullion stiffener.
- C. Reinforcing Mullions: A horizontal or vertical member with an added continuous mullion stiffener and joining two or more individual fenestration units along the sides of the mullion stiffener.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Review, discuss, and coordinate interrelationship of vinyl windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
 3. Review and discuss sequence of work required to construct a watertight and weathertight exterior building envelope.
 4. Inspect and discuss condition of substrate and other preparatory work performed by other trades.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes.
- B. Shop Drawings:
1. Plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

- D. Samples for Verification: Actual sample of finished products for each type of exposed finish:
 - 1. Exposed Finishes: **[2 by 4 inches (50 by 100 mm)]<Insert dimensions>**.
 - 2. Exposed Hardware: Full-size units.
- E. Product Schedule: For vinyl windows. Use same designations indicated on Drawings.
- F. Delegated Design Submittals: For reinforcing mullions, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- G. Sustainable Design Submittals:
 - 1. Product Data: For installation adhesives, indicating VOC content.
 - 2. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low-emitting materials.
 - 3. Product Data: For indicated products, indicating compliance with requirements for ENERGY STAR product labeling.
 - 4. ENERGY STAR: Product data for indicated products, showing compliance with requirements for ENERGY STAR product labeling.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of vinyl window, for tests performed by **[a qualified testing agency][manufacturer and witnessed by a qualified testing agency]**.
- B. Field Quality-Control Reports: For vinyl windows.
- C. Qualification Statements: For manufacturer and Installer.
- D. Delegated Design Engineer Qualifications: For reinforcing mullions.
- E. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Warranty Documentation:
 - 1. Manufacturers' special warranties.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating vinyl windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.
- B. Installer Qualifications: Authorized representative who is trained and approved by vinyl window manufacturer.
- C. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in **[state]<Insert jurisdiction>** where Project is located and who is experienced in providing engineering services of the type indicated.

- D. Testing Agency Qualifications: An FGIA-accredited testing agency for testing indicated.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution. [**See Section 014339 "Mockups" for additional construction requirements for integrated exterior mockups.**]
1. Build mockup [**as indicated on Drawings**]**<Insert mockup requirements>**.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace vinyl windows that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection, water leakage, and air infiltration.
 - c. Faulty operation of movable sash and hardware.
 - d. Deterioration of materials and finishes beyond normal weathering.
 - e. Failure of insulating glass.
 2. Warranty Period:
 - a. Window: [**Two**][**Five**][**10**]**<Insert number>** years from date of Substantial Completion.
 - b. Glazing Units: [**Five**][**10**]**<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain vinyl windows from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design reinforcing mullions.
- B. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
1. Window Certification: FGIA or WDMA certified with label attached to each window.
- C. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: **[R][LC][CW][As indicated on Drawings]<Insert class>**.
2. Minimum Performance Grade: **[15][20][25][30][35][40][45][50][As indicated on Drawings]<Insert grade>**.
3. Muller Window Systems: Evaluate and rate combination assemblies as single systems as determined by AAMA 450 in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 requirements.

D. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor): As determined in accordance with NFRC 100:
 - a. Fixed Windows: Not more than **[0.50 Btu/sq. ft. x h x deg F (2.84 W/sq. m x K)][0.45 Btu/sq. ft. x h x deg F (2.56 W/sq. m x K)][0.42 Btu/sq. ft. x h x deg F (2.38 W/sq. m x K)][0.36 Btu/sq. ft. x h x deg F (2.04 W/sq. m x K)][0.34 Btu/sq. ft. x h x deg F (1.93 W/sq. m x K)][0.29 Btu/sq. ft. x h x deg F (1.65 W/sq. m x K)][0.26 Btu/sq. ft. x h x deg F (1.48 W/sq. m x K)]<Insert value>**.
 - b. Operable Windows: Not more than **[0.62 Btu/sq. ft. x h x deg F (3.52 W/sq. m x K)][0.60 Btu/sq. ft. x h x deg F (3.41 W/sq. m x K)][0.54 Btu/sq. ft. x h x deg F (3.07 W/sq. m x K)][0.45 Btu/sq. ft. x h x deg F (2.56 W/sq. m x K)][0.42 Btu/sq. ft. x h x deg F (2.38 W/sq. m x K)][0.36 Btu/sq. ft. x h x deg F (2.04 W/sq. m x K)][0.32 Btu/sq. ft. x h x deg F (1.82 W/sq. m x K)]<Insert value>**.
2. Solar Heat-Gain Coefficient (SHGC): As determined in accordance with NFRC 200.
 - a. Fixed Windows: Not more than **[0.23][0.25][0.36][0.38][0.40]<Insert value>**.
 - b. Operable Windows: Not more than **[0.21][0.23][0.33][0.34][0.36]<Insert value>** as determined in accordance with NFRC 200.

E. Outdoor-Indoor Transmission Class (OITC): Rated for not less than **[22][26][30]<Insert rating>** OITC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E1332.

F. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone **[1][2][3]** for **[basic][enhanced]** protection.

1. Large-Missile Test: For glazing located within **[30 ft. (9.1 m)]<Insert dimension>** of grade.
2. Small-Missile Test: For glazing located more than **[30 ft. (9.1 m)]<Insert dimension>** above grade.

2.3 VINYL WINDOWS

A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

1. **[All Seasons Architectural Windows Mfg., Inc.; All Seasons Commercial Division, Inc.]**
2. **[Gerkin Windows & Doors]**
3. **[Intus Windows]**
4. **[JELD-WEN, Inc.]**
5. **[MI Windows and Doors, LLC]**
6. **[Milgard Manufacturing, LLC]**
7. **[Pella Corporation]**

8. [PGT Custom Windows + Doors; PGT Innovations (PGTI)]
 9. [Ply-Gem]
 10. [Quaker Windows Products Co.]
 11. [Shwinco Architectural Products LLC]
 12. [Simonton Windows, Inc.]
 13. [Thermal Windows, Inc.]
 14. [Thermo-Tech Windows and Doors LLC.]
 15. [VPI Quality Windows, Inc.; JELD-WEN Holding, Inc.]
 16. <Insert manufacturer's name>
- B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
1. [All Seasons Architectural Windows Mfg., Inc.; All Seasons Commercial Division, Inc.]
 2. [Gerkin Windows & Doors]
 3. [Intus Windows]
 4. [JELD-WEN, Inc.]
 5. [MI Windows and Doors, LLC]
 6. [Milgard Manufacturing, LLC]
 7. [Pella Corporation]
 8. [PGT Custom Windows + Doors; PGT Innovations (PGTI)]
 9. [Ply-Gem]
 10. [Quaker Windows Products Co.]
 11. [Shwinco Architectural Products LLC]
 12. [Simonton Windows, Inc.]
 13. [Thermal Windows, Inc.]
 14. [Thermo-Tech Windows and Doors LLC.]
 15. [VPI Quality Windows, Inc.; JELD-WEN Holding, Inc.]
 16. <Insert manufacturer's name>
- C. Provide manufacturer's standard vinyl window assemblies consisting of frames, sashes, glass, hardware, fasteners, and all components and accessories as required for a complete installation.
- D. Operating Types: Provide the following operating types in locations indicated on Drawings:
1. Casement: Project out.
 2. Awning: Project out.
 3. Single hung.
 4. Double hung.
 5. Horizontal sliding.
 6. Fixed.
- E. Frames and Sashes: Impact-resistant, UV-stabilized PVC complying with AAMA/WDMA/CSA 101/I.S.2/A440.
1. Finish: Integral color, [white][beige][sandstone]<Insert finish>.
 2. Gypsum Board Returns: Provide at interior face of frame.
- F. Glass: Clear annealed glass, ASTM C1036, Type 1, Class 1, q3.
1. Kind: Fully tempered [where indicated on Drawings]<Insert requirements>.
- G. Windborne-Debris-Impact-Resistant Laminated Glass: ASTM C1172, with two plies of float glass.
1. Float Glass: [Annealed][Heat strengthened][Fully tempered][As required by performance requirements indicated].

2. Inner Ply: Clear.
3. Interlayer: **[0.090 inch (2.29 mm)]****[As required by performance requirements indicated]****<Insert requirements>**.
4. Outer Ply: **[Clear]****[Gray]****[Bronze]****[Green]****<Insert tint>**.
5. Low-E Coating: **[Pyrolytic on second surface]****[Sputtered on second surface]****[Sputtered on third surface]****[Sputtered on second or third surface]****<Insert coating>**.

H. Insulating-Glass Units: ASTM E2190.

1. Glass: ASTM C1036, Type 1, Class 1, q3.
 - a. Tint: **[Clear]****[Gray]****[Bronze]****[Green]****<Insert tint>**.
 - b. Kind: Fully tempered **[where indicated on Drawings]****<Insert requirements>**.
2. Lites: **[Two]****[Three]**.
3. Filling: Fill space between glass lites with **[air]****[argon]**.
4. Low-E Coating: **[Pyrolytic on second surface]****[Sputtered on second surface]****[Sputtered on third surface]****[Sputtered on second or third surface]****<Insert coating>**.
5. Integral Louver Blinds: Glass manufacturer's standard, horizontal louver blinds with aluminum slats and polyester fiber cords, located in space between glass lites, and operated by hardware located on inside face of sash.
 - a. Operation: **[Tilt only]****[Tilt, raising, and lowering]**.
 - b. Color: **[As indicated by manufacturer's designations]****[Match Architect's sample]****[As selected by Architect from manufacturer's full range]****<Insert color>**.

I. Windborne-Debris-Impact-Resistant Insulating-Glass Units: ASTM E2190, with two lites and complying with impact-resistance requirements in "Performance Requirements" Article.

1. Exterior Lite: ASTM C1036, Type 1, Class 1, q3.
 - a. Tint: **[Clear]****[Gray]****[Bronze]****[Green]****<Insert tint>**.
 - b. Kind: **[Heat strengthened]****[Fully tempered]**.
2. Interior Lite: ASTM C1172, clear laminated glass with two plies of float glass.
 - a. Float Glass: **[Annealed]****[Heat strengthened]****[Fully tempered]****[As required by performance requirements indicated]**.
 - b. Interlayer Thickness: **[0.090 inch (2.29 mm)]****[As required by performance requirements indicated]****<Insert requirements>**.
3. Filling: Fill space between glass lites with **[air]****[argon]**.
4. Low-E Coating: **[Pyrolytic on second surface]****[Sputtered on second surface]****[Sputtered on third surface]****[Sputtered on second or third surface]****<Insert coating>**.

J. Glazing System: **[Manufacturer's standard factory-glazing system that produces weathertight seal]****<Insert glazing requirements>**.

1. Dual Glazing System:
 - a. Interior Lite: **[Glass]****[Insulating-glass unit]****<Insert type>**.
 - b. Exterior Lite: **[Glass]****[Insulating-glass unit]****<Insert type>**.

K. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with

adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and finish>**.

L. Projected Window Hardware:

1. Gear-Type Rotary Operators: Complying with AAMA 901 when tested in accordance with ASTM E405, Method A. Provide operators that function without requiring the removal of interior screens or using screen wickets.
 - a. Type and Style: **[Match Architect's sample][As selected by Architect from manufacturer's full range of types and styles]<Insert type and style>**.
2. Hinges: **[Manufacturer's standard type for sash weight and size indicated][Stainless-steel hinges with stainless-steel-reinforced, sliding nylon shoes]<Insert description>**.
3. Single-Handle Locking System: Operates positive-acting arms that pull sash into locked position. Provide one arm on sashes up to **29 inches (735 mm)** tall and two arms on taller sashes.
4. Limit Devices: **[Concealed friction adjustor, adjustable stay bar][Concealed support arms with adjustable, limited, hold-open]<Insert type>** limit devices designed to restrict sash opening.
 - a. Limit clear opening to **[4 inches (100 mm)]<Insert dimension>** for ventilation; with custodial key release.
5. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than **60 inches (1500 mm)** above floor; one pole operator and pole hanger per room that has operable windows more than **72 inches (1800 mm)** above floor.

M. Hung Window Hardware:

1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. **[Provide custodial locks.]**
3. Tilt Hardware: Releasing tilt latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.

N. Horizontal-Sliding Window Hardware:

1. Sill Cap/Track: **[Extruded-aluminum track with natural anodized finish][Rigid PVC or other weather-resistant plastic track with manufacturer's standard integral color][Manufacturer's standard]<Insert track material and finish>** of dimensions and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. **[Provide custodial locks.]**
3. Roller Assemblies: Low-friction design.

O. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

P. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Avoid exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

- Q. Mullions: Provide combination and reinforcing mullions and cover plates matching window units, complete with anchors for support to structure. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide reinforcing mullions and cover plates capable of withstanding design wind loads of window units.

2.4 ACCESSORIES

- A. Dividers (False Muntins): Provide divider grilles in designs indicated for each sash lite.
1. Quantity and Type: **[One permanently located between insulating-glass lites][Three per sash, one permanently located between insulating-glass lites, and two permanently attached to the interior and exterior lites]<Insert requirements>.**
 2. Material: **[Manufacturer's standard]<Insert material>.**
 3. Pattern: **[As indicated on Drawings]<Insert pattern>.**
 4. Profile: **[As selected by Architect from manufacturer's full range]<Insert profile>.**
 5. Color: **[As selected by Architect from manufacturer's full range]<Insert color>.**

2.5 INSECT SCREENS

- A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.
1. Type and Location: **[Full, inside for project-out][Full, outside for double-hung][Half, outside for single-hung][Full, outside for sliding][Half, outside for sliding]** sashes.
- B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.
 2. Finish for Interior Screens: Baked-on organic coating in **[color selected by Architect from manufacturer's full range]<Insert finish>.**
 3. Finish for Exterior Screens: **[Baked-on organic coating in color selected by Architect from manufacturer's full range]<Insert finish>.**
- C. Glass-Fiber Mesh Fabric: **[18-by-14 (1.1-by-1.4-mm) or 18-by-16 (1.0-by-1.1-mm)][20-by-20 (0.85-by-0.85-mm) or 20-by-30 (0.85-by-0.42-mm)]<Insert type>** mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D3656/D3656M.
1. Mesh Color: **[Manufacturer's standard]<Insert color>.**
- D. Aluminum Wire Fabric: **18-by-16 (1.1-by-1.3-mm)** mesh of **0.011-inch- (0.28-mm-)** diameter, coated aluminum wire.
1. Wire-Fabric Finish: **[Natural bright][Charcoal gray][Black]<Insert finish>.**

2.6 FABRICATION

- A. Fabricate vinyl windows in sizes indicated. Include a complete system for installing and anchoring windows.
- B. Glaze vinyl windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Hardware: Mount hardware through double walls of vinyl extrusions or provide corrosion-resistant reinforcement.
- E. Window Assemblies: **[Bow][Bay][Combination]**. Provide window units in configuration indicated on Drawings. Provide window frames, sashes, hardware, and other trim and components necessary for a complete, secure, and weathertight installation, including the following:
 - 1. Combination and reinforcing mullions with interior and exterior trim.
 - 2. Interior and exterior extension and trim.
 - 3. Clear **[pine]<Insert species>** head and seat boards.
 - 4. Top and bottom plywood platforms.
 - 5. Support brackets.
- F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, **[vapor retarders,]** air and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.
- B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Mullions: Install combination and reinforcing mullions for combination assemblies in accordance with

manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
 - 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing Services: Testing and inspecting of installed windows to take place as follows:
 - 1. Testing Methodology: Testing of windows for air infiltration and water resistance will be performed in accordance with AAMA 502.
 - 2. Air-Infiltration Testing:
 - a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
 - b. Allowable Air-Leakage Rate: **[1.5]<Insert number>** times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
 - 3. Water-Resistance Testing:
 - a. Test Pressure: **[Two-thirds]<Insert number>** times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
 - b. Allowable Water Infiltration: No water penetration.
 - 4. Testing Extent: **[One][Three]<Insert number or description>** window(s) of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows will be tested **[immediately after installation][at 5, 50, and 90 percent completion]<Insert test schedule>**.
 - 5. Test Reports: Prepared in accordance with AAMA 502.
- C. Test and Inspections:
 - 1. Windows will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

3.5 CLEANING AND PROTECTION

- A. Clean exposed surfaces immediately after installing windows using manufacturer's written instructions. Remove excess sealants, glazing materials, dirt, and other substances.
- B. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during

construction period.

- C. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.

END OF SECTION 08 53 13 00

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Task	Specification	Specification Description
08 53 66 00	08 53 13 00	Vinyl Windows



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SECTION 08 54 00 00 - COMPOSITE WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Composite windows.

B. Related Requirements:

1. Section 081674 "Sliding Composite-Framed Glass Doors" for related sliding doors.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review, discuss, and coordinate the interrelationship of composite windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.3 ACTION SUBMITTALS

A. Product Data: Composite windows.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes.

B. Shop Drawings:

1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
2. **<Insert requirements>**.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

D. Samples for Verification: Actual sample of finished products for each type of exposed finish.

1. Composite Window Finishes: **[Manufacturers' standard size]<Insert size>**.
2. Exposed Hardware: Full-size units.

E. Product Schedule: For composite windows. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of composite window, for tests performed by **[a qualified testing agency][manufacturer and witnessed by a qualified testing agency]**.
- B. Field Quality-Control Reports: For composite windows.
- C. Sample Warranties: For composite windows.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An installer acceptable to manufacturer of composite windows for installation of units required for this Project.

1.6 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup **[as indicated on Drawings]<Insert mockup requirements>**.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace composite windows that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including excessive deflection, water leakage, and air infiltration.
 - b. Faulty operation of moveable sash and hardware.
 - c. Deterioration of materials and finishes beyond normal weathering.
 - d. Failure of insulating glass units.
 - 2. Warranty Period:
 - a. Composite Windows: **[10]<Insert number>** years from date of Substantial Completion.
 - b. Glazing Units: **[10][20]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Product Certification: WDMA certified with label attached to each window.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
 1. Minimum Performance Class: **[LC][As indicated on Drawings]<Insert class>**.
 2. Minimum Performance Grade: **[30][35][40][50][As indicated on Drawings]<Insert grade>**.
- C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of **[0.27 Btu/sq. ft. x h x deg F (1.53 W/sq. m x K)][0.28 Btu/sq. ft. x h x deg F (1.59 W/sq. m x K)][0.29 Btu/sq. ft. x h x deg F (1.65 W/sq. m x K)][0.30 Btu/sq. ft. x h x deg F (1.70 W/sq. m x K)][0.40 Btu/sq. ft. x h x deg F (2.27 W/sq. m x K)]<Insert value>**.
- D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 whole-window SHGC of **[0.32 minimum][0.37 minimum][0.42 minimum][0.40 maximum][0.25 maximum]<Insert value>**.
- E. Sound Transmission Class (STC): Rated for not less than **[25][37]<Insert rating>** STC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E413.
- F. Outside-Inside Transmission Class (OITC): Rated for not less than **[21][28]<Insert rating>** OITC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E1332.

2.2 COMPOSITE WINDOWS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 1. **[Andersen Windows, Inc.; Andersen Corporation]**
 2. **[JELD-WEN, Inc.]**
 3. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 1. **[Andersen Windows, Inc.; Andersen Corporation]**
 2. **[JELD-WEN, Inc.]**
 3. **<Insert manufacturer's name>**
- C. Source Limitations: Obtain composite windows from single manufacturer.
- D. Operating Types:
 1. Projected: **[Casement][Awning]**, project out.
 2. Single Hung: With **[even][manufacturer's standard]** sight lines for bottom and top sash.
 3. Horizontal sliding.
 4. Fixed.
- E. Frames and Sashes: Extruded profiles made from composite mix of reclaimed pre-consumer wood-based cellulosic fibers embedded in a thermoplastic polymer matrix.
 1. Percent Reclaimed Wood-Based-Fiber Content: Minimum **[28][40]<Insert number>** percent by weight.

- F. Exterior Finish: **[Manufacturer's standard finish in color selected by Architect from manufacturer's full range]<Insert requirements>**.
- G. Interior Finish: **[Manufacturer's standard finish matching exterior color][Manufacturer's standard finish in color contrasting exterior color as selected by Architect from manufacturer's full range]<Insert requirements>**.
- H. Attachment Flange: **[Manufacturer's standard][1-3/8-inch (3.5-mm) flange setback][1-inch (2.5-mm) flange setback with stucco key][No flange]<Insert requirements>**.
- I. Insulating-Glass Units: ASTM E2190.
1. Glass: ASTM C1036, Type 1, Class 1, q3.
 - a. Tint: **[Clear][Manufacturer's standard tint designed to reduce heat gain]<Insert requirements>**.
 - b. Kind: ASTM C1048, fully tempered Category II safety glass complying with testing requirements in 16 CFR 1201 **[where indicated on Drawings]<Insert requirements>**.
 2. Lites: **[Two]<Insert requirements>**.
 3. Filling: Fill space between glass lites with **[air][or][argon]**.
 4. Low-E Coating: **[Pyrolytic or sputtered on second surface]<Insert requirements>**.
 5. Film Pattern: **[None][Cascade][Fern][Obscure][Rain][Reed][Satin Etch]<Insert requirements>**.
 - a. Location: **[Third][Fourth]** surface.
 6. Glass-Spacer Color: **[Manufacturer's standard color][Black][Stainless steel]<Insert requirements>**.
 7. Dirt-Resistant Coating: Exterior coating that reduces surface friction to enhance water runoff and reduce water spots and dirt residue.
- J. Glazing System: **[Manufacturer's standard factory-glazing system that produces weathertight seal]<Insert glazing requirements>**.
- K. Dividers: Grilles permanently **[attached to exterior and interior of insulating-glass unit with spacer between lites matching color of insulating-glass spacer][attached to exterior and interior of insulating-glass unit, with no spacer between lites][attached to exterior and permanently installed between lites of insulating-glass unit][installed between lites of insulating-glass unit]<Insert requirements>**.
1. Profile: **[Contoured][Flat][Putty]<Insert requirements>**.
 2. Width: **[Manufacturer's standard not more than 3/4 inch (19 mm) wide][5/8 inch (16 mm)][3/4 inch (19 mm)][7/8 inch (22 mm)][1-1/8 inches (29 mm)][2-1/4 inches (57 mm)]<Insert dimension>**.
 3. Pattern: **[As indicated on Drawings]<Insert requirements>**.
 4. Exterior Color: **[Matching window exterior]<Insert color>**.
 5. Interior Color: **[Matching window interior]<Insert color>**.
- L. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, or carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock composite windows, and sized to accommodate sash weight and dimensions.
1. Exposed Hardware Color and Finish: **[As selected by Architect from manufacturer's full range]<Insert color and finish>**.

M. Projected Window Hardware:

1. Gear-Type Rotary Operators: Complying with AAMA 901 when tested in accordance with ASTM E405, Method A. Provide operators that function without requiring the removal of interior screens or using screen wickets.
 - a. Type: **[Manufacturer's standard][Folding operating handle, polycarbonate with integral color]<Insert type>**.
2. Hinge-Type Operators: **[Manufacturer's standard]<Insert requirements>**.
3. Hinges: **[Manufacturer's standard][Stainless steel][Washability-type casement hinges][Egress-type casement hinges][In type indicated on Drawings]<Insert description>** sized for sash weight and size indicated.
4. Sash Locks: Operates positive-acting arms that pull sash into locked position.
5. Limit Devices: Restrict operable sash to less than **4-inch (10-mm)** clear opening dimension; **[releasable, complying with requirements of ASTM F2090 for emergency egress mechanisms][fixed]**.

N. Single-Hung Window Hardware:

1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
2. Locks and Latches: Self-latching, polycarbonate with integral color that allow unobstructed movement of the operable sash across fixed sash and operated from the inside only.
 - a. Material: **[Polycarbonate with integral color][Corrosion-resistant metal with applied finish]<Insert requirements>**.
3. Lift: **[Manufacturer's standard]<Insert requirements>**.

O. Horizontal-Sliding Window Hardware:

1. Sill Cap/Track: **[Manufacturer's standard]<Insert track material and finish>** of dimensions and profile indicated on Drawings; designed to comply with performance requirements indicated and to drain to the exterior.
2. Locks and Latches: Self-latching that allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
 - a. Material: **[Polycarbonate with integral color][Corrosion-resistant metal with applied finish]<Insert requirements>**.
3. Roller Assemblies: **[Manufacturer's standard][Dual adjustable]<Insert requirements>** low-friction design.
4. Pull: **[Manufacturer's standard]<Insert requirements>**.

P. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

Q. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

R. Accessories:

1. Extension jamb **[attachment flange][attachment flange and trim of depth indicated on Drawings]<Insert requirements>**.
2. Drip caps.
3. Head expanders.
4. Exterior sill extender trim.
5. Gypsum board returns.
6. **<Insert accessory>**.

S. Mullions: Provide manufacturer's standard **[non-reinforced][reinforced]** fiberglass mullion system configured to be structurally sound.

T. Insect Screens: Provide screens for each operable sash. Wickets are not permitted.

1. Type and Location: **[Full, inside for project-out][Half, outside for single-hung][Full, outside for sliding][Half, outside for sliding]** sashes.
2. Frames: Roll-formed or extruded-aluminum alloy complying with requirements in SMA 1201; fabricated with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC splines/anchors concealing edge of frames and securing screen material.
 - a. Finish and Color: Manufacturer's standard baked-on coating in color **[selected by Architect from manufacturer's full range][matching window exterior]<Insert color>**.
3. Glass-Fiber Mesh Fabric: **[Manufacturer's standard]<Insert requirements>** mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with requirements in ASTM D3656/D3656M.
 - a. Mesh Color: **[Charcoal gray][Black]<Insert color>**.
4. Aluminum Wire Fabric: **[Manufacturer's standard]<Insert requirements>** mesh of coated aluminum wire.
 - a. Wire-Fabric Finish: **[Charcoal gray]<Insert finish>**.
5. Stainless Steel Wire Fabric: **[Manufacturer's standard]<Insert requirements>** mesh of coated, Type 300 series, stainless steel wire.

2.3 FABRICATION OF COMPOSITE WINDOWS

- A. Fabricate composite windows in sizes indicated. Include a complete system for installing and anchoring windows.
- B. Glaze composite windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough-opening dimensions, levelness of sill plate, and operational clearance.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF COMPOSITE WINDOWS

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.
- B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
 - 1. Testing Methodology: Testing of windows for air infiltration and water resistance is to be performed in accordance with AAMA 502.
 - 2. Air-Infiltration Testing:
 - a. Test Pressure: Pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
 - b. Allowable Air-Leakage Rate: **[1.5]<Insert number>** times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
 - 3. Water-Resistance Testing:
 - a. Test Pressure: **[Two-thirds]<Insert number>** times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
 - b. Allowable Water Infiltration: No water penetration.
 - 4. Testing Extent: **[Three][Three mockup]<Insert number or description>** windows of each type as selected by Architect and a qualified testing and inspecting agency. Windows are to be tested after perimeter sealants have cured.
 - 5. Composite windows will be considered defective if they do not pass tests and inspections.

- C. Prepare test reports in accordance with AAMA 502.

3.4 ADJUSTING

- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

3.5 CLEANING

- A. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.

- 1. Keep protective films and coverings in place until final cleaning.

3.6 PROTECTION

- A. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.
- B. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 08 54 00 00

SECTION 08 54 13 00 - FIBERGLASS WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fiberglass windows.

1.2 DEFINITIONS

- A. Combination Assemblies: Assemblies formed by a combination of two or more separate fenestration products whose frames are mulled together utilizing a combination mullion or reinforcing mullion.
- B. Combination Mullions: Horizontal or vertical members formed by joining two or more individual fenestration units together without a mullion stiffener.
- C. Reinforcing Mullions: Horizontal or vertical members with an added continuous mullion stiffener and joining two or more individual fenestration units along the sides of the mullion stiffener.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review, discuss, and coordinate the interrelationship of fiberglass windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
 - 3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
 - 4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, window rough openings, and details of installation, including anchor, flashing, and sealant installation.
- C. Samples for Initial Selection: For units with factory-applied finishes, manufacturer's standard color

sheets, showing full range of available colors for each type of exposed finish.

1. Include Samples of hardware and accessories involving color selection.

D. Samples for Verification: Actual sample of finished products for each type of exposed finish:

1. Exposed Finishes: **[Manufacturers' standard size][2 by 4 inches (50 by 100 mm)]<Insert dimensions>**.
2. Exposed Hardware: Full-size units.

E. Product Schedule: For fiberglass windows. Use same designations indicated on Drawings.

F. Delegated Design Submittals: For **[reinforcing mullions]<Insert product or system>**, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Product Test Reports: For each fiberglass window, for tests performed by **[qualified testing agency][manufacturer and witnessed by a qualified testing agency]**.

B. Field Quality-Control Reports: For fiberglass windows.

C. Qualification Statements: For manufacturer and Installer.

D. Delegated Design Engineer Qualifications: For **[reinforcing mullions]<Insert product or system>**.

E. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

A. Warranty Documentation:

1. Manufacturers' special warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating fiberglass windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.

B. Installer Qualifications: An installer acceptable to fiberglass window manufacturer for installation of units required for this Project.

C. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in **[state]<Insert jurisdiction>** where Project is located and who is experienced in providing engineering services of the type indicated.

D. Testing Agency Qualifications: An FGIA- or WDMA-accredited testing agency for testing indicated.

1.8 MOCKUPS

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution. [See Section 014339 "Mockups" for additional construction requirements for integrated exterior mockups.]
1. Build mockup [as indicated on Drawings]<Insert mockup requirements>.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations by Change Order.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fiberglass windows to Project site in original, unopened packages and store them in accordance with manufacturer's written instructions. Protect fiberglass windows against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Handle fiberglass windows in a manner that prevents damage before, during, and after installation.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install fiberglass windows outside of limits recommended in writing by manufacturer.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fiberglass windows that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures, including excessive deflection, water leakage, and air infiltration.
 - c. Faulty operation of movable sash and hardware.
 - d. Deterioration of materials and finishes beyond normal weathering.
 - e. Failure of insulating glass.
 2. Warranty Period:
 - a. Window: [10]<Insert number> years from date of Substantial Completion.
 - b. Glazing Units: [Five][10][20]<Insert number> years from date of Substantial Completion.
 - c. Hardware: [Three]<Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain fiberglass windows from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design **[reinforcing mullions]<Insert product or system>**.
- B. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Window Certification: FGIA or WDMA certified with label attached to each window.
- C. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
 - 1. Minimum Performance:
 - a. **[Class R][Class LC][Class CW][As indicated on Drawings]<Insert class>**.
 - b. **[Grade 15][Grade 20][Grade 25][Grade 30][Grade 35][Grade 40][Grade 45][As indicated on Drawings]<Insert grade>**.
 - 2. Muller Window Systems: Evaluate and rate combination assemblies as single systems as determined by AAMA 450 in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 requirements.
- D. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
 - 1. Thermal Transmittance (U-factor): As determined in accordance with NFRC 100:
 - a. Fixed Windows: Not more than **[0.50 Btu/sq. ft. x h x deg F (2.84 W/sq. m x K)][0.45 Btu/sq. ft. x h x deg F (2.56 W/sq. m x K)][0.42 Btu/sq. ft. x h x deg F (2.38 W/sq. m x K)][0.36 Btu/sq. ft. x h x deg F (2.04 W/sq. m x K)][0.34 Btu/sq. ft. x h x deg F (1.93 W/sq. m x K)][0.29 Btu/sq. ft. x h x deg F (1.65 W/sq. m x K)][0.26 Btu/sq. ft. x h x deg F (1.48 W/sq. m x K)]<Insert value>**.
 - b. Operable Windows: Not more than **[0.62 Btu/sq. ft. x h x deg F (3.52 W/sq. m x K)][0.60 Btu/sq. ft. x h x deg F (3.41 W/sq. m x K)][0.54 Btu/sq. ft. x h x deg F (3.07 W/sq. m x K)][0.45 Btu/sq. ft. x h x deg F (2.56 W/sq. m x K)][0.42 Btu/sq. ft. x h x deg F (2.38 W/sq. m x K)][0.36 Btu/sq. ft. x h x deg F (2.04 W/sq. m x K)][0.32 Btu/sq. ft. x h x deg F (1.82 W/sq. m x K)]<Insert value>**.
 - 2. Solar Heat-Gain Coefficient (SHGC): As determined in accordance with NFRC 200:
 - a. Fixed Windows: Not more than **[0.23][0.25][0.36][0.38][0.40]<Insert value>**.
 - b. Operable Windows: Not more than **[0.21][0.23][0.33][0.34][0.36]<Insert value>** as determined in accordance with NFRC 200.
 - 3. Condensation-Resistance Factor (CRF): Provide windows tested for thermal performance in accordance with AAMA 1503, showing a CRF of **[45][52]<Insert value>**.
- E. Outdoor-Indoor Transmission Class (OITC): Rated for not less than **[22][26][30]<Insert rating>** OITC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E1332.
- F. Windborne-Debris-Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone **[1][2][3]** for **[basic][enhanced]** protection.

1. Large-Missile Test: For glazing located within [30 ft. (9.1 m)]<Insert dimension> of grade.
2. Small-Missile Test: For glazing located more than [30 ft. (9.1 m)]<Insert dimension> above grade.

2.3 FIBERGLASS WINDOWS

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 1. [Accurate Dorwin Inc.]
 2. [Alpen High Performance Products]
 3. [Duxton Windows and Doors]
 4. [Fibertec Window and Door Manufacturing]
 5. [Milgard Manufacturing, LLC]
 6. [Pella Corporation]
 7. <Insert manufacturer's name>
- B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 1. [Accurate Dorwin Inc.]
 2. [Alpen High Performance Products]
 3. [Duxton Windows and Doors]
 4. [Fibertec Window and Door Manufacturing]
 5. [Milgard Manufacturing, LLC]
 6. [Pella Corporation]
 7. <Insert manufacturer's name>
- C. General: Provide manufacturer's standard fiberglass window assemblies consisting of frames, sashes, glass, hardware, fasteners, and all components and accessories as required for a complete installation.
- D. Operating Types: Provide the following operating types in locations indicated on Drawings:
 1. Casement: Project [out][in].
 2. Awning: Project out.
 3. Single hung.
 4. Double hung.
 5. Horizontal sliding.
 6. Fixed.
- E. Frames and Sashes: Pultruded fiberglass[with insulating foam inserts] complying with AAMA/WDMA/CSA 101/I.S.2/A440 and with exposed exterior fiberglass surfaces finished with manufacturer's standard enamel coating complying with [AAMA 613][AAMA 623].
 1. Exterior Color: [As selected by Architect from manufacturer's full range]<Insert color>.
 2. Interior Finish: [Matching exterior color and finish][Matching exterior finish, in color selected by Architect from manufacturer's full range][Wood veneer clad, maple][Wood veneer clad, oak]<Insert finish>.
- F. Glass: Clear annealed glass, ASTM C1036, Type 1, Class 1, q3.
 1. Kind: Fully tempered [where indicated on Drawings]<Insert requirements>.
- G. Windborne-Debris-Impact-Resistant Laminated Glass: ASTM C1172 with two plies of float glass.

1. Float Glass: **[Annealed][Heat strengthened][Fully tempered][As required by performance requirements indicated]**.
 2. Inner Ply: Clear.
 3. Interlayer: **[0.090 inch (2.29 mm)][As required by performance requirements indicated]<Insert requirements>**.
 4. Outer Ply: **[Clear][Gray][Bronze][Green]<Insert tint>**.
 5. Low-E Coating: **[Pyrolytic on second surface][Sputtered on second surface][Sputtered on third surface][Sputtered on second or third surface]<Insert coating>**.
- H. Insulating-Glass Units: ASTM E2190.
1. Glass: ASTM C1036, Type 1, Class 1, q3.
 - a. Tint: **[Clear][Gray][Bronze][Green]<Insert tint>**.
 - b. Kind: Fully tempered **[where indicated on Drawings]<Insert requirements>**.
 2. Lites: **[Two][Three]**.
 3. Filling: Fill space between glass lites with **[air][argon]**.
 4. Low-E Coating: **[Pyrolytic on second surface][Sputtered on second surface][Sputtered on third surface][Sputtered on second or third surface]<Insert coating>**.
- I. Windborne-Debris-Impact-Resistant Insulating-Glass Units: ASTM E2190 with two lites and complying with impact-resistance requirements in "Performance Requirements" Article.
1. Exterior Lite: ASTM C1036, Type 1, Class 1, q3.
 - a. Tint: **[Clear][Gray][Bronze][Green]<Insert tint>**.
 - b. Kind: **[Heat strengthened][Fully tempered]**.
 2. Interior Lite: ASTM C1172 clear laminated glass with two plies of float glass.
 - a. Float Glass: **[Annealed][Heat strengthened][Fully tempered][As required by performance requirements indicated]**.
 - b. Interlayer Thickness: **[0.090 inch (2.29 mm)][As required by performance requirements indicated]<Insert requirements>**.
 3. Filling: Fill space between glass lites with **[air][argon]**.
 4. Low-E Coating: **[Pyrolytic on second surface][Sputtered on second surface][Sputtered on third surface][Sputtered on second or third surface]<Insert coating>**.
- J. Glazing System: **[Manufacturer's standard factory-glazing system that produces weathertight seal]<Insert glazing requirements>**.
- K. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock fiberglass windows, and sized to accommodate sash weight and dimensions.
1. Exposed Hardware Color and Finish: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and finish>**.
- L. Projected Window Hardware:
1. Gear-Type Rotary Operators: Complying with AAMA 901 when tested in accordance with ASTM

E405, Method A. Provide operators that function without requiring the removal of interior screens or using screen wickets.

- a. Type and Style: **[Match Architect's sample][As selected by Architect from manufacturer's full range of types and styles]<Insert type and style>**.
 2. Hinges: **[Manufacturer's standard type for sash weight and size indicated][Stainless steel hinges with stainless steel-reinforced, sliding nylon shoes]<Insert description>**.
 3. Single-Handle Locking System: Operates positive-acting arms that pull sash into locked position. Provide one arm on sashes up to **27-1/2 inches (700 mm)** tall and two arms on taller sashes.
 4. Limit Devices: **[Concealed friction adjuster, adjustable stay bar][Concealed support arms with adjustable, limited, hold-open]<Insert type>** limit devices designed to restrict sash opening.
 - a. Limit clear opening to **[4 inches (100 mm)]<Insert dimension>** for ventilation; with custodial key release.
 5. Pole Operators: Tubular-shaped anodized aluminum; with rubber-capped lower end and standard push-pull hook at top to match hardware design; of sufficient length to operate window without reaching more than **60 inches (1500 mm)** above floor; one pole operator and pole hanger per room that has operable windows more than **72 inches (1800 mm)** above floor.
- M. Hung Window Hardware:
1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
 2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. **[Provide custodial locks.]**
 3. Tilt Hardware: Releasing tilt latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.
- N. Horizontal-Sliding Window Hardware:
1. Sill Cap/Track: **[Extruded-aluminum track with natural anodized finish][Rigid PVC or other weather-resistant plastic track with manufacturer's standard integral color][Manufacturer's standard]<Insert track material and finish>** of dimensions and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
 2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. **[Provide custodial locks.]**
 3. Roller Assemblies: Low-friction design.
- O. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
- P. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
1. Exposed Fasteners: Avoid exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.
- Q. Mullions: Provide combination and reinforcing mullions and cover plates matching window units, complete with anchors for support to structure. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide reinforcing mullions and cover plates capable of withstanding design wind loads of window units.

2.4 ACCESSORIES

- A. Dividers (False Muntins): Provide divider grilles in designs indicated for each sash lite.
 - 1. Quantity and Type: **[One per sash, removable from exposed surface of interior lite][Two per sash, removable from exposed surfaces of interior and permanently located at exterior lite][One permanently located between insulating-glass lites]<Insert requirements>.**
 - 2. Material: **[Manufacturer's standard]<Insert material>.**
 - 3. Pattern: **[As indicated on Drawings]<Insert pattern>.**
 - 4. Profile: **[As selected by Architect from manufacturer's full range]<Insert profile>.**
 - 5. Color: **[As selected by Architect from manufacturer's full range]<Insert color>.**
- B. Jamb Extensions: **[Stain-grade Pacific Hemlock]<Insert description>.**
- C. Nail Fins: Manufacturer's standard mounting flanges with holes pre-punched for mechanical fasteners.

2.5 INSECT SCREENS

- A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.
 - 1. Type and Location: **[Full, inside for project-out][Full, outside for project-in][Full, outside for double-hung][Half, outside for single-hung][Full, outside for sliding][Half, outside for sliding]** sashes.
- B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
 - 1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.
 - 2. Finish for Interior Screens: Baked-on organic coating in **[color selected by Architect from manufacturer's full range]<Insert color>.**
 - 3. Finish for Exterior Screens: **[Baked-on organic coating in color selected by Architect from manufacturer's full range][Matching color and finish of cladding]<Insert finish>.**
- C. Glass-Fiber Mesh Fabric: **[18-by-14-inch (1.1-by-1.4-mm) or 18-by-16-inch (1.1-by-1.3-mm)][20-by-20-inch (0.85-by-0.85-mm) or 20-by-30-inch (0.85-by-0.42-mm)]<Insert type>** mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D3656/D3656M.
 - 1. Mesh Color: **[Manufacturer's standard]<Insert color>.**
- D. Aluminum Wire Fabric: **18-by-16-inch (1.1-by-1.3-mm)** mesh of **0.011-inch- (0.28-mm-)** diameter, coated aluminum wire.
 - 1. Wire-Fabric Finish: **[Natural bright][Charcoal gray][Black]<Insert finish>.**

2.6 FABRICATION

- A. Fabricate fiberglass windows in sizes indicated. Include a complete system for installing and anchoring windows.

- B. Glaze fiberglass windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Window Assemblies: Provide **[bow][bay][and][combination]** window units in configuration indicated. Provide window frames, sashes, hardware, and other trim and components necessary for a complete, secure, and weathertight installation, including the following:
 - 1. Combination and reinforcing mullions with interior and exterior trim.
 - 2. Interior and exterior extension and trim.
 - 3. Clear **[pine]<Insert species>** head and seat boards.
 - 4. Top and bottom plywood platforms.
 - 5. Exterior head and sill casings and trim.
 - 6. Support brackets.
- E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, **[vapor retarders,]** water and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF FIBERGLASS WINDOWS

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.
- B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Mullions: Install combination and reinforcing mullions for combination assemblies in accordance with manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Test and inspect installed windows as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance to be performed in accordance with AAMA 502.
2. Air-Infiltration Testing:
 - a. Test Pressure: As required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
 - b. Allowable Air-Leakage Rate: **[1.5]<Insert number>** times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
3. Water-Resistance Testing:
 - a. Test Pressure: **[Two-thirds]<Insert number>** times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
 - b. Allowable Water Infiltration: No water penetration.
4. Testing Extent: **[One][Three]<Insert number or description>** windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows to be tested **[immediately after installation][at 5 percent, 50 percent, and 90 percent completion]<Insert test schedule>**.
5. Test Reports: Prepared in accordance with AAMA 502.
6. Windows will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- B. Clean exposed surfaces immediately after installing windows using manufacturer's written instructions. Remove excess sealants, glazing materials, dirt, and other substances.
 1. Keep protective films and coverings in place until final cleaning.
- C. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.
- D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.

END OF SECTION 08 54 13 00



Task	Specification	Specification Description
08 54 13 00	08 53 13 00	Vinyl Windows
08 54 13 00	08 54 00 00	Composite Windows
08 54 66 00	08 53 13 00	Vinyl Windows
08 54 66 00	08 54 00 00	Composite Windows



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SECTION 08 56 19 00 - SECURITY WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vision security windows.
2. Fixed, transaction security windows.
3. Sliding, transaction security windows.

B. Related Requirements:

1. Section 119821 "Detention Windows" for windows where persons are forcibly detained.
2. Section 099113 "Exterior Painting" for field painting exterior security windows.
3. Section 099123 "Interior Painting" for field painting interior security windows.

1.2 COORDINATION

- A. Coordinate installation of anchorages for security windows. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in adjacent construction.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, weights and finishes for window units.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Environmental Product Declaration (EPD): For each product.
4. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
5. Environmental Product Declaration: For each product.
6. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of

- transportation, and cost for each regional material.
- 7. Environmental Product Declaration: For each product.
- 8. Environmental Product Declaration: For each product.
- 9. Third-Party Certifications: For each product.
- 10. Third-Party Certified Life Cycle Assessment: For each product.
- 11. Environmental Product Declaration: For each product.
- 12. Health Product Declaration: For each product.
- 13. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
- 14. Environmental Product Declaration: For each product.
- 15. Environmental Product Declaration: For each product.
- 16. Environmental Product Declaration: For each product.
- 17. Third-Party Certifications: For each product.
- 18. Third-Party Certified Life Cycle Assessment: For each product.

C. Shop Drawings: For security windows.

- 1. Include plans, elevations, sections, and attachment details.
- 2. Full-size section details of framing members, including internal armoring, reinforcement, and stiffeners.
- 3. Location of weep holes.
- 4. Hardware for sliding window units.
- 5. Glazing details.
- 6. Details of **[deal tray][transaction drawer][transaction counter][and][speaking aperture]**.

D. Samples for Initial Selection: For frame members with factory-applied color finishes.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of sizes indicated below:

- 1. Framing: **12-inch- (305-mm-)** long sections of frame members.
- 2. Transaction Drawer: **6 inches (150 mm)** square.

F. Cutaway Sample: Corner of security window, made from **12-inch (305-mm)** lengths of full-size components, and showing details of the following:

- 1. Joinery.
- 2. Anchorage.
- 3. Glazing.
- 4. Flashing and drainage.

G. Delegated Design Submittal: For security windows indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[Installer][and][testing agency]**.
- B. Welding certificates.
- C. Product Test Reports: For each type of security window and accessory indicated as **[ballistics][or][forced-entry]** resistant, for tests performed by a qualified testing agency.
- D. Configuration Disclosure Drawing: For each type of forced-entry-resistant security window, complying

with ASTM F1233.

- E. Examination reports documenting inspections of substrates, areas, and conditions.
- F. Anchor inspection reports documenting inspections of built-in and cast-in anchors.
- G. Field quality-control reports documenting inspections of installed products.
 - 1. Field quality-control certification signed by Contractor.
- H. Sample Warranty: For special warranty.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation[**and maintenance**] of units required for this Project.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
 - 4. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Pack security windows in wood crates for shipment. Crate glazing separate from frames unless factory glazed.
- B. Label security window packaging with drawing designation.
- C. Store crated security windows on raised blocks to prevent moisture damage.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.9 SEQUENCING

- A. Field Painting: Except where security windows have been preglazed before installation, complete field painting of security windows before glazing installation.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace security windows that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including deflections exceeding **1/4 inch (6 mm)**.

- b. Failure of welds.
- c. Excessive air leakage.
- d. Faulty operation of sliding window hardware.
- e. Faulty operation of transom drawers.
- f. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
- g. **<Insert failure modes>**.

2. Warranty Period: **[Three]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- B. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25][50]<Insert value>** percent.
- C. Regional Materials: Products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- D. Regional Materials: Products shall be manufactured within **500 miles (800 km)** of Project site.
- E. Regional Materials: Products shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- F. Indigenous Materials: Products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- G. Regional Materials: Products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- H. Attack Resistance: Provide units identical to those tested for compliance with requirements indicated, and as follows:
 - 1. Ballistics Resistance, UL 752: **[Listed and labeled as][Level 1][Level 2][Level 3][Level 4][Level 5][Level 6][Level 7][Level 8][Level 9][Level 10][Level 1-SG][Level 2-SG][Level 3-SG][Level 4-SG][Level 5-SG][Level 6-SG][Level 7-SG][Level 8-SG][Level 9-SG][Level 10-SG]** in accordance with UL 752.
 - 2. Ballistics Resistance, ASTM F1233: **[Class HG1][Class HG2][Class HG3][Class HG4][Class SMG][Class R1][Class R2][Class R3][Class R4-AP][Class R5][Class SH1][Class SH2]** in accordance with ASTM F1233.
 - 3. Ballistics Resistance, HPW-TP-0500.03: **[A][B][C][D][E]** in accordance with HPW-TP-0500.03.
 - 4. Ballistics Resistance, SD-STD-01.01: **[R][SH]** in accordance with SD-STD-01.01.
 - 5. Ballistics Resistance, NIJ STD-0108.01: **[Level I][Level IIA][Level II][Level IIIA][Level III][Level**

- IV] in accordance with NIJ STD-0108.01.
 6. Forced-Entry Resistance, HPW-TP-0500.03: [Level I][Level II][Level III][Level IV][Level V] in accordance with HPW-TP-0500.03.
 7. Forced-Entry Resistance, ASTM F1233: [Class 1.0][Class 1.1][Class 1.2][Class 1.3][Class 1.4][Class 1.5][Class 2.0][Class 2.1][Class 2.2][Class 2.3][Class 2.4][Class 2.5][Class 2.6][Class 2.7][Class 2.8][Class 3.0][Class 3.1][Class 3.2][Class 3.3][Class 3.4][Class 3.5][Class 3.6][Class 3.7][Class 3.8][Class 3.9][Class 3.10][Class 4.0][Class 4.1][Class 4.2][Class 4.3][Class 4.4][Class 4.5][Class 4.6][Class 4.7][Class 4.8][Class 4.9][Class 4.10][Class 4.11][Class 4.12][Class 4.13][Class 5.0] in accordance with ASTM F1233.
 8. Forced-Entry Resistance, SD-STD-01.01: [Five][15][60]-minute protection level in accordance with SD-STD-01.01.
- I. Structural Loads: Security windows withstand the effects of wind loads, with no permanent deformation or breakage of components within window assembly when tested in accordance with ASTM E330/E330M.
 1. Wind Loads: As indicated on Drawings.
 - J. Air Leakage, Fixed Glazing and Framing: Provide windows with maximum air leakage through fixed glazing and framing areas of [0.06 cfm/sq. ft. (0.03 L/s per sq. m)]<Insert value> of fixed wall area when tested in accordance with ASTM E283 at a minimum static-air-pressure difference of [1.57 lbf/sq. ft. (75 Pa)][6.24 lbf/sq. ft. (300 Pa)]<Insert value>.
 - K. Air Leakage, Operable Window: Not more than [0.37 cfm/ft. (0.18 L/s per m)]<Insert value> of sash crack length at an inward test pressure of [6.24 lbf/sq. ft. (298 Pa)]<Insert value> when tested in accordance with ASTM E283.
 - L. Water Penetration under Static Pressure, Fixed Glazing and Framing: Provide windows that do not evidence water penetration through fixed glazing and framing areas when tested in accordance with ASTM E331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than [6.24 lbf/sq. ft. (300 Pa)]<Insert value>.
 - M. Water Penetration under Static Pressure, Operable Windows: Provide windows that do not evidence water leakage through operable units for 15 minutes when window is subjected to a rate of flow of 5 gal./h per sq. ft. (0.05 L/s per sq. m) with a differential pressure across the window of [2.86 lbf/sq. ft. (137 Pa)][6.24 lbf/sq. ft. (298 Pa)] when tested in accordance with ASTM E331.
 - N. Energy Performance: Provide windows with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below[**and certified and labeled in accordance with NFRC**]:
 1. Thermal Transmittance (U-Factor): Glazing and framing areas as a whole have U-factor of not more than [0.80 Btu/sq. ft. x h x deg F (4.54 W/sq. m x K)][0.65 Btu/sq. ft. x h x deg F (3.69 W/sq. m x K)]<Insert value> as determined in accordance with NFRC 100.
 2. Solar Heat-Gain Coefficient (SHGC): Glazing and framing areas as a whole have SHGC of no greater than [0.6][0.7]<Insert value> as determined in accordance with NFRC 200.
 - O. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone [1][2][3][4] for [basic][enhanced] protection.
 1. Large-Missile Test: For glazing located within [30 feet (9.1 m)]<Insert dimension> of grade.
 2. Small-Missile Test: For glazing located between 30 feet (9.1 m) and [60 feet (18.3 m)]<Insert dimension> above grade.

2.2 VISION SECURITY WINDOWS

- A. Vision Security Windows: Provide vision security windows with framing on four sides and no operable sash or ventilator.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Action Bullet Resistant Corp.]**
 - b. **[American Vault Corporation]**
 - c. **[Armortex]**
 - d. **[Chicago Bullet Proof Systems]**
 - e. **[Creative Industries, Inc]**
 - f. **[Hamilton; Gunnebo Group]**
 - g. **[Krieger Specialty Products Company]**
 - h. **[National Bullet Proof, Inc]**
 - i. **[Norshield Security Products, LLC]**
 - j. **[Overly Door Company]**
 - k. **[Quikserv, Inc.]**
 - l. **[Ross Technology Company]**
 - m. **[SABIC Innovative Plastics IP BV]**
 - n. **[Seibold Security of Florida Inc.]**
 - o. **[United States Bullet Proofing, Inc.]**
 - p. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Action Bullet Resistant Corp.]**
 - b. **[American Vault Corporation]**
 - c. **[Armortex]**
 - d. **[Chicago Bullet Proof Systems]**
 - e. **[Creative Industries, Inc]**
 - f. **[Hamilton; Gunnebo Group]**
 - g. **[Krieger Specialty Products Company]**
 - h. **[National Bullet Proof, Inc]**
 - i. **[Norshield Security Products, LLC]**
 - j. **[Overly Door Company]**
 - k. **[Quikserv, Inc.]**
 - l. **[Ross Technology Company]**
 - m. **[SABIC Innovative Plastics IP BV]**
 - n. **[Seibold Security of Florida Inc.]**
 - o. **[United States Bullet Proofing, Inc.]**
 - p. **<Insert manufacturer's name>**

- B. Framing: Fabricate perimeter framing, mullions, and glazing stops from **[steel][metallic-coated steel sheet][stainless steel][aluminum]** as follows:

1. Profile: **[Manufacturer's standard][Narrow]**, with minimum face dimension indicated.
 - a. Minimum Face Dimension: **[2 inches (50 mm)][1-1/4 inches (32 mm)][As indicated on Drawings]<Insert dimension>**.

2. Depth: **[Manufacturer's standard][Adjustable, two-piece clamp][As indicated on Drawings]<Insert depth>**.
 3. Provide **[thermally broken][thermally improved]** construction for aluminum framing.
- C. Glazing and Glazing Materials: Comply with requirements in Section 088853 "Security Glazing."
- D. Materials:
1. Mild Steel Plates, Shapes, and Bars: ASTM A36/A36M.
 2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, CS (Commercial Steel), Type B; suitable for exposed applications.
 3. Metallic-Coated Steel Sheet: ASTM A653/A653M, CS (Commercial Steel), Type B; with **G60 (Z180)** zinc (galvanized) or **A60 (ZF180)** zinc-iron-alloy (galvannealed) coating designation.
 4. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, CS (Commercial Steel), Type B; free of scale, pitting, or surface defects; pickled and oiled.
 5. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A666 or ASTM A240/A240M, austenitic stainless steel, **[Type 304][Type 316][Type 304 or 316 as indicated]<Insert type>**.
 6. Aluminum Extrusions: **ASTM B221 (ASTM B221M)**. Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than **22,000-psi (150-MPa)** ultimate tensile strength.
 7. Aluminum Sheet and Plate: **ASTM B209 (ASTM B209M)**.

2.3 FIXED, TRANSACTION SECURITY WINDOWS

- A. Fixed, Transaction Security Windows: Provide fixed, transaction security windows with operable sash or ventilator capable of allowing transfer of currency and documents.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Armortex]**
 - b. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - c. **[Chicago Bullet Proof Systems]**
 - d. **[Creative Industries, Inc]**
 - e. **[Krieger Specialty Products Company]**
 - f. **[National Bullet Proof, Inc]**
 - g. **[Norshield Security Products, LLC]**
 - h. **[Overly Door Company]**
 - i. **[Protective Structures, Ltd.]**
 - j. **[Quikserv, Inc.]**
 - k. **[Ready Access]**
 - l. **[Ross Technology Company]**
 - m. **[SABIC Innovative Plastics IP BV]**
 - n. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Armortex]**
 - b. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - c. **[Chicago Bullet Proof Systems]**
 - d. **[Creative Industries, Inc]**

- e. **[Krieger Specialty Products Company]**
 - f. **[National Bullet Proof, Inc]**
 - g. **[Norshield Security Products, LLC]**
 - h. **[Overly Door Company]**
 - i. **[Protective Structures, Ltd.]**
 - j. **[Quikserv, Inc.]**
 - k. **[Ready Access]**
 - l. **[Ross Technology Company]**
 - m. **[SABIC Innovative Plastics IP BV]**
 - n. **<Insert manufacturer's name>**
- B. Configuration: **[One fixed-glazed panel][Multiple fixed-glazed panels][As indicated on Drawings]**.
- C. Framing: Fabricate perimeter framing, mullions, and glazing stops from **[steel][metallic-coated steel sheet][stainless steel][aluminum]** as follows:
- 1. Profile: **[Manufacturer's standard][Narrow]**, with minimum face dimension indicated.
 - a. Minimum Face Dimension: **[2 inches (50 mm)][1-1/4 inches (32 mm)][As indicated on Drawings]<Insert dimension>**.
 - 2. Depth: **[Manufacturer's standard][Adjustable, two-piece clamp][As indicated on Drawings]<Insert depth>**.
 - 3. Provide **[thermally broken][thermally improved]** construction for aluminum framing.
- D. Head and Jamb Framing: Designed for **[sealant glazing][gasket glazing][voice communication by speech at normal volume]**.
- E. Channel-Frame Sill: Formed from stainless steel and designed for sealant glazing.
- 1. Transaction Counter: Stainless steel, **[12 inches (305 mm)][18 inches (457 mm)]** deep by width of security window, with integral deal tray **[centered in opening][as indicated on Drawings]**.
 - 2. Transaction Counter: Stainless steel, **21 inches (533 mm)** deep by width of security window, with operable deal tray **[centered in opening][as indicated on Drawings]**.
- F. Voice-Communication-Type Sill: Formed from stainless steel and designed to allow passage of speech at normal speaking volume without distortion.
- 1. Sill Depth: **[12 inches (305 mm) deep][18 inches (457 mm) deep with 6-inch (152-mm) deep projection on attack side][21 inches (533 mm) deep with 6-inch (152-mm) deep projection on both sides]**.
 - 2. Transaction Counter: Stainless steel, **[12 inches (305 mm)][18 inches (457 mm)]** deep by width of security window, with integral deal tray **[centered in opening][as indicated on Drawings]**.
 - 3. Integral Transaction-Drawer Sill: Formed from **[stainless steel][framing to match head and jamb framing]**; with transaction drawer integrated into framing and contained in a stainless steel housing that forms a transaction counter on **[secure side][attack side][both sides]** of opening. Drawer front is flush with housing when drawer is closed.
- G. Glazing and Glazing Materials: Comply with requirements in Section 088853 "Security Glazing."
- H. Glazing Meeting Edges: Polished glazing.
- I. Materials:
- 1. Mild Steel Plates, Shapes, and Bars: ASTM A36/A36M.

2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, CS (Commercial Steel), Type B; suitable for exposed applications.
3. Metallic-Coated Steel Sheet: ASTM A653/A653M, CS (Commercial Steel), Type B; with **G60 (Z180)** zinc (galvanized) or **A60 (ZF180)** zinc-iron-alloy (galvannealed) coating designation.
4. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, CS (Commercial Steel), Type B; free of scale, pitting, or surface defects; pickled and oiled.
5. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A666 or ASTM A240/A240M, austenitic stainless steel, **[Type 304][Type 316][Type 304 or 316 as indicated]<Insert type>**.
6. Aluminum Extrusions: **ASTM B221 (ASTM B221M)**. Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than **22,000-psi (150-MPa)** ultimate tensile strength.
7. Aluminum Sheet and Plate: **ASTM B209 (ASTM B209M)**.

2.4 SLIDING, TRANSACTION SECURITY WINDOWS

- A. Sliding, Transaction Security Windows: Provide sliding, transaction security windows.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Action Bullet Resistant Corp.]**
 - b. **[Armortex]**
 - c. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - d. **[Creative Industries, Inc]**
 - e. **[Krieger Specialty Products Company]**
 - f. **[Protective Structures, Ltd.]**
 - g. **[Quikserv, Inc.]**
 - h. **[Ready Access]**
 - i. **[SABIC Innovative Plastics IP BV]**
 - j. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Action Bullet Resistant Corp.]**
 - b. **[Armortex]**
 - c. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - d. **[Creative Industries, Inc]**
 - e. **[Krieger Specialty Products Company]**
 - f. **[Protective Structures, Ltd.]**
 - g. **[Quikserv, Inc.]**
 - h. **[Ready Access]**
 - i. **[SABIC Innovative Plastics IP BV]**
 - j. **<Insert manufacturer's name>**
- B. Configuration: **[One fixed-glazed panel and one horizontal-sliding glazed panel][Two glazed panels that slide horizontally and meet at center of security window][As indicated on Drawings]**.
- C. Operation: **[Manual open/manual closing][Manual open/self-closing]**.
- D. Framing: Fabricate perimeter framing, mullions, and glazing stops from **[steel][metallic-coated steel sheet][stainless steel][aluminum]** as follows:

1. Profile: **[Manufacturer's standard][Narrow]**, with minimum face dimension indicated.
 - a. Minimum Face Dimension: **[2 inches (50 mm)][1-1/4 inches (32 mm)][As indicated on Drawings]<Insert dimension>**.
 2. Depth: **[Manufacturer's standard][Adjustable, two-piece clamp][As indicated on Drawings]<Insert depth>**.
 3. Provide **[thermally broken][thermally improved]** construction for aluminum framing.
- E. Head and Jamb Framing: Designed for **[sealant][gasket]** glazing. Removable header access panel on secure side.
- F. Sill: Stainless steel channel frame designed for **[sealant][gasket]** glazing.
1. Shelf: Stainless steel, **[12 inches (305 mm)][18 inches (457 mm)]** deep by width of security window, with integral deal tray.
- G. Sliding Window Hardware: Provide roller track designed for overhead support of **[two- or four-wheel carriage][heavy-duty, antilift ball-bearing carrier][manufacturer's standard carrier]** supporting horizontal-sliding glazed panel **[with manufacturer's standard self-closing mechanism mounted in header]**. Provide **[self-latching][and][self-locking][manufacturer's standard]** pull and lock with two keys for each horizontal-sliding glazed panel.
1. Provide weather stripping for exterior horizontal-sliding, transaction security windows.
- H. Glazing and Glazing Materials: Comply with requirements in Section 088853 "Security Glazing."
1. Glazing Meeting Edges: Polished glazing.
- I. Materials:
1. Mild Steel Plates, Shapes, and Bars: ASTM A36/A36M.
 2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, CS (Commercial Steel), Type B; suitable for exposed applications.
 3. Metallic-Coated Steel Sheet: ASTM A653/A653M, CS (Commercial Steel), Type B; with **G60 (Z180)** zinc (galvanized) or **A60 (ZF180)** zinc-iron-alloy (galvannealed) coating designation.
 4. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, CS (Commercial Steel), Type B; free of scale, pitting, or surface defects; pickled and oiled.
 5. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A666 or ASTM A240/A240M, austenitic stainless steel, **[Type 304][Type 316][Type 304 or 316 as indicated]<Insert type>**.
 6. Aluminum Extrusions: **ASTM B221 (ASTM B221M)**. Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than **22,000-psi (150-MPa)** ultimate tensile strength.
 7. Aluminum Sheet and Plate: **ASTM B209 (ASTM B209M)**.

2.5 FABRICATION

- A. General: Fabricate security windows to provide a complete system for assembly of components and anchorage of window units.
1. Provide units that are reglazable from the secure side without dismantling the attack side of framing.
 2. Prepare security windows for field glazing unless preglazing at the factory is indicated.

- B. Provide weep holes and internal water passages for exterior security windows to conduct infiltrating water to the exterior.
- C. Thermally Improved or Thermally Broken Construction: Fabricate framing with an integral, concealed, low-conductance thermal barrier, located between exterior materials and members exposed on interior in a manner that eliminates direct metal-to-metal contact.
- D. Framing: Miter or cope corners the full depth of framing; weld and dress smooth.
 - 1. Fabricate framing with manufacturer's standard, internal opaque armoring in thicknesses required for security windows to comply with ballistics-resistance performance indicated.
- E. Glazing Stops: Finish glazing stops to match security window framing.
 - 1. Attack-Side (Exterior) Glazing Stops: Welded or integral to framing.
 - 2. Secure-Side (Interior) Glazing Stops: Removable, coordinated with glazing indicated.
- F. Welding: Weld components to comply with referenced AWS standard. To greatest extent possible, weld before finishing and in concealed locations to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- G. Metal Protection: Separate dissimilar metals to protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
- H. Factory-cut openings in glazing for speaking apertures.
- I. Preglazed Fabrication: Preglaze window units at factory, where required for applications indicated. Installation orientation of glazing to meet performance requirements. Comply with requirements in Section 088853 "Security Glazing."
- J. Weather Stripping: Factory applied.

2.6 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - 1. Color: **[Light bronze][Medium bronze][Dark bronze][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5

mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

2.8 METALLIC-COATED STEEL SHEET FINISHES

- A. Surface Preparation: Clean surfaces of oil and other contaminants. Use cleaning methods that do not leave residue. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A780/A780M.
- B. Factory Prime Finish: After cleaning and pretreating, apply an air-dried primer compatible with the coating to be applied over it.
- C. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of **2 mils (0.05 mm)**.
 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

2.9 STEEL FINISHES

- A. Galvanizing: After fabrication, galvanize window components by chemical cleaning complying with SSPC-SP 1, "Solvent Cleaning," and pickling treatment complying with SSPC-SP 8, "Pickling," followed by hot-dip galvanizing complying with ASTM A123/A123M.
- B. Factory Prime Finish: After surface preparation and pretreatment, apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer.
- C. Baked-Enamel or Power-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of **2 mils (0.05 mm)**.
 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

2.10 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 1. Run grain of directional finishes with long dimension of each piece.
 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- C. Stainless Steel Sheet and Plate Finishes:

1. Directional Satin Finish: ASTM A480/A480M, No. 4.

2.11 ACCESSORIES

- A. Recessed Deal Trays: Formed from stainless steel[**with sliding stainless steel cover**]; fabricated in curved shape with exposed flanges for recessed installation into horizontal surface.
 1. Clear Opening Size: [12 inches wide by 8 inches deep by 1-1/2 inches high (305 mm wide by 203 mm deep by 38 mm high)][12 inches wide by 11 inches deep by 1-1/2 inches high (305 mm wide by 279 mm deep by 38 mm high)][16 inches wide by 11 inches deep by 1-1/2 inches high (406 mm wide by 279 mm deep by 38 mm high)]<Insert dimensions>.
- B. Recessed, Nonricochet Deal Trays: Formed from stainless steel; fabricated with recessed bullet trap to ricochet bullets away from secure side, with exposed flanges for recessed installation into horizontal surface[, **and with sliding stainless steel cover**].
 1. Clear Opening Size: [10 inches wide by 7 inches deep by 1-1/2 inches high (254 mm wide by 178 mm deep by 38 mm high)][12 inches wide by 8 inches deep by 1-1/2 inches high (305 mm wide by 203 mm deep by 38 mm high)][12 inches wide by 11 inches deep by 1-1/2 inches high (305 mm wide by 279 mm deep by 38 mm high)][16 inches wide by 11 inches deep by 1-1/2 inches high (406 mm wide by 279 mm deep by 38 mm high)]<Insert dimensions>.
 2. Bullet Trap Location: [Secure side][Both sides].
 3. Ballistics Resistance: [UL Level 1][UL Level 3][Same as security window]<Insert level>.
 4. Listed and labeled as bullet resisting in accordance with UL 752.
- C. Rotating Deal Trays: Formed from stainless steel, with rotating recessed deal tray on each side of secure opening and with handle that rotates deal trays 180 degrees.
 1. Mounting: [Drop in][Countertop].
 2. Ballistics Resistance: [UL Level 1][UL Level 3][Same as security window]<Insert level>.
 3. Listed and labeled as bullet resisting in accordance with UL 752.
- D. Transaction Drawers: Formed from [stainless steel][steel][bullet-resistant armoring]; with ball-bearing, telescoping sliding mechanism; with cover on secure side of top of drawer that automatically closes when drawer is extended to attack side.
 1. Inside Dimensions: [15-3/8 inches wide by 8-1/2 inches deep by 4-3/8 inches high (390 mm wide by 216 mm deep by 111 mm high)][13 inches wide by 22 inches deep by 6-1/2 inches high (330 mm wide by 559 mm deep by 165 mm high)]<Insert dimensions>.
 2. Operation: [Manual][Electric, with sliding handle for emergency manual operation during lack of power. Provide individual switches for power and drawer movement on secure side and call button on attack side].
 3. Ballistics Resistance: [UL Level 1][UL Level 3][Same as security window]<Insert level>.
 4. Listed and labeled as bullet resisting in accordance with UL 752.
- E. Speaking Apertures: Fabricate from [stainless steel][security glazing], designed to allow passage of speech at normal speaking volume without distortion.
 1. Shape: [Circular][Square].
 2. Ballistics Resistance: [UL Level 1][UL Level 3][Same as security window]<Insert level>.
 3. Listed and labeled as bullet resisting in accordance with UL 752.
- F. Concealed Bolts: ASTM A307, Grade A unless otherwise indicated.

- G. Cast-in-Place Anchors in Concrete: Fabricated from corrosion-resistant materials capable of sustaining, without failure, a load equal to **[four]<Insert number>** times the load imposed, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified testing agency; of type indicated below.
 - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A27/A27M cast steel or ASTM A47/A47M malleable iron. Provide bolts, washers, and shims as required; hot-dip galvanized in accordance with ASTM A153/A153M or ASTM F2329/F2329M.
- H. Embedded Plate Anchors: Fabricated from mild steel shapes and plates, minimum **3/16 inch (4.8 mm)** thick; with minimum **1/2-inch- (12.7-mm-)** diameter, headed studs welded to back of plate.
- I. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.
- J. Glazing Strips and Weather Stripping: Manufacturer's standard replaceable components.
 - 1. Compression Type: Molded EPDM or neoprene gaskets complying with ASTM D2000, Designations 2BC415 to 3BC620; molded PVC gaskets complying with ASTM D2287; or molded, expanded EPDM or neoprene gaskets complying with ASTM C509, Grade 4.
 - 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric backing.
- K. Miscellaneous Glazing Materials: Provide material, size, and shape complying with requirements of glass manufacturers and with a proven record of compatibility with surfaces contacted in installation.
 - 1. Cleaners, Primers, and Sealers: Type recommended by sealant or gasket manufacturer.
 - 2. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.
 - 3. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 - 4. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- L. Anchors, Clips, and Window Accessories: Stainless steel; hot-dip, zinc-coated steel or iron, complying with ASTM B633; provide sufficient strength to withstand design pressures indicated.
- M. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- N. Sealants: For sealants required within fabricated security windows, provide type recommended by manufacturer for joint size and movement. Sealant remains permanently elastic, nonshrinking, and nonmigrating.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of security windows.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations of security window connections before security window installation.

- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of security windows.
- D. Inspect built-in and cast-in anchor installations, before installing security windows, to verify that anchor installations comply with requirements. Prepare inspection reports.
 - 1. Remove and replace anchors where inspections indicate that they do not comply with specified requirements. Reinspect after repairs or replacements are made.
 - 2. Perform additional inspections to determine compliance of replaced or additional work. Prepare anchor inspection reports.
- E. For factory-installed glazing materials whose orientation (secure or attack side) is critical for performance, verify installation orientation.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other security window anchors whose installation is specified in other Sections.
 - 1. Furnish cast-in-place anchors and similar devices to other trades for installation well in advance of time needed for coordinating other work.

3.3 INSTALLATION

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing security windows to in-place construction. Include threaded fasteners for inserts, security fasteners, and other connectors.
 - 1. Install an attached or integral flange to secure side of security windows extending over rough-in opening gap so that gap has same **[forced-entry-resistance][and][ballistics-resistance]** performance as security window.
- B. Voice-Communication-Type Framing: Attach removable glass spacers to jambs and head of glazing, located not more than **6 inches (152 mm)** from each corner and spaced not more than **12 inches (305 mm)** o.c.
- C. Glazed Framing: Provide **[sealant][gasket]**-glazed framing. Comply with installation requirements in Section 088853 "Security Glazing."
- D. Removable Glazing Stops and Trim: Fasten components with security fasteners.
- E. Fasteners: Install security windows using fasteners recommended by manufacturer with head style appropriate for installation requirements, strength, and finish of adjacent materials. **[Provide stainless steel fasteners in stainless steel materials.]**
- F. Sealants: Comply with requirements in Section 079200 "Joint Sealants" for installing sealants, fillers, and gaskets.
 - 1. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction unless otherwise indicated.
 - 2. Seal frame perimeter with sealant to provide weathertight construction unless otherwise

indicated.

- G. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended in writing by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

3.4 FIELD QUALITY CONTROL

- A. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.
- B. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.
- C. Prepare field quality-control certification that states installed products and their installation comply with requirements in the Contract Documents.

3.5 ADJUSTING

- A. Adjust horizontal-sliding, transaction security windows to provide a tight fit at contact points for smooth operation and a secure enclosure.
- B. Adjust transaction drawers to provide a tight fit at contact points[**and weather stripping**] for smooth operation and[**weathertight and**] secure enclosure.
- C. Remove and replace defective work, including security windows that are warped, bowed, or otherwise unacceptable.

3.6 CLEANING AND PROTECTION

- A. Clean surfaces promptly after installation of security windows. Take care to avoid damaging the finish. Remove excess glazing and sealant compounds, dirt, and other substances.
 - 1. Lubricate sliding security window hardware.
 - 2. Lubricate transaction drawer hardware.
- B. Clean glass of preglazed security windows promptly after installation. Comply with requirements in Section 088853 "Security Glazing" for cleaning and maintenance.
- C. Provide temporary protection to ensure that security windows are without damage at time of Substantial Completion.

3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain [**operable security windows**][**and**][**security windows with transaction drawers**].

END OF SECTION 08 56 19 00



Task	Specification	Specification Description
08 56 49 00	13 49 00 00	Radiation Protection
08 56 59 00	01 11 19 00	No Specification Required



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SECTION 08 62 00 00 - ROOF WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof windows.

B. Related Requirements:

1. Section 086200 "Unit Skylights" for unit skylights and tubular daylighting devices installed in overhead ceiling areas.
2. Section 086300 "Metal-Framed Skylights" for glass-glazed, site-erected, metal-framed monumental units.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include product dimensions, construction details, material descriptions, dimensions and profiles of components, and finishes.
2. Include power requirements, ratings, characteristics, and mounting requirements for electrical components.

B. Sustainable Design Submittals:

1. Environmental Product Declaration: For each product.
2. Health Product Declaration: For each product.
3. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
4. Environmental Product Declaration: For each product.
5. Environmental Product Declaration: For each product.
6. Environmental Product Declaration: For each product.
7. Third-Party Certifications: For each product.
8. Third-Party Certified Life Cycle Assessment: For each product.
9. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
10. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
11. Chain-of-Custody Qualification Data: For manufacturer and vendor.

C. Shop Drawings: For roof windows.

1. Include plans, elevations, sections, and installation details.
2. Include diagrams for power, signal, and control wiring for motorized operation.

D. Samples: For each exposed product and for each color and finish specified.

E. Samples for Initial Selection: For units with factory-applied finishes.

1. Include Samples of hardware and accessories involving color selection.

- F. Samples for Verification: For each type of roof window, as follows:
 - 1. Glazing: **[In manufacturer's standard size][12 inches (305 mm) square]<Insert requirements>** and of same thickness indicated for the final Work.
 - 2. Finishes: For each type and color of factory-applied exposed finish required, in manufacturer's standard size.
 - 3. Hardware and Accessories: **[Full-size]<Insert requirements>** Samples of hardware and accessories involving color selection.
- G. Product Schedule: For roof windows. **[Use same designations indicated on Drawings.]**

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type and size of roof windows, for tests performed by a qualified testing agency on specimens equal to or greater than sizes required for Project.
- B. Evaluation Reports: **[Indicating product compliance with code requirements of authorities having jurisdiction]<Insert requirements>**.
- C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roof windows and accessories to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.
- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.
- D. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect roof windows during transit, storage, and handling to prevent damage, soiling, and deterioration. Store off ground and covered in a clean, dry, well-ventilated, protected space. Comply with manufacturer's written instructions.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace roof windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection.
 - c. Water leakage not controlled by drainage features.
 - d. Faulty operation of sashes and hardware.
 - e. Deterioration of materials and finishes beyond normal weathering.
 - f. Deterioration of insulating-glass units including failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating-glass units contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - g. Deterioration of laminated-glass lites including defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation and delamination that materially obstructs vision through glass.
 - h. **<Insert requirements>**.
2. Warranty Period:
 - a. Roof Window: **[Five][10]<Insert number>** years from date of Substantial Completion.
 - b. Insulating-Glass Units: **[10][20]<Insert number>** years from date of Substantial Completion.
 - c. **[Accessories][and][Electronic Controls]: [Five]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Performance Standard: Comply with AAMA/WDMA/CSA 101/1.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 1. Minimum Performance Grade: PG **[30][35][40][45]<Insert requirements>**.
 2. Label Requirements: Label each product with names of manufacturer and labeling agency and AAMA/WDMA/CSA 101/1.S.2/A440 product designation, performance grade, and test specimen size equal to or greater than the size of the product.
 3. Certification Requirements: Provide **[WDMA]<Insert requirements>** certified products, with label attached to each roof window.
- B. Thermal Transmittance: NFRC 100 maximum U-factor of **[0.42 Btu/sq. ft. x h x deg F (2.38 W/sq. m x K)][0.45 Btu/sq. ft. x h x deg F (2.56 W/sq. m x K)][0.46 Btu/sq. ft. x h x deg F (2.61 W/sq. m x K)][0.48 Btu/sq. ft. x h x deg F (2.73 W/sq. m x K)][0.50 Btu/sq. ft. x h x deg F (2.84 W/sq. m x K)][0.53 Btu/sq. ft. x h x deg F (3.01 W/sq. m x K)][0.55 Btu/sq. ft. x h x deg F (3.12 W/sq. m x K)][0.60 Btu/sq. ft. x h x deg F (3.41 W/sq. m x K)]<Insert value>**.
- C. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum SHGC of **[0.40][0.35][0.28]<Insert value>**.
- D. Sound Transmission Class (STC): Rated for not less than **[33]<Insert rating>** STC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E413.
- E. Outside-Inside Transmission Class (OITC): Rated for not less than **[28]<Insert rating>** OITC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E1332.

- F. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone [1][2][3][4] for **[basic][enhanced]** protection.
 - 1. Large-Missile Test: For glazing located within **[30 feet (9.1 m)]<Insert dimension>** of grade.
 - 2. Small-Missile Test: For glazing located between **30 feet (9.1 m)** and **[60 feet (18.3 m)]<Insert dimension>** above grade.
- G. Certified Wood: Wood products shall be certified as "FSC Pure"[**or "FSC Mixed Credit"**] according to FSC STD-01-001 and FSC STD-40-004.
- H. Certified Wood: Wood products shall be certified as "FSC Pure"[**or "FSC Mixed Credit"**] according to FSC STD-01-001 and FSC STD-40-004.
- I. Certified Wood: Wood products shall be labeled according to the AF&PA's Sustainable Forestry Initiative, be certified as "FSC Pure" according to FSC STD-01-001 and FSC STD-40-004, or be certified and labeled according to the standards of the Programme for Endorsement of Forest Certification.
- J. Certified Wood: Wood products shall **[contain not less than 60 percent][be made from]** certified wood tracked through a chain-of-custody process. Certified wood documentation shall be provided by sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."
- K. Certified Wood: Wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40-004, or the standards of the Programme for Endorsement of Forest Certification.
- L. Exterior Fire-Test Exposure: Provide roof windows identical to those of assemblies tested for Class B fire resistance in accordance with ASTM E108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction.
- M. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 ROOF WINDOWS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **[Dome'I Inc.]**
 - 2. **[FAKRO America, LLC]**
 - 3. **[Skylight Specialist, Inc.]**
 - 4. **[Sun-Tek Manufacturing, Inc.]**
 - 5. **[Velux Commercial; Velux America LLC]**
 - 6. **[Wasco Part of Velux Commercial; Velux America LLC]**
 - 7. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1. **[Dome'I Inc.]**
 - 2. **[FAKRO America, LLC]**
 - 3. **[Skylight Specialist, Inc.]**

4. **[Sun-Tek Manufacturing, Inc.]**
 5. **[Velux Commercial; Velux America LLC]**
 6. **[Wasco Part of Velux Commercial; Velux America LLC]**
 7. **<Insert manufacturer's name>**
- C. Curb/Frame: **[Manufacturer's standard][Wood][Aluminum][Thermally broken aluminum][Aluminum-clad wood][Copper-clad wood][Vinyl][Molded polyurethane over wood]<Insert requirements>**.
1. Flashing: **[Self-flashing frame][Manufacturer's standard aluminum][Manufacturer's standard copper]<Insert requirements>**.
- D. Sash: **[Fixed (nonoperable)][venting (operable)]**.
1. Material: **[Manufacturer's standard][Wood][Aluminum][Aluminum and wood][Copper and wood][Aluminum and vinyl][Vinyl][Molded polyurethane over wood]<Insert requirements>**.
- E. Insulating-Glass Units: ASTM E2190, manufacturer's standard.
1. Exterior Lite: **[Fully tempered glass with Low-E coating]<Insert requirements>**.
 2. Interior Lite: **[Laminated glass; heat-strengthened glass and 0.03-inch- (0.76-mm-) thick polyvinyl butyral interlayer][Fully tempered glass][Laminated glass; heat-strengthened glass with 0.090-inch (2.29-mm) polyvinyl butyral interlayer][Laminated glass; fully tempered glass with 0.03-inch- (0.76-mm-) thick polyvinyl butyral interlayer]<Insert requirements>**.
 3. Interspace Content: **[Air][Argon]**.
- F. Glazing System: **[Manufacturer's standard factory-glazing system that produces weathertight seal]<Insert glazing requirements>**.
- G. Operating Hardware:
1. Hardware Finish: **[Manufacturer's standard][Match cladding appearance]<Insert finish>**.
 2. Operators and Controls: Gear-type rotary operator with **[manufacturer's standard][cable][arm]** control device with latching/locking mechanism.
 - a. Crank-Handle Operator: Manufacturer's standard for manually operating venting units that are less than **72 inches (1829 mm)** above floor.
 - b. Pole Operator: Manufacturer's standard **[manual][motorized]** pole for operating venting units that are more than **72 inches (1829 mm)** above floor.
 - c. Remote-Control Motor Operator: Manufacturer's standard for operating venting units that are more than **72 inches (1829 mm)** above floor.
 - 1) **[Electric][Solar-powered battery]** motor.
 - 2) **[Wireless remote][Keypad][Building automation system]<Insert requirements>** control.
 - 3) Provide rain sensor that automatically closes venting unit when water is detected.
 3. Hinges: **[Continuous][Pivots, two per sash][Manufacturer's standard]<Insert requirements>**.
- H. Exposed Finishes:
1. Exposed Wood: **[Unfinished][Manufacturer's standard transparent finish in color selected by Architect from manufacturer's full range][Manufacturer's standard prime-painted finish][Manufacturer's standard opaque finish in color selected by Architect from manufacturer's full range]<Insert requirements>**.

2. Aluminum: **[Manufacturer's standard][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert requirements>.**
3. Copper: **[Manufacturer's standard][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert requirements>.**
4. Vinyl: **[Manufacturer's standard color][In color selected by Architect from manufacturer's full range]<Insert requirements>.**
5. Molded Polyurethane: **[Manufacturer's standard color][In color selected by Architect from manufacturer's full range]<Insert requirements>.**

I. Fabrication:

1. Fabricate roof windows that are reglazable without dismantling sash framing.
2. Provide full-perimeter weather stripping for each operable sash.
3. Provide condensation gutter or other means to hold condensed moisture or drain it to exterior.
4. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.3 ACCESSORIES

- A. Insect Screens: Manufacturer's standard removable screen; aluminum or vinyl frame with mitered or coped joints and with ASTM D3656/D3656M mesh of plastic-coated glass-fiber threads. Provide frame in manufacturer's standard finish and mesh in manufacturer's standard color.
- B. Blinds: In color and pattern selected by Architect from manufacturer's full range.
 1. Type: **[Pleated][Roll up, light filtering][Roll up, blackout][Venetian][Manufacturer's standard]<Insert requirements>.**
 2. Pole Operation: Provide **[manual][motorized]** pole for operating blinds that are more than **72 inches (1829 mm)** above floor.
 3. Motor Operator: Manufacturer's standard for blinds that are more than **72 inches (1829 mm)** above floor.
 - a. **[Electric][Solar-powered battery]** motor.
 - b. **[Wireless remote][Keypad]<Insert requirements>** control.
- C. Mull Kit: Manufacturer's standard for installing two units side by side or inline; finished to match roof window units.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements, rough opening dimensions, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written installation instructions for installing roof windows and accessories.
- B. Install roof windows square, true, and without distortion, warp, or rack of frames and sash. Securely anchor windows to structural support without impeding thermal movement.
- C. Install flashing to provide a watertight and weathertight seal.
- D. Separate aluminum, copper, and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials in accordance with recommendations in ASTM E2112.

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sash, screens, and accessories for a tight fit at contact points and for smooth operation and weathertight closure.
- B. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.
- C. Adjust blinds to hang true to line without rack. Provide unencumbered operation.
- D. Clean frame surfaces immediately after installing roof windows. Comply with manufacturer's written instructions for final cleaning and maintenance. Avoid damaging protective coatings and finishes.
- E. Inspect drainage holes for blockage. Clean and free holes of any obstructions to allow drainage.
- F. Clean glass immediately after installing roof windows. Comply with manufacturer's written instructions for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.
- G. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- H. Protect roof window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances contact roof window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.
- I. Refinish or replace roof windows that have damaged finishes.
- J. Replace damaged components.

3.4 <INSERT PRODUCT SCHEDULE>

END OF SECTION 08 62 00 00



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SECTION 08 62 00 00A - UNIT SKYLIGHTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Unit skylights.
2. Tubular daylighting devices.

B. Related Requirements:

1. Section 084513 "Structured-Polycarbonate-Panel Assemblies" for metal-framed skylights glazed with translucent insulating panels.
2. Section 084523 "Fiberglass-Sandwich-Panel Assemblies" for metal-framed skylights glazed with translucent insulating panels.
3. Section 086100 "Roof Windows" for flat, insulating-glass fenestration units installed in sloped ceiling areas and intended for in-reach operation.
4. Section 086300 "Metal-Framed Skylights" glass-glazed, site-erected, metal-framed skylights.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include product dimensions, construction details, material descriptions, dimensions and profiles of components, and finishes.
2. Include power requirements, ratings, characteristics, and mounting requirements for electrical components.
3. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
4. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
5. Environmental Product Declaration (EPD): For each product.
6. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
7. Environmental Product Declaration: For each product.
8. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
9. Environmental Product Declaration: For each product.
10. Environmental Product Declaration: For each product.
11. Third-Party Certifications: For each product.
12. Third-Party Certified Life Cycle Assessment: For each product.

- B. Shop Drawings:
 - 1. Include plans, elevations, sections, mounting, and attachment details and methods of structural support.
 - 2. Include diagrams for power, signal, and control wiring.
- C. Samples: For each exposed product and for each color and finish specified.
- D. Samples for Initial Selection: For each type of glazing and exposed factory-applied finish.
 - 1. Include Samples of accessories involving color and finish selection.
- E. Samples for Verification: For each product, as follows:
 - 1. Glazing: **[In manufacturer's standard size][12 inches (305 mm) square]<Insert requirements>** and of same thickness indicated for the final Work.
 - 2. Finishes: For each type and color of factory-applied exposed finish required, in manufacturer's standard size.
 - 3. Interior Diffuser Lens for Tubular Daylighting Device: **[Full size]<Insert requirements>**.
- F. Product Schedule: For each type of product specified. **[Use same designations indicated on Drawings.]**

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type and size of product, for tests performed by a qualified testing agency on specimens equal to or greater than sizes required for Project.
- B. Evaluation Reports: **[Indicating product compliance with code requirements of authorities having jurisdiction]<Insert requirements>**.
- C. Field quality-control reports.
- D. Sample Warranty: For special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For products and accessories to include in maintenance manuals.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of products that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Water leakage not controlled by drainage features.
 - c. Deterioration of materials and finishes beyond normal weathering.
 - d. Yellowing of acrylic glazing.
 - e. Breakage of polycarbonate glazing.

- f. Deterioration of insulating-glass units including failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating-glass units contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 2. Warranty Period:
 - a. Products and Accessories: **[Five]<Insert number>** years from date of Substantial Completion.
 - b. Insulating-Glass Units: **[10][20]<Insert number>** years from date of Substantial Completion.
- B. Special Aluminum Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of finish deterioration within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, peeling, checking, or chipping.
 2. Warranty Period: **[Five][10][20]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Performance Standard: Comply with AAMA/WDMA/CSA 101/1.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
1. Minimum Performance Grade: PG **[30][50][70][90][125][165]<Insert requirements>**.
 2. Label Requirements: Label each product with names of manufacturer and labeling agency and AAMA/WDMA/CSA 101/1.S.2/A440 product designation, performance grade, and test specimen size equal to or greater than the size of the product.
 3. Certification Requirements: Provide **[AAMA][or][WDMA]<Insert requirements>** certified products, with label attached to each.
- B. Thermal Transmittance: NFRC 100 maximum U-factor of **[0.42 Btu/sq. ft. x h x deg F (2.38 W/sq. m x K)][0.45 Btu/sq. ft. x h x deg F (2.56 W/sq. m x K)][0.46 Btu/sq. ft. x h x deg F (2.61 W/sq. m x K)][0.48 Btu/sq. ft. x h x deg F (2.73 W/sq. m x K)][0.50 Btu/sq. ft. x h x deg F (2.84 W/sq. m x K)][0.53 Btu/sq. ft. x h x deg F (3.01 W/sq. m x K)][0.55 Btu/sq. ft. x h x deg F (3.12 W/sq. m x K)][0.60 Btu/sq. ft. x h x deg F (3.41 W/sq. m x K)]<Insert value>**.
- C. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum SHGC of **[0.40][0.35][0.28]<Insert value>**.
- D. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone **[1][2][3][4]** for **[basic][enhanced]** protection.
1. Large-Missile Test: For glazing located within **[30 feet (9.1 m)]<Insert dimension>** of grade.
 2. Small-Missile Test: For glazing located between **30 feet (9.1 m)** and **[60 feet (18.3 m)]<Insert dimension>** above grade.

- E. Plastic Glazing:
1. Self-Ignition Temperature: **650 deg F (343 deg C)** or more for plastic sheets in thickness indicated when tested in accordance with ASTM D1929.
 2. Smoke-Production Characteristics: Smoke-developed index of 450 or less when tested in accordance with ASTM E84, and smoke density of 75 or less when tested in accordance with ASTM D2843.
 3. Combustibility Characteristics: Tested in accordance with ASTM D635 and classified for burning rate of nominal thickness of **0.060 inch (1.5 mm)** or thickness of plastic glazing indicated for use as follows:
 - a. Class CC1: Burning rate of **1 inch (25 mm)** per minute or less.
 - b. Class CC2: Burning rate of **2-1/2 inches (64 mm)** per minute or less.
- F. Exterior Fire-Test Exposure: Provide products identical to those of assemblies tested for Class B fire resistance in accordance with ASTM E108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction.
- G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Fall-Protection Performance: **[Installed assemblies are capable of safely supporting the greater of 400 lbs (181.4 kg) or twice the weight of employees, equipment, and materials that may be imposed on any 1 sq. foot (0.09 sq. m) of the assembly at any time]<Insert requirements>.**

2.2 UNIT SKYLIGHTS

- A. Factory-Assembled Skylight: Unit that includes glazing, extruded-aluminum glazing retainers, gaskets, and inner frame.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[AES Sunoptics; Acuity Brands International, Inc.]**
 - b. **[American Skylights, Inc.]**
 - c. **[Birdview Skylights]**
 - d. **[Dayliter Skylights Inc.]**
 - e. **[Dome'I Inc.]**
 - f. **[Dur-Red Products]**
 - g. **[Energy-Glazed Systems, Inc.]**
 - h. **[Exarc Skylights, Inc]**
 - i. **[FAKRO America, LLC]**
 - j. **[Kingspan Light + Air LLC]**
 - k. **[Lane-Aire Manufacturing Corp.]**
 - l. **[Major Industries, Inc.]**
 - m. **[Plasteco, Inc]**
 - n. **[Plastic Engineering Company of Tulsa, Inc.]**
 - o. **[Skyline Sky-Lites, LLC]**
 - p. **[Solar Industries, Inc.]**
 - q. **[Sun-Tek Manufacturing, Inc.]**
 - r. **[Sunglo Skylight Products]**
 - s. **[Wasco Part of Velux Commercial; Velux America LLC]**

- t. **[Wisconsin Solar Design Inc]**
 - u. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[AES Sunoptics; Acuity Brands International, Inc.]**
 - b. **[American Skylights, Inc.]**
 - c. **[Birdview Skylights]**
 - d. **[Dayliter Skylights Inc.]**
 - e. **[Dome'I Inc.]**
 - f. **[Dur-Red Products]**
 - g. **[Energy-Glazed Systems, Inc.]**
 - h. **[Exarc Skylights, Inc]**
 - i. **[FAKRO America, LLC]**
 - j. **[Kingspan Light + Air LLC]**
 - k. **[Lane-Aire Manufacturing Corp.]**
 - l. **[Major Industries, Inc.]**
 - m. **[Plasteco, Inc]**
 - n. **[Plastic Engineering Company of Tulsa, Inc.]**
 - o. **[Skyline Sky-Lites, LLC]**
 - p. **[Solar Industries, Inc.]**
 - q. **[Sun-Tek Manufacturing, Inc.]**
 - r. **[Sunglo Skylight Products]**
 - s. **[Wasco Part of Velux Commercial; Velux America LLC]**
 - t. **[Wisconsin Solar Design Inc]**
 - u. **<Insert manufacturer's name>**
- B. Product Type: AAMA/WDMA/CSA 101/1.S.2/A440 **[SKG, unit skylight - glass glazed][SKP, unit skylight - plastic glazed]**.
 1. Provide **[fixed (nonoperable)][venting (operable)]** units.
- C. Outside-Inside Transmission Class (OITC): Rated for not less than **[22][26][30]<Insert value>** OITC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E1332.
- D. Unit Shape and Size: **[As indicated][Square, 40-by-40-inch (1016-by-1016-mm) inside curb][Rectangular, 40-by-48-inch (1016-by-1219-mm) inside curb][Circular, 40-inch- (1016-mm-) diameter inside curb]<Insert requirements>**.
- E. Acrylic Glazing: ASTM D4802, thermoformable, monolithic sheet, category as standard with manufacturer, Finish 1 (smooth or polished), Type UVF (formulated with UV absorber); and Class CC2 based on testing in accordance with ASTM D635.
 1. Single-Glazing Profile: **[Dome, 25 percent rise][Pyramid, 30-degree slope]<Insert requirements>**.
 - a. Thickness: **[As indicated][Not less than thickness required to meet specified requirements]<Insert requirements>**.
 - b. Color: **[Colorless, transparent][White, translucent][Bronze tinted, transparent][Gray tinted, transparent]<Insert requirements>**.
 2. Double-Glazing Profile: **[Dome, 25 percent rise][Pyramid, 30-degree slope]<Insert requirements>**.

- a. Thicknesses of Each Glazing Layer: **[As indicated][Not less than thicknesses required to meet specified requirements]<Insert requirements>.**
 - b. Outer Glazing Color: **[Colorless, transparent][White, translucent][Bronze tinted, transparent][Gray tinted, transparent]<Insert requirements>.**
 - c. Inner Glazing Color: **[Colorless, transparent][White, translucent][Bronze tinted, transparent][Gray tinted, transparent]<Insert requirements>.**
- F. Polycarbonate Glazing: Thermoformable, extruded monolithic sheets, UV resistant, burglar-resistance rated in accordance with UL 972; with average impact strength of **12 to 16 ft-lb/in. (640 to 854 J/m)** of width when tested in accordance with ASTM D256, Test Method A (Izod); and Class CC1 based on testing in accordance with ASTM D635.
1. Single-Glazing Profile: **[Dome, 25 percent rise][Pyramid, 30-degree slope]<Insert requirements>.**
 - a. Thickness: **[As indicated][Not less than thickness required to meet specified requirements]<Insert requirements>.**
 - b. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert requirements>.**
 2. Double-Glazing Profile: **[Dome, 25 percent rise][Pyramid, 30-degree slope]<Insert requirements>.**
 - a. Thicknesses of Each Glazing Layer: **[As indicated][Not less than thicknesses required to meet specified requirements]<Insert requirements>.**
 - b. Inner Glazing Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert requirements>.**
 - c. Outer Glazing Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's stand colors]<Insert requirements>.**
- G. Insulating Glass: Sealed units that comply with Section 088000 "Glazing," in manufacturer's standard overall thickness.
1. Exterior Lite: **[6-mm, tinted, fully tempered][6-mm, clear, heat-strengthened]<Insert requirements> glass.**
 2. Interior Lite: **[Laminated glass; two plies of 3-mm clear heat-strengthened glass with 0.030-inch (0.76-mm) clear polyvinyl butyral interlayer]<Insert requirements>.**
 3. Interspace Content: **[Air][Argon].**
 4. Low-Emissivity Coating: **[Manufacturer's standard]<Insert requirements>.**
- H. Polycarbonate-Insulating-Panel Glazing: Manufacturer's standard polycarbonate sheet with cellular cross section that provides isolated airspaces, coextruded with a UV-protective layer, and Class CC2 based on testing in accordance with ASTM D635.
1. Thickness: **[As indicated][Not less than thickness required to meet specified requirements]<Insert requirements>.**
 2. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert requirements>.**
- I. Fiberglass-Sandwich-Panel Glazing: Manufacturer's standard with uniformly colored, translucent, fiberglass-reinforced-polymer face sheets permanently adhered to a grid core; **[Class CC1][Class CC2]** based on testing in accordance with ASTM D635.

1. Thickness: **[As indicated][Not less than thickness required to meet specified requirements]<Insert thickness>**.
 2. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert requirements>**.
- J. Glazing Gaskets: **[Manufacturer's standard][EPDM, neoprene, partially vulcanized butyl tape, or liquid-applied elastomeric sealant]<Insert requirements>**.
- K. Integral Curb: **[Extruded-aluminum, ASTM B221 (ASTM B221M), alloy and temper to suit structural and finish requirements but with not less than the strength and durability of Alloy 6063-T52][Manufacturer's standard vinyl profile][Manufacturer's standard reinforced-thermoset-fiberglass profile]<Insert requirements>**, self-flashing type.
1. Height: **[As indicated on Drawings][8 inches (203 mm)][9 inches (229 mm)][12 inches (305 mm)]<Insert height>**.
 2. Construction: **[Single][Double]** wall.
 3. Insulation: **[Manufacturer's standard rigid or semirigid type]<Insert material>**.
 - a. Exposed Insulation: Cover face of insulation exposed to interior of building with **[aluminum][vinyl]** liner.
- L. Prefabricated Curb: As specified in Section 077200 "Roof Accessories."
- M. Condensation Control: Fabricate unit skylights with integral internal gutters and nonclogging weeps to collect and drain condensation to the exterior.
- N. Thermal Break: Fabricate unit skylights with thermal break separating exterior and interior metal framing.
- O. Operator: Equip operable unit skylights with manufacturer's standard hinges, chain-driven operating hardware, and weather-sealing gaskets.
1. Manual Operator: Manufacturer's standard, rotary-crank extension device.
 - a. Pole Operator: **[Manual, 60 inches (1524 mm) long][Manual, telescoping to 144 inches (3658 mm)][Rechargeable-motor, power-driven type, telescoping to 144 inches (3658 mm)]<Insert requirements>**.
 2. Motor Operator: Manufacturer's standard electronic control, including switch, transformer, low-voltage motor, cover, mounting hardware, and other components required for a complete installation.
 - a. Provide motor of size and capacity recommended by unit skylight manufacturer to suit unit skylight indicated.
 - b. Rain Sensors: Provide rain sensor that automatically closes operable unit when water is detected.
 - c. Remote Control: Provide motor operator with portable remote-control device.
- P. Accessories:
1. Security Grille: **1/2-inch- (13-mm-) diameter, hardened steel bars spaced not more than [5 inches (127 mm) o.c. in one direction and 16 inches (406 mm) o.c. in other direction][5 inches (127 mm) o.c. in both directions]<Insert requirements>**.
 2. Protective Screen: Manufacturer's standard to protect against **[falling glass][hail]**.
 3. Manual Blackout Shade: **[Manufacturer's standard sized to fit unit-skylight opening]<Insert requirements>**.

4. **<Insert accessory>.**

Q. Aluminum Finishes:

1. Mill Finish: Manufacturer's standard.
2. Clear Anodic Finish: AAMA 611, **[AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm]** or thicker.
3. Color Anodic Finish: AAMA 611, **[AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm]** or thicker.
 - a. Color: **[Match Architect's sample][As selected by Architect from full range of industry colors and color densities][Light bronze][Medium bronze][Dark bronze][Black][Champagne]<Insert color>.**
 - b. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
4. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - a. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
5. High-Performance Organic Finish, Two-Coat: Fluoropolymer finish complying with **[AAMA 2604][AAMA 2605]** and containing not less than **[50][70]** percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
6. High-Performance Organic Finish, Three-Coat: Fluoropolymer finish complying with AAMA 2605 and containing not less than **[50][70]** percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
7. High-Performance Organic Finish, Four-Coat: Fluoropolymer finish complying with AAMA 2605 and containing not less than **[50][70]** percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

2.3 TUBULAR DAYLIGHTING DEVICES

- A. Tubular Daylighting Device: Complete with exterior glazed opening, glazing retainers and gaskets, exterior flashing assembly, reflective tube, interior diffuser assembly, and components and accessories required to provide a complete installation.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[AES Sunoptics; Acuity Brands International, Inc.]**
 - b. **[Solarise, Inc.]**
 - c. **[Solatube International, Inc.]**
 - d. **[Sun-Tek Manufacturing, Inc.]**
 - e. **[Tubular Skylight Inc.]**
 - f. **[Velux Commercial; Velux America LLC]**
 - g. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[AES Sunoptics; Acuity Brands International, Inc.]**
 - b. **[Solarise, Inc.]**
 - c. **[Solatube International, Inc.]**
 - d. **[Sun-Tek Manufacturing, Inc.]**
 - e. **[Tubular Skylight Inc.]**
 - f. **[Velux Commercial; Velux America LLC]**
 - g. **<Insert manufacturer's name>**
- B. Product Type: AAMA/WDMA/CSA 101/1.S.2/A440 **[TDDCC, tubular daylighting device - closed ceiling][TDDOC, tubular daylighting device - open ceiling]**.
- C. Nominal Reflective Tube Diameter: **[5-1/2 inches (140 mm)][8 inches (203 mm)][10 inches (254 mm)][13 inches (330 mm)][14 inches (356 mm)][21 inches (533 mm)][22 inches (559 mm)][29 inches (737 mm)]<Insert dimension>**.
- D. Exterior Glazing: Manufacturer's standard **[single dome][double dome][collector dome and cylinder]<Insert requirements>**.
1. Size: **[As required to coordinate with reflective tube]<Insert requirements>**.
 2. Material:
 - a. Acrylic: ASTM D4802, thermoformable, monolithic sheet, category as standard with manufacturer, Finish 1 (smooth or polished), Type UVF (formulated with UV absorber); and Class CC2 based on testing in accordance with ASTM D635.
 - b. Polycarbonate: Thermoformable, extruded monolithic sheets, UV resistant, burglar-resistance rated in accordance with UL 972; with average impact strength of **12 to 16 ft-lb/in. (640 to 854 J/m)** of width when tested in accordance with ASTM D256, Test Method A (Izod); and Class CC1 based on testing in accordance with ASTM D635.
 - c. Minimum Thickness: **[0.125 inch (3.18 mm)][As required to meet specified requirements]<Insert requirements>**.
 3. Seal: **[Manufacturer's standard][Adhesive-backed foam weatherstripping]<Insert requirements>**.

4. Exterior Glazing Accessories:

- a. Fire-Protection Band: Dome edge-protection band matching flashing material and finish. Domes installed with fire-protection band pass Class B burning brand tests when tested in accordance with ASTM E108.
- b. Secondary Diffuser: **[Manufacturer's standard ASTM D4802 acrylic, Class CC2 based on testing in accordance with ASTM D635]<Insert requirements>.**
- c. Security Bar: **[Manufacturer's standard ASTM A240/A240M Type 304 stainless steel bar across flashing diameter opening]<Insert requirements>.**
- d. Security Grille: Manufacturer's standard **[powder-coated steel][stainless steel]<Insert requirements>** 1/8-inch- (3.2-mm-) diameter rods formed into guard with maximum 8-inch (203-mm) opening and fastened to curb-cap assembly.
- e. Security Kit: **[Manufacturer' standard rivets with nylon spacers to replace dome screws]<Insert requirements>.**
- f. **<Insert accessory>.**

E. Exterior Flashing: Manufacturer's standard **[one-piece, self-mounted][two-piece, self-mounted][one-piece, curb-cap]<Insert requirements>** type.

1. Size: **[As required to coordinate with exterior glazing and reflective tube]<Insert requirements>.**
2. Base Pitch: **[None, flat][22.5-degree slope from horizontal]<Insert requirements>.**
3. Base Height: **[Manufacturer's standard low-profile][4 inches (102 mm)][8 inches (203 mm)][11 inches (279 mm)]<Insert dimension>.**
4. Prefabricated Curb: As specified in Section 077200 "Roof Accessories."
5. Material: **[Manufacturer's standard corrosion-resistant metal and finish][ASTM A 653/A 653M commercial steel or forming steel with G90 (Z275) hot-dip galvanized coating, 0.023 inches (0.58 mm) thick, finished with grey powder coat]<Insert requirements>.**
6. Tube Attachment: Manufacturer's standard receiver attached to top of roof flashing and serving as mounting base for dome assembly; provides thermal break between flashing and reflective tube; configured to channel condensed moisture to the exterior.
 - a. Seal: **[Manufacturer's standard]<Insert requirements>** that provides weathertight seal with roof flashing.
7. Flashing Accessories:
 - a. Flashing Insulation: **[Manufacturer's standard thermal isolation material]<Insert requirements>.**
 - b. Turret Extension: Manufacturer's standard extension tube in length **[indicated on Drawings]<Insert dimension>.**
 - c. Roof-Membrane Counterflashing: **[Manufacturer's standard corrosion-resistant aluminum]<Insert requirements>.**
 - d. **<Insert accessory>.**

F. Reflective Tube:

1. Flexible Tube: Reflective, metalized polyester, fiberglass scrim, and steel-wire spring tube.
 - a. Length: **[As required to accommodate installation area][8 foot (2.4 m)]<Insert requirements>.**
 - 1) Tube Extensions: Provide manufacturer's standard components as required to accommodate installation areas indicated.

2. Rigid Tube: Light shaft formed from aluminum sheet, **ASTM B209 (ASTM B209M)**, with **[manufacturer's standard specular interior finish]<Insert requirements>**.
 - a. Thickness: **[Manufacturer's standard][0.016 inch (0.41 mm)][0.018 inch (0.46 mm)]<Insert dimension>**.
 - b. Length and Configuration: **[As indicated on Drawings]<Insert requirements>**.
 - 1) Tube Extensions: **[Provide manufacturer's standard components as required to accommodate installation areas indicated]<Insert requirements>**.
 - 2) Tube Elbows: Provide angle adaptors adjustable to **[45][30][90]<Insert number>** degrees as required to accommodate installation areas indicated.
 - 3) Rotating Couplers: Rotating adaptors allowing coupling of two elbows to create 90-degree transition of tube.
 - c. Color Rendition: When tested in accordance with ASTM E308, minimum L* axis value of 99 and a* (green to red) and b* (blue to yellow) axes values not more than **[1][2]<Insert number>** or less than minus **[1][2]<Insert number>** in accordance with CIELAB results.
 - d. Fastening System: **[Manufacturer's standard]<Insert requirements>** that provides tight mating of interconnecting tube component pieces.
3. Tube Accessories:
 - a. Suspension Wire: **[Manufacturer's standard to provide bracing of tube to structure as required for a fully supported installation]<Insert requirements>**.
 - b. Extension Tube with Thermal Insulation Panel: **[Manufacturer's standard extension-tube assembly containing two light-transmitting, acrylic discs with an airspace between them and secured together by a plastic band to prevent conductive and convective heat transfer. Plastics are Class CC2 based on testing in accordance with ASTM D635]<Insert requirements>**.
 - c. Ceiling Trim: **[Manufacturer's standard trim for ceiling opening]<Insert requirements>**.
 - d. Trim Ring: **[Manufacturer's standard trim that covers the cut edge of the roof deck penetration]<Insert requirements>**.
 - e. **<Insert accessory>**.
- G. Interior Diffuser: Assembly attached to bottom of reflective tube, with high-visible-light-transmittance lens **[separated by airtight seals providing insulating airspace]<Insert requirements>**.
 1. Size: **[As required to coordinate with reflective tube]<Insert requirements>**.
 2. Lens Type: **[Round, prismatic lens, acrylic Class CC2 based on testing in accordance with ASTM D635][Round, Fresnel lens, acrylic Class CC2 based on testing in accordance with ASTM D635][Round, prismatic lens, polycarbonate Class CC1 based on testing in accordance with ASTM D635][Translucent white glass globe with metal trim ring]<Insert requirements>**.
 - a. Metal Trim Finish: **[White][Brushed nickel][Polished brass][Oil-rubbed bronze]<Insert requirements>**.
- H. Accessories:
 1. Daylight Dimmer: Manufacturer's standard dimmer baffle, **[electro-mechanical, and complete with power supply, switch, and daylight valve that adjusts daylight output when actuated][low-voltage, programmable, and complete with 12 V DC dimming control switch and 20 W low-voltage transformer]<Insert requirements>**.
 2. Light Kit: **[Supplemental electrical light fixture kit with fluorescent GU24 lamp base, 120 V AC, 60 Hz, maximum 26 W lamp][Light fixture kit for use with one 23 W LED lamp]<Insert requirements>**.

3. Exhaust Fan: **[Manufacturer's standard 110 cfm (52 L/s) exhaust-fan assembly complete with separate exhaust duct, air-intake trim, exhaust vent cap, and permanently lubricated in-line fan motor]<Insert requirements>.**
4. Manual Blackout Shade: **[Manufacturer's standard sized to fit ceiling diffuser opening]<Insert requirements>.**
5. **<Insert accessory>.**

2.4 ACCESSORY MATERIALS

- A. Fasteners: Same metal as metal being fastened, nonmagnetic stainless steel, or other noncorrosive metal that is compatible with the materials being fastened and as recommended in writing by manufacturer. Finish exposed fasteners to match material being fastened.
 1. Where removal of exterior exposed fasteners might allow access to building, provide nonremovable fastener heads.
- B. Bituminous Coating: Cold-applied asphalt mastic, compounded for **15-mil (0.4-mm)** dry film thickness per coat.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNIT SKYLIGHTS

- A. Coordinate installation of products and accessories with installation of substrates, vapor retarders, roof insulation, roofing membrane, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.
- B. Install products and accessories to comply with recommendations in AAMA 1607 and with manufacturer's written installation instructions.
- C. Install products true to line and without distortion.
- D. Anchor products securely to supporting substrates.
- E. Where metal surfaces of products will contact other metal or corrosive substrates, such as preservative-treated wood, apply bituminous coating on concealed metal surfaces or provide other approved permanent separation recommended in writing by manufacturer.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and

inspections.

- B. After completion of installation and nominal curing of sealant and glazing compounds, but before installation of interior finishes, test for water leaks in accordance with AAMA 501.2.
- C. Perform test for total area of each installed product.
- D. Work will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- F. Prepare test and inspection reports.

3.4 CLEANING AND ADJUSTING

- A. Clean exposed product surfaces in accordance with manufacturer's written instructions. Touch up damaged metal coatings and finishes.
- B. Remove excess sealants, glazing materials, dirt, and other substances.
- C. Remove and replace glazing that has been broken, chipped, cracked, abraded, or damaged during construction period.
- D. Protect product surfaces from contact with contaminating substances resulting from construction operations.
- E. Unit-Skylight Operating System: Clean and lubricate joints and hardware. Adjust for proper operation.
- F. Daylight Dimmer Assemblies: Test and adjust dimmer assemblies in tubular daylighting devices for proper operation.

3.5 DEMONSTRATION

- A. **[Engage a factory-authorized service representative to train][Train]** Owner's maintenance personnel to adjust, operate, and maintain the following:
 - 1. Operating systems for unit skylights.
 - 2. Daylight dimmer assemblies for tubular daylighting devices.

3.6 PRODUCT SCHEDULE

- A. **<Insert schedule>**.

END OF SECTION 08 62 00 00A



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Task	Specification	Specification Description
08 62 23 00	08 62 00 00	Roof Windows
08 62 23 00	08 62 00 00a	Unit Skylights



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SECTION 08 63 00 00 - METAL-FRAMED SKYLIGHTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Metal-framed skylights.
- B. Related Requirements:
 - 1. Section 084433 "Sloped Glazing Assemblies" for glazed curtain walls in which the glazed panels are primarily on a sloped plane.
 - 2. Section 086200 "Unit Skylights" for skylights without framing except at the perimeter of the glazing.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for metal-framed skylights.
 - 2. Motors: Show nameplate data, power requirements, ratings, characteristics, and mounting arrangements.
- B. Shop Drawings: For metal-framed skylights. Include the following information, as applicable:
 - 1. Plans, elevations, sections, and attachment details.
 - 2. Structural loadings and reactions to be transmitted to supporting curbs.
 - 3. Details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.
 - 4. Full-size isometric details of each vertical-to-horizontal intersection of assembly, showing the following:
 - a. Joinery including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 - 5. Manual Operators: Show locations, mounting, and details for installing operator components and controls.
 - 6. Motor Operators: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
 - a. Diagrams for power, signal, and control wiring for electric motors of operable metal-framed

skylights.

- C. Samples for Initial Selection: For units with factory-applied finishes.
- D. Samples for Verification: Actual sample of finished products for each type of exposed finish required, in manufacturer's standard sizes.
- E. Fabrication Sample: Of each framing intersection of assemblies, made from **12-inch (305-mm)** lengths of full-size components and showing details of the following:
 - 1. Joinery including concealed welds.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.
- F. Delegated Design Submittals: For metal-framed skylights indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- G. Sustainable Design Submittals:
 - 1. Product Data: For adhesives, mastics, and sealants, indicating VOC content.
 - 2. Laboratory Test Reports: For adhesives, mastics, and sealants, indicating compliance with requirements for low-emitting materials.

1.4 INFORMATIONAL SUBMITTALS

- A. Compatibility and Adhesion Test Reports: For structural-sealant-glazed skylights, test reports from sealant manufacturer indicating that joint sealants have been tested for each material that will come in contact with sealants.
- B. Product Test Reports: For metal-framed skylights, for tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Qualification Statements: For Installer.
- E. Delegated Design Engineer Qualifications: For metal-framed skylights.
- F. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal-framed skylights **[and][metal-framed skylight operating system]**.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Authorized representative who is trained and approved by manufacturer for installation of metal-framed skylights required for this Project.

- B. Structural-Sealant Glazing: Comply with recommendations in ASTM C1401 for joint design and quality-control procedures.
1. Joint designs are reviewed and approved by structural-sealant manufacturer.
 2. Quality-control program development and reporting comply with ASTM C1401 recommendations for material qualification procedures, preconstruction sealant-testing program, and procedures and intervals for fabrication and installation reviews and checks.
 3. Perform manufacturer's standard tests for compatibility and adhesion of sealants with each material that will come in contact with sealants.

1.7 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
1. Build mockup of typical metal-framed skylight as indicated on Drawings.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal-framed skylights that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration caused by thermal movements.
 - c. Deterioration of metals[, **metal finishes**,] and other materials beyond normal weathering.
 - d. Adhesive or cohesive sealant failures.
 - e. Water leakage.
 2. Warranty Period: **[Two][Five][10]<Insert number>** years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked-enamel, powder-coat, or organic finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: **[Five][10][20]<Insert number>** years from date of Substantial Completion.
- C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, peeling, or chipping.
2. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain metal-framed skylights from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal-framed skylights.
- B. Structural Loads: **[As indicated on Drawings]<Insert loads>**.
- C. Deflection of Framing Members: At design wind pressure, as follows:
 1. Deflection Normal to Glazing Plane: Limited to **[edge of glass in a direction perpendicular to glass plane not exceeding L/175 of the glass edge length for each individual glazing lite][1/175 of clear span for spans up to 13 ft. 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans more than 13 ft. 6 inches (4.1 m)]<Insert deflection limit>** or an amount that restricts edge deflection of individual glazing lites to **3/4 inch (19.1 mm)**, whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to **[L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller][amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm)]<Insert deflection limit>**.
- D. Lateral Bracing of Framing Members: Compression flanges of flexural members are laterally braced by cross members with minimum depth equal to 50 percent of flexural member that is braced. Glazing does not provide lateral support.
- E. Structural-Test Performance: Metal-framed skylights tested in accordance with ASTM E330/E330M, as follows:
 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified deflection limits.
 2. When tested at **[150]<Insert number>** percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding **[0.2]<Insert number>** percent of span.
 3. Test Durations: As required by design wind velocity, but not less than **[10]<Insert number>** seconds.
- F. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone **[1][2][3][4]** for **[basic][enhanced]** protection.

1. Large-Missile Test: For glazing located within [30 ft. (9.1 m)]<Insert dimension> of grade.
 2. Small-Missile Test: For glazing located between 30 ft. (9.1 m) and [60 ft. (18.3 m)]<Insert dimension> above grade.
- G. Air Leakage: Metal-framed skylights with maximum air leakage through fixed glazing and framing areas of [0.06 cfm/sq. ft. (0.03 L/s per sq. m)]<Insert value> of when tested in accordance with ASTM E283/E283M at a minimum static-air-pressure difference of [1.57 lbf/sq. ft. (75 Pa)][6.24 lbf/sq. ft. (300 Pa)]<Insert value>.
- H. Water Penetration under Static Pressure: Metal-framed skylights that do not evidence water penetration through fixed glazing and framing areas when tested in accordance with ASTM E331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than [6.24 lbf/sq. ft. (300 Pa)]<Insert value>.
- I. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
1. Temperature Change: [120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature change>.
- J. Condensation Resistance: Metal-framed skylights with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than [45][53]<Insert number> when tested in accordance with AAMA 1503.
1. Haze Factor: Greater than 90 percent when tested in accordance with ASTM D1003.
- K. Structural Sealant: Capable of withstanding tensile and shear stresses imposed without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant occurs before adhesive failure.
- L. Energy Performance: Provide metal-framed skylights with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below[**and certified and labeled in accordance with NFRC**]:
1. Thermal Transmittance (U-Factor): Fixed glazing and framing areas have U-factor of not more than [0.80 Btu/sq. ft. x h x deg F (4.54 W/sq. m x K)][0.65 Btu/sq. ft. x h x deg F (3.69 W/sq. m x K)]<Insert value> as determined in accordance with NFRC 100.
 2. Solar Heat-Gain Coefficient (SHGC): Fixed glazing and framing areas have a SHGC of no greater than [0.6][0.7]<Insert value> as determined in accordance with NFRC 200.
- M. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 2.3 METAL-FRAMED SKYLIGHTS
- A. Metal-Framed Skylights: Glazed skylight assemblies supported by aluminum framing.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Acurlite Structural Skylights, Inc.]
 - b. [Custom Designed Skylights, Inc.]
 - c. [Exarc Skylights, Inc]
 - d. [Gammans Skylight Systems]

- e. [Kawneer Company, Inc.; Arconic Corporation]
- f. [Kingspan Light + Air LLC]
- g. [Linel; Mestek, Inc.]
- h. [OldCastle BuildingEnvelope (OBE)]
- i. [Skyline Sky-Lites, LLC]
- j. [Solar Innovations, Inc.]
- k. [Sunglo Skylight Products]
- l. [Super Sky Products Enterprises, LLC]
- m. [Sussman Architectural Products]
- n. [Unicel Architectural Corp.]
- o. [Wasco Part of Velux Commercial; Velux America LLC]
- p. [Wisconsin Solar Design Inc]
- q. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Acurlite Structural Skylights, Inc.]
- b. [Custom Designed Skylights, Inc.]
- c. [Exarc Skylights, Inc]
- d. [Gammans Skylight Systems]
- e. [Kawneer Company, Inc.; Arconic Corporation]
- f. [Kingspan Light + Air LLC]
- g. [Linel; Mestek, Inc.]
- h. [OldCastle BuildingEnvelope (OBE)]
- i. [Skyline Sky-Lites, LLC]
- j. [Solar Innovations, Inc.]
- k. [Sunglo Skylight Products]
- l. [Super Sky Products Enterprises, LLC]
- m. [Sussman Architectural Products]
- n. [Unicel Architectural Corp.]
- o. [Wasco Part of Velux Commercial; Velux America LLC]
- p. [Wisconsin Solar Design Inc]
- q. <Insert manufacturer's name>

- B. Aluminum Framing Systems: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.

- C. Aluminum: Alloy and temper as recommended in writing by manufacturer for type of use and finish indicated.

- 1. Sheet and Plate: ASTM B209/B209M.
- 2. Extruded Bars, Rods, Profiles, and Tubes: **ASTM B221 (ASTM B221M).**
- 3. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
- 4. Structural Profiles: ASTM B308/B308M.

- D. Operable Systems: Equip operable metal-framed skylights with manufacturer's standard hinges, chain-driven operating hardware, and weather-sealing gaskets.

- 1. Manual Operator: Manufacturer's standard, rotary-crank extension device.
 - a. Pole Operator: [Manual, 60 inches (1524 mm) long][Manual, telescoping to 144 inches (3658 mm)][Rechargeable-motor, power-driven type, telescoping to 144 inches (3658 mm)]<Insert requirements>.

2. Motor Operator: Manufacturer's standard electronic control, including switch, transformer, low-voltage motor, cover, and mounting hardware.
 - a. Provide motor of size and capacity recommended by metal-framed skylight manufacturer to suit metal-framed skylight indicated.
 - b. Rain Sensors: Provide rain sensor that automatically closes operable unit when water is detected.
 - c. Remote Control: Provide motor operator with portable remote-control device.
- E. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
 1. Include snap-on aluminum trim that conceals fasteners.
- F. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.
- G. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 1. At pressure caps, use ASTM A193/A193M stainless steel screws.
 2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 3. Reinforce members as required to receive fastener threads.
 4. Use exposed fasteners with countersunk Phillips screw heads[, **finished to match framing system**][, **fabricated from Series 300 stainless steel**].
- H. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- I. Anchor Bolts: ASTM A307, Grade A, galvanized steel.
- J. Concealed Flashing: [**Manufacturer's standard, corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials**][**Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, ASTM A240/A240M of type recommended in writing by manufacturer**].
- K. Exposed Flashing and Closures: Manufacturer's standard aluminum components not less than [0.030 inch (0.762 mm)][0.040 inch (1.016 mm)][0.060 inch (1.524 mm)]<Insert dimension> thick.
- L. Framing Sealants: As [**recommended in writing by manufacturer**][**specified in Section 079200 "Joint Sealants."**]
 1. Product Data: Verify architectural sealant has a VOC content of 250 g/L or less.
 - a. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - b. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 - c. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify the building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.

- M. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for **15-mil (0.4-mm)** dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 GLAZING

- A. Glazing: As specified in **[Section 088000 "Glazing."][Section 088400 "Plastic Glazing."]**
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Spacers and Setting Blocks: **[Manufacturer's standard elastomeric types.][As specified in Section 088000 "Glazing."][As specified in Section 088400 "Plastic Glazing."]**
- D. Glazing Sealants: As recommended in writing by manufacturer.
 - 1. Product Data: Verify architectural sealant has a VOC content of 250 g/L or less.
 - a. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - b. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
 - c. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify the building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.
- E. Structural Glazing Sealants:
 - 1. Structural Sealant: ASTM C1184, neutral-curing silicone formulation compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant, and approved by structural-sealant manufacturer for use in metal-framed skylights indicated.
 - a. Color: **[Black][Gray][As selected by Architect from manufacturer's full range].**
 - 2. Weatherseal Sealant: ASTM C920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; neutral-curing silicone formulation compatible with structural sealant and other components with which it comes in contact; and recommended in writing by structural- and weatherseal-sealant and metal-framed skylight manufacturers for this use.
 - a. Color: Matching structural sealant.
 - 3. Product Data: Verify architectural sealant has a VOC content of 250 g/L or less.
 - a. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - b. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic

- Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify formaldehyde emissions do not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
- c. Verify sealant complies with testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Verify the building concentration of formaldehyde does not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde does not exceed 9 mcg/cu. m.
4. Bond-Breaker Tape: **[Manufacturer's standard tetrafluoroethylene-fluorocarbon or polyethylene material to which sealants will not develop adhesion]<Insert requirements>.**

2.5 FABRICATION

- A. Where practical, fit and assemble metal-framed skylights in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Fabricate aluminum components that, when assembled, have the following characteristics:
 1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Internal guttering systems or other means to drain water passing joints and moisture migrating within skylight to exterior.
 4. Physical and thermal isolation of glazing from framing members.
 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
- C. Fabricate aluminum sill closures with weep holes and for installation as continuous component.
- D. Reinforce aluminum components as required to receive fastener threads.
- E. Factory-Glazed, Metal-Framed Skylights:
 1. Factory install glazing to comply with requirements in **[Section 088000 "Glazing."][Section 088400 "Plastic Glazing."]**
- F. Structural-Sealant-Glazed, Metal-Framed Skylights: Prepare surfaces that will contact structural sealant in accordance with structural-sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
- G. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, **[AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm]** or thicker.
- B. Color Anodic Finish: AAMA 611, **[AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm]** or thicker.
 1. Color: **[Light bronze][Medium bronze][Dark bronze][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>.**

- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- D. High-Performance Organic-Finish, Two-Coat PVDF: Fluoropolymer finish complying with **AAMA 2604][AAMA 2605]** and containing not less than **[50][70]** percent PVDF resin by weight in color coat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- E. Superior-Performance Organic-Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- F. Superior-Performance Organic-Finish, Four-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- G. Superior-Performance Organic-Finish, Single-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- H. Superior-Performance Organic-Finish, Two-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

2.7 SOURCE QUALITY CONTROL

- A. Structural-Sealant Glazing: Perform quality-control procedures complying with ASTM C1401 recommendations including, but not limited to, material qualification procedures, sealant testing, and fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF METAL-FRAMED SKYLIGHTS

- A. General: Comply with manufacturer's written instructions.
 - 1. Do not install damaged components.
 - 2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 - 3. Rigidly secure nonmovement joints.
 - 4. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - 5. Seal joints watertight unless otherwise indicated.
- B. Metal Protection: Where aluminum will contact dissimilar materials, protect against galvanic action by painting contact surfaces with protective coating or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
- C. Install continuous aluminum sill closure with weatherproof expansion joints and locked and sealed or welded corners. Locate weep holes at rafters.
- D. Install components to drain water passing joints and drain moisture migrating within skylight to exterior.
- E. Install components plumb and true in alignment with established lines and elevations.
- F. Glazing: Install glazing as specified in [Section 088000 "Glazing."][Section 088400 "Plastic Glazing."]
- G. Structural-Sealant Glazing:
 - 1. Prepare surfaces that will contact structural sealant in accordance with structural-sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
 - 2. Install weatherseal sealant in accordance with weatherseal-sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind weatherseal sealant as recommended in writing by weatherseal-sealant manufacturer.
- H. Erection Tolerances: Install metal-framed skylights to comply with the following maximum tolerances:
 - 1. Alignment: Limit offset from true alignment to **1/32 inch (0.8 mm)** where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than **3 inches (76 mm)**; otherwise, limit offset to **1/8 inch (3.2 mm)**.
 - 2. Location and Plane: Limit variation from true location and plane to **1/8 inch in 12 ft. (3.2 mm in 3.7 m)**, but no greater than **1/2 inch (13 mm)** over total length.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: **[Owner will engage][Engage]** a qualified testing agency to perform tests and inspections.
1. Water-Spray Test: Before installation of interior finishes has begun, skylights are tested in accordance with AAMA 501.2 and do not evidence water penetration.
 2. Structural-Sealant Compatibility and Adhesion: Structural sealant is tested in accordance with ASTM C1401.
 - a. Destructive test method, Method A, Hand Pull Tab (Destructive) in ASTM C1401, Appendix X2, is used.
 - 1) A minimum of **[one][two]<Insert number>** area(s) on each skylight face is tested.
 - 2) Repair installation areas damaged by testing.
 3. Structural-Sealant Glazing Inspection: After installation of metal-framed skylights is complete, structural-sealant glazing is inspected and evaluated in accordance with ASTM C1401 recommendations for quality-control procedures.
- B. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.4 CLEANING AND PROTECTION

- A. Clean exposed surfaces immediately after installing skylights. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- B. Remove and replace **[glass][plastic glazing]** that has been broken, chipped, cracked, abraded, or damaged during construction period.
- C. Protect skylights from contact with contaminating substances resulting from construction operations. If contaminating substances do contact skylight surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.
- D. Metal-Framed Skylight Operating System: Clean and lubricate joints and hardware. Adjust for proper operation.

3.5 DEMONSTRATION

- A. **[Engage a factory-authorized service representative to train][Train]** Owner's maintenance personnel to adjust, operate, and maintain metal-framed skylight operating system.

END OF SECTION 08 63 00 00



Task	Specification	Specification Description
08 63 13 00	08 62 00 00	Roof Windows
08 63 13 00	08 63 00 00	Metal-Framed Skylights
08 66 00 00	08 62 00 00a	Unit Skylights



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SECTION 08 71 00 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hinges.
2. Self-closing hinges and pivots.
3. Center-hung and offset pivots.
4. Continuous, pin-and-barrel-type hinges.
5. Continuous, gear-type hinges.
6. Concealed hinges.
7. Bored locks.
8. Mortise locks.
9. Interconnected locks.
10. Roller latches.
11. Push-pull latches.
12. Bored auxiliary locks.
13. Mortise auxiliary locks.
14. Narrow-stile auxiliary locks.
15. Push-button combination locks.
16. Electric strikes.
17. Electromagnetic locks.
18. Delayed-egress electromagnetic locks.
19. Electromechanical locks.
20. Self-contained electronic locks.
21. Exit locks and alarms.
22. Surface bolts.
23. Manual flush bolts.
24. Automatic flush bolts.
25. Self-latching flush bolts.
26. Exit devices and auxiliary items.
27. Lock cylinders.
28. Key control cabinet.
29. Key lock boxes.
30. Key control system software.
31. Operating trim.
32. Surface closers.
33. Concealed closers.
34. Closer holder release devices.
35. Wall- and floor-mounted stops.
36. Electromagnetic door holders.
37. Overhead stops and holders.
38. Door gasketing.
39. Thresholds.
40. Sliding door hardware.
41. Folding door hardware.
42. Metal protective trim units.
43. Plastic protection plates.
44. Auxiliary door hardware.
45. Auxiliary electrified door hardware.

B. Related Requirements:

1. **[Section 064100 "Architectural Wood Casework"]****[Section 064101 "Architectural Wood Casework (NAAWS Standard)"]** for cabinet door hardware provided with cabinets.
2. Section 081113 "Hollow Metal Doors and Frames" **[for astragals provided as part of labeled fire-rated assemblies]****[and]****[for door silencers provided as part of hollow-metal frames]**.
3. Section 081119 "Stainless-Steel Doors and Frames" **[for astragals provided as part of labeled fire-rated assemblies]****[and]****[for door silencers provided as part of stainless steel frames]**.
4. Section 081173 "Sliding Metal Fire Doors" for door and track preparation, reinforcement, and motorized operators provided as part of automatic-closing assemblies.
5. Section 081213 "Hollow Metal Frames" **[for astragals provided as part of labeled fire-rated assemblies]****[and]****[for door silencers provided as part of hollow-metal frames]**.
6. Section 081216 "Aluminum Frames" for door silencers provided as part of aluminum frames.
7. Section 081316.13 "Aluminum Terrace Doors" for entrance door hardware, **[except]****[including]** cylinders.
8. Section 081416 "Flush Wood Doors" for **[astragals]****[and]****[integral intumescent seals]** provided as part of labeled fire-rated assemblies.
9. Section 081433 "Stile and Rail Wood Doors" for **[astragals]****[and]****[integral intumescent seals]** provided as part of labeled fire-rated assemblies.
10. Section 081713 "Integrated Metal Door Opening Assemblies" for door hardware provided as part of integrated metal door opening assemblies.
11. Section 083113 "Access Doors and Frames" for access door hardware, **[except]****[including]** cylinders.
12. Section 083323 "Overhead Coiling Doors" for door hardware provided as part of overhead coiling door assemblies.
13. Section 083326 "Overhead Coiling Grilles" for door hardware provided as part of overhead coiling grille assemblies.
14. **[Section 083473.13 "Metal Sound Control Door Assemblies"]****[and]****[Section 083473.16 "Wood Sound Control Door Assemblies"]** for hinges and gasketing provided as part of sound-rated door assemblies.
15. Section 083513 "Folding Doors" for pulls, latches, hinges, guides, and pivots provided as part of the folding door package.
16. Section 084113 "Aluminum-Framed Entrances and Storefronts" for entrance door hardware, **[except]****[including]** cylinders.
17. Section 084126 "All-Glass Entrances and Storefronts" for entrance door hardware, **[except]****[including]** cylinders.
18. Section 084229.13 "Folding Automatic Entrances" for entrance door hardware, **[except]****[including]** cylinders.
19. Section 084229.23 "Sliding Automatic Entrances" for entrance door hardware, **[except]****[including]** cylinders.
20. Section 084229.33 "Swinging Automatic Entrances" for entrance door hardware, **[except]****[including]** cylinders.
21. Section 084233 "Revolving Door Entrances" for revolving door entrance hardware, **[except]****[including]** cylinders.
22. Section 084243 "Intensive Care Unit/Critical Care Unit (ICU/CCU) Entrances" for entrance door hardware, **[except]****[including]** cylinders.
23. Section 087113 "Power Door Operators" for low-energy power operators and low-energy power-assist operators.
24. Section 102213 "Wire Mesh Partitions" for door hardware for doors in wire mesh partitions, **[except]****[including]** cylinders.
25. Section 102600 "Wall and Door Protection" for plastic door protection units that match wall protection units.
26. Section 119812 "Detention Doors and Frames" for door silencers provided as part of detention frames.
27. Section 119814 "Detention Door Hardware" for hardware for detention doors.

28. Section 133419 "Metal Building Systems" for door hardware, **[except][including]** cylinders.
29. Section 134900 "Radiation Protection" for lead-lined astragals provided as part of labeled fire-rated assemblies.
30. Section 281000 "Access Control" for coordination of access control system components.
31. Section 281400 "Access Control System Hardware" for access control system units, power, battery chargers, and computer equipment.
32. Section 283100 "Intrusion Detection" for detection devices installed at door openings and provided as part of an intrusion-detection system.
33. **[Section 284600 "Fire Detection and Alarm"]****[and]****[Section 284614 "Single- and Multiple-Station Alarms"]** for connections to building fire alarm system.

1.2 ALLOWANCES

- A. Door hardware is part of **[Door Hardware Allowance]**<Insert allowance>.

1.3 COORDINATION

- A. Floor-Recessed Door Hardware: Coordinate layout and installation with floor construction.
 1. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field-verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]**<Insert location>.
 1. Conference participants must include Installer's Architectural Hardware Consultant**[and Owner's security consultant]**.
- B. Keying Conference: Conduct conference at **[Project site]**<Insert location>.
 1. Conference participants must include Installer's Architectural Hardware Consultant**[and Owner's security consultant]**.
 2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system, including, but not limited to, the following:
 - a. Flow of traffic and degree of security required.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key control system.

- d. Requirements for access control.
- e. Address for delivery of keys.
- f. **<Insert requirements to suit Project>**.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For electrified door hardware.
 - 1. Include diagrams for power, signal, and control wiring.
 - 2. Include details of interface of electrified door hardware and building safety and security systems.
- C. Samples: For each exposed product in each finish specified, in manufacturer's standard size.
 - 1. Tag Samples with full product description to coordinate Samples with door hardware schedule.
- D. Samples for Initial Selection: For each type of exposed finish.
- E. Samples for Verification: For each type of exposed product, in each finish specified.
 - 1. Sample Size: Full-size units or minimum **2-by-4-inch (51-by-102-mm)** Samples for sheet and **4-inch (102-mm)** long Samples for other products.
 - a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
 - 2. Tag Samples with full product description to coordinate Samples with door hardware schedule.
- F. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Submittal Sequence: Submit door hardware schedule **[after][or][concurrent with]** submissions of product data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - 2. Format: Use same scheduling sequence and format[**and use same door numbers**] as in door hardware schedule in the Contract Documents.
 - 3. Content: Include the following information:
 - a. Identification number, location, hand, fire rating, size, and material of each door and frame.
 - b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
 - e. Fastenings and other installation information.

- f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
 - g. Mounting locations for door hardware.
 - h. List of related door devices specified in other Sections for each door and frame.
- G. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[Installer][and][Architectural Hardware Consultant]**.
- B. Product Certificates: For each type of electrified door hardware.
 - 1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.
- C. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- D. Field quality-control reports.
- E. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals.
- B. Schedules: Final **[door hardware][and][keying]** schedule.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Door Hardware: **<Insert detailed descriptions and specific numbers of units>**.
 - 2. Electrical Parts: **<Insert detailed descriptions and specific numbers of units>**.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
 - 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.



- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as [a Door and Hardware Specification Consultant (DHSC)][an Architectural Hardware Consultant (AHC)][an Architectural Hardware Consultant (AHC) and an Electrified Hardware Consultant (EHC)][an Architectural Opening Consultant (AOC)].

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lockup for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- D. Deliver keys[and permanent cores] to Owner by registered mail or overnight package service.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. Warranty Period: [Three]<Insert number> years from date of Substantial Completion unless otherwise indicated below:
 - a. Electromagnetic and Delayed-Egress Locks: [Five]<Insert number> years from date of Substantial Completion.
 - b. Exit Devices: [Two]<Insert number> years from date of Substantial Completion.
 - c. Manual Closers: [10]<Insert number> years from date of Substantial Completion.
 - d. Concealed Floor Closers: [Five][10][25]<Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of door hardware from single manufacturer.
 - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a

testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
- B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested in accordance with UL 1784 and installed in compliance with NFPA 105.
 - 1. Air-Leakage Rate: Maximum air leakage of **[0.3 cfm per sq. ft. (3 cu. m per minute/sq. m)]<Insert rate>** at the tested pressure differential of **[0.3 inch wg (75 Pa)]<Insert value>** of water.
- C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Means of Egress Doors: Latches do not require more than **15 lbf (67 N)** to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with **[the USDOJ's "2010 ADA Standards for Accessible Design"]****[the DOT's "ADA Standards for Transportation Facilities"]****[the ABA standards of the Federal agency having jurisdiction]****[ICC A117.1]****[HUD's "Fair Housing Accessibility Guidelines"]****[and]<Insert regulation>**.
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than **5 lbf (22.2 N)**.
 - 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: **5 lbf (22.2 N)** applied perpendicular to door.
 - b. Sliding or Folding Doors: **5 lbf (22.2 N)** applied parallel to door at latch.
 - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than **1/2 inch (13 mm)** high.
 - 4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
 - 5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

2.3 HINGES

- A. Hinges: ANSI/BHMA A156.1. **[Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.]**
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following]****[provide products by one of the following]****[available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Allegion plc]**
 - b. **[Baldwin; part of the Spectrum Brands Hardware and Home Improvement Group]**

- (HHI)]
 - c. [Bommer Industries, Inc]
 - d. [Cal-Royal Products, Inc]
 - e. [Design Hardware; Mesker Openings Group; dormakaba]
 - f. [Don-Jo Mfg., Inc]
 - g. [Hager Companies]
 - h. [INOX; Unison Hardware, Inc]
 - i. [Lawrence Hardware Inc.]
 - j. [McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - k. [PAMEX Inc.]
 - l. [PBB, Inc]
 - m. [STANLEY; dormakaba USA, Inc.]
 - n. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Allegion plc]
 - b. [Baldwin; part of the Spectrum Brands Hardware and Home Improvement Group (HHI)]
 - c. [Bommer Industries, Inc]
 - d. [Cal-Royal Products, Inc]
 - e. [Design Hardware; Mesker Openings Group; dormakaba]
 - f. [Don-Jo Mfg., Inc]
 - g. [Hager Companies]
 - h. [INOX; Unison Hardware, Inc]
 - i. [Lawrence Hardware Inc.]
 - j. [McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - k. [PAMEX Inc.]
 - l. [PBB, Inc]
 - m. [STANLEY; dormakaba USA, Inc.]
 - n. <Insert manufacturer's name>

2.4 SELF-CLOSING HINGES AND PIVOTS

A. Self-Closing Hinges and Pivots: ANSI/BHMA A156.17.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- a. [Allegion plc]
 - b. [Bommer Industries, Inc]
 - c. [Cal-Royal Products, Inc]
 - d. [Design Hardware; Mesker Openings Group; dormakaba]
 - e. [Don-Jo Mfg., Inc]
 - f. [Hager Companies]
 - g. [McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - h. [PBB, Inc]

- i. **[STANLEY; dormakaba USA, Inc.]**
 - j. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[Allegion plc]**
 - b. **[Bommer Industries, Inc]**
 - c. **[Cal-Royal Products, Inc]**
 - d. **[Design Hardware; Mesker Openings Group; dormakaba]**
 - e. **[Don-Jo Mfg., Inc]**
 - f. **[Hager Companies]**
 - g. **[McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - h. **[PBB, Inc]**
 - i. **[STANLEY; dormakaba USA, Inc.]**
 - j. **<Insert manufacturer's name>**

2.5 CENTER-HUNG AND OFFSET PIVOTS

A. Center-Hung and Offset Pivots: ANSI/BHMA A156.4.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
- a. **[Accurate Lock & Hardware Co.]**
 - b. **[Allegion plc]**
 - c. **[Architectural Builders Hardware Mfg., Inc]**
 - d. **[dormakaba USA Inc.]**
 - e. **[Hager Companies]**
 - f. **[INOX; Unison Hardware, Inc]**
 - g. **[Rixson Specialty Door Controls; ASSA ABLOY]**
 - h. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[Accurate Lock & Hardware Co.]**
 - b. **[Allegion plc]**
 - c. **[Architectural Builders Hardware Mfg., Inc]**
 - d. **[dormakaba USA Inc.]**
 - e. **[Hager Companies]**
 - f. **[INOX; Unison Hardware, Inc]**
 - g. **[Rixson Specialty Door Controls; ASSA ABLOY]**
 - h. **<Insert manufacturer's name>**

2.6 CONTINUOUS HINGES

- A. Continuous, Pin-and-Barrel-Type Hinges: ANSI/BHMA A156.26; minimum **0.120-inch- (3.0-mm-)** thick, hinge leaves with minimum overall width of **4 inches (102 mm)**; fabricated to full height of door and

frame and to template screw locations; with components finished after milling and drilling are complete.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Allegion plc]**
 - b. **[Architectural Builders Hardware Mfg., Inc]**
 - c. **[Hager Companies]**
 - d. **[Lawrence Hardware Inc.]**
 - e. **[Markar Architectural Products, Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - f. **[McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - g. **[PBB, Inc]**
 - h. **[Select Products Limited]**
 - i. **[STANLEY; dormakaba USA, Inc.]**
 - j. **[Zero International; Allegion plc]**
 - k. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Allegion plc]**
 - b. **[Architectural Builders Hardware Mfg., Inc]**
 - c. **[Hager Companies]**
 - d. **[Lawrence Hardware Inc.]**
 - e. **[Markar Architectural Products, Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - f. **[McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - g. **[PBB, Inc]**
 - h. **[Select Products Limited]**
 - i. **[STANLEY; dormakaba USA, Inc.]**
 - j. **[Zero International; Allegion plc]**
 - k. **<Insert manufacturer's name>**

- B. Continuous, Gear-Type Hinges: ANSI/BHMA A156.26; minimum **0.120-inch- (3.0-mm-)** thick, extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings. Minimum overall width of **4 inches (102 mm)**; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Allegion plc]**
 - b. **[Architectural Builders Hardware Mfg., Inc]**
 - c. **[Bommer Industries, Inc]**
 - d. **[Cal-Royal Products, Inc]**
 - e. **[Hager Companies]**

- f. [Legacy Manufacturing]
 - g. [McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - h. [PBB, Inc]
 - i. [Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - j. [Select Products Limited]
 - k. [STANLEY; dormakaba USA, Inc.]
 - l. [Zero International; Allegion plc]
 - m. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Allegion plc]
 - b. [Architectural Builders Hardware Mfg., Inc]
 - c. [Bommer Industries, Inc]
 - d. [Cal-Royal Products, Inc]
 - e. [Hager Companies]
 - f. [Legacy Manufacturing]
 - g. [McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - h. [PBB, Inc]
 - i. [Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - j. [Select Products Limited]
 - k. [STANLEY; dormakaba USA, Inc.]
 - l. [Zero International; Allegion plc]
 - m. <Insert manufacturer's name>

2.7 CONCEALED HINGES

- A. Concealed Hinges: Fully concealed within mortises in the door edge and frame and allowing door to swing open 180 degrees.
- 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - b. [Simonswerk North America, Inc.]
 - c. [SOSS Door Hardware; Universal Industrial Products, Inc.]
 - d. [Sugatsune America, Inc.]
 - e. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - b. [Simonswerk North America, Inc.]

- c. **[SOSS Door Hardware; Universal Industrial Products, Inc.]**
- d. **[Sugatsune America, Inc.]**
- e. **<Insert manufacturer's name>**

2.8 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Bored Locks: Minimum **1/2-inch (13-mm)** latchbolt throw.
 - 2. Mortise Locks: Minimum **3/4-inch (19-mm)** latchbolt throw.
 - 3. Deadbolts: Minimum **[1-inch (25-mm)][1.25-inch (32-mm)]<Insert dimension>** bolt throw.
- C. Lock Backset: **2-3/4 inches (70 mm)** unless otherwise indicated.
- D. Lock Trim:
 - 1. Description: **[As indicated on Drawings]<Insert description or manufacturer's design designation>**.
 - 2. Levers: **[Wrought][Forged][Cast]**.
 - a. **<Insert model number and description>**.
 - 3. Escutcheons (Roses): **[Wrought][Forged][Cast]**.
 - 4. Dummy Trim: Match lever lock trim and escutcheons.
- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 - 3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
 - 4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.
- F. Bored Locks: ANSI/BHMA A156.2, **[Grade 1][Grade 2]**, Series 4000.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Allegion plc]**
 - b. **[Arrow USA; an ASSA ABLOY Group company]**
 - c. **[BEST Access Solutions, Inc.; dormakaba USA Inc.]**
 - d. **[Cal-Royal Products, Inc]**
 - e. **[Corbin Russwin, Inc.; an ASSA ABLOY Group company]**
 - f. **[Design Hardware; Mesker Openings Group; dormakaba]**
 - g. **[dormakaba USA Inc.]**
 - h. **[Hager Companies]**
 - i. **[INOX; Unison Hardware, Inc]**

- j. [Lawrence Hardware Inc.]
 - k. [Marks USA; Napco Security Technologies, Inc.]
 - l. [PAMEX Inc.]
 - m. [PDQ Industries, Inc.]
 - n. [SARGENT Manufacturing Company; ASSA ABLOY]
 - o. [SOSS Door Hardware; Universal Industrial Products, Inc.]
 - p. [STANLEY; dormakaba USA, Inc.]
 - q. [Weiser; part of the Spectrum Brands Hardware and Home Improvement Group (HHI)]
 - r. [Yale Security Inc; ASSA ABLOY]
 - s. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Allegion plc]
 - b. [Arrow USA; an ASSA ABLOY Group company]
 - c. [BEST Access Solutions, Inc.; dormakaba USA Inc.]
 - d. [Cal-Royal Products, Inc]
 - e. [Corbin Russwin, Inc.; an ASSA ABLOY Group company]
 - f. [Design Hardware; Mesker Openings Group; dormakaba]
 - g. [dormakaba USA Inc.]
 - h. [Hager Companies]
 - i. [INOX; Unison Hardware, Inc]
 - j. [Lawrence Hardware Inc.]
 - k. [Marks USA; Napco Security Technologies, Inc.]
 - l. [PAMEX Inc.]
 - m. [PDQ Industries, Inc.]
 - n. [SARGENT Manufacturing Company; ASSA ABLOY]
 - o. [SOSS Door Hardware; Universal Industrial Products, Inc.]
 - p. [STANLEY; dormakaba USA, Inc.]
 - q. [Weiser; part of the Spectrum Brands Hardware and Home Improvement Group (HHI)]
 - r. [Yale Security Inc; ASSA ABLOY]
 - s. <Insert manufacturer's name>
- G. Mortise Locks: ANSI/BHMA A156.13, [Operational Grade 1][Security Grade 1][Operational Grade 2][Security Grade 2]; stamped steel case with steel or brass parts; Series 1000.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Accurate Lock & Hardware Co.]
 - b. [Adams Rite Manufacturing Company, an ASSA ABLOY Group company]
 - c. [Allegion plc]
 - d. [Arrow USA; an ASSA ABLOY Group company]
 - e. [BEST Access Solutions, Inc.; dormakaba USA Inc.]
 - f. [Cal-Royal Products, Inc]
 - g. [Corbin Russwin, Inc.; an ASSA ABLOY Group company]
 - h. [Design Hardware; Mesker Openings Group; dormakaba]
 - i. [dormakaba USA Inc.]
 - j. [Hager Companies]
 - k. [INOX; Unison Hardware, Inc]

- l. [Lawrence Hardware Inc.]
- m. [Marks USA; Napco Security Technologies, Inc.]
- n. [RR Brink Locking Systems, Inc.]
- o. [SARGENT Manufacturing Company; ASSA ABLOY]
- p. [STANLEY; dormakaba USA, Inc.]
- q. [Yale Security Inc; ASSA ABLOY]
- r. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. [Accurate Lock & Hardware Co.]
- b. [Adams Rite Manufacturing Company, an ASSA ABLOY Group company]
- c. [Allegion plc]
- d. [Arrow USA; an ASSA ABLOY Group company]
- e. [BEST Access Solutions, Inc.; dormakaba USA Inc.]
- f. [Cal-Royal Products, Inc]
- g. [Corbin Russwin, Inc.; an ASSA ABLOY Group company]
- h. [Design Hardware; Mesker Openings Group; dormakaba]
- i. [dormakaba USA Inc.]
- j. [Hager Companies]
- k. [INOX; Unison Hardware, Inc]
- l. [Lawrence Hardware Inc.]
- m. [Marks USA; Napco Security Technologies, Inc.]
- n. [RR Brink Locking Systems, Inc.]
- o. [SARGENT Manufacturing Company; ASSA ABLOY]
- p. [STANLEY; dormakaba USA, Inc.]
- q. [Yale Security Inc; ASSA ABLOY]
- r. <Insert manufacturer's name>

- H. Interconnected Locks: ANSI/BHMA A156.12, [Grade 1][Grade 2], Series 5000.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Adams Rite Manufacturing Company, an ASSA ABLOY Group company]
- b. [Allegion plc]
- c. [Cal-Royal Products, Inc]
- d. [dormakaba USA Inc.]
- e. [Hager Companies]
- f. [PAMEX Inc.]
- g. [STANLEY; dormakaba USA, Inc.]
- h. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. [Adams Rite Manufacturing Company, an ASSA ABLOY Group company]
- b. [Allegion plc]
- c. [Cal-Royal Products, Inc]
- d. [dormakaba USA Inc.]

- e. **[Hager Companies]**
 - f. **[PAMEX Inc.]**
 - g. **[STANLEY; dormakaba USA, Inc.]**
 - h. **<Insert manufacturer's name>**
- I. Roller Latches: ANSI/BHMA A156.16, Grade 1; rolling plunger that engages socket or catch, with adjustable roller projection.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Allegion plc]**
 - b. **[Architectural Builders Hardware Mfg., Inc]**
 - c. **[Baldwin; part of the Spectrum Brands Hardware and Home Improvement Group (HHI)]**
 - d. **[Burns Manufacturing Incorporated]**
 - e. **[Don-Jo Mfg., Inc]**
 - f. **[Door Controls International]**
 - g. **[Hiawatha, Inc; a division of the Activar Construction Products Group]**
 - h. **[INOX; Unison Hardware, Inc]**
 - i. **[Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - j. **[Standard Metal Hardware Manufacturing LTD]**
 - k. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Allegion plc]**
 - b. **[Architectural Builders Hardware Mfg., Inc]**
 - c. **[Baldwin; part of the Spectrum Brands Hardware and Home Improvement Group (HHI)]**
 - d. **[Burns Manufacturing Incorporated]**
 - e. **[Don-Jo Mfg., Inc]**
 - f. **[Door Controls International]**
 - g. **[Hiawatha, Inc; a division of the Activar Construction Products Group]**
 - h. **[INOX; Unison Hardware, Inc]**
 - i. **[Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - j. **[Standard Metal Hardware Manufacturing LTD]**
 - k. **<Insert manufacturer's name>**
- J. Push-Pull Latches: **[Bored, ANSI/BHMA A156.2, Series 4000][Mortise, ANSI/BHMA A156.13]**; with paddle handles that retract latchbolt; capable of being mounted vertically or horizontally.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Adams Rite Manufacturing Company, an ASSA ABLOY Group company]**
 - b. **[Allegion plc]**
 - c. **[Architectural Builders Hardware Mfg., Inc]**

- d. [Corbin Russwin, Inc.; an ASSA ABLOY Group company]
 - e. [Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - f. [SARGENT Manufacturing Company; ASSA ABLOY]
 - g. [SOSS Door Hardware; Universal Industrial Products, Inc.]
 - h. [Trimco]
 - i. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Adams Rite Manufacturing Company, an ASSA ABLOY Group company]
 - b. [Allegion plc]
 - c. [Architectural Builders Hardware Mfg., Inc]
 - d. [Corbin Russwin, Inc.; an ASSA ABLOY Group company]
 - e. [Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - f. [SARGENT Manufacturing Company; ASSA ABLOY]
 - g. [SOSS Door Hardware; Universal Industrial Products, Inc.]
 - h. [Trimco]
 - i. <Insert manufacturer's name>
3. [Grade 1][Grade 2].

2.9 AUXILIARY LOCKS

- A. Bored Auxiliary Locks: ANSI/BHMA A156.36, [Grade 1][Grade 2]; with strike that suits frame.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- a. [Allegion plc]
 - b. [Arrow USA; an ASSA ABLOY Group company]
 - c. [BEST Access Solutions, Inc.; dormakaba USA Inc.]
 - d. [Cal-Royal Products, Inc]
 - e. [Hager Companies]
 - f. [INOX; Unison Hardware, Inc]
 - g. [Lawrence Hardware Inc.]
 - h. [Marks USA; Napco Security Technologies, Inc.]
 - i. [Medeco Security Locks; an ASSA ABLOY Group company]
 - j. [PDQ Industries, Inc.]
 - k. [SARGENT Manufacturing Company; ASSA ABLOY]
 - l. [STANLEY; dormakaba USA, Inc.]
 - m. [Weiser; part of the Spectrum Brands Hardware and Home Improvement Group (HHI)]
 - n. [Yale Security Inc; ASSA ABLOY]
 - o. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Allegion plc]
 - b. [Arrow USA; an ASSA ABLOY Group company]
 - c. [BEST Access Solutions, Inc.; dormakaba USA Inc.]
 - d. [Cal-Royal Products, Inc]
 - e. [Hager Companies]
 - f. [INOX; Unison Hardware, Inc]
 - g. [Lawrence Hardware Inc.]
 - h. [Marks USA; Napco Security Technologies, Inc.]
 - i. [Medeco Security Locks; an ASSA ABLOY Group company]
 - j. [PDQ Industries, Inc.]
 - k. [SARGENT Manufacturing Company; ASSA ABLOY]
 - l. [STANLEY; dormakaba USA, Inc.]
 - m. [Weiser; part of the Spectrum Brands Hardware and Home Improvement Group (HHI)]
 - n. [Yale Security Inc; ASSA ABLOY]
 - o. <Insert manufacturer's name>
- B. Mortise Auxiliary Locks: ANSI/BHMA A156.36, [Grade 1][Grade 2]; with strike that suits frame.
- 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Accurate Lock & Hardware Co.]
 - b. [Adams Rite Manufacturing Company, an ASSA ABLOY Group company]
 - c. [Allegion plc]
 - d. [Arrow USA; an ASSA ABLOY Group company]
 - e. [BEST Access Solutions, Inc.; dormakaba USA Inc.]
 - f. [Cal-Royal Products, Inc]
 - g. [Hager Companies]
 - h. [RR Brink Locking Systems, Inc.]
 - i. [SARGENT Manufacturing Company; ASSA ABLOY]
 - j. [STANLEY; dormakaba USA, Inc.]
 - k. [Yale Security Inc; ASSA ABLOY]
 - l. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Accurate Lock & Hardware Co.]
 - b. [Adams Rite Manufacturing Company, an ASSA ABLOY Group company]
 - c. [Allegion plc]
 - d. [Arrow USA; an ASSA ABLOY Group company]
 - e. [BEST Access Solutions, Inc.; dormakaba USA Inc.]
 - f. [Cal-Royal Products, Inc]
 - g. [Hager Companies]
 - h. [RR Brink Locking Systems, Inc.]
 - i. [SARGENT Manufacturing Company; ASSA ABLOY]
 - j. [STANLEY; dormakaba USA, Inc.]
 - k. [Yale Security Inc; ASSA ABLOY]
 - l. <Insert manufacturer's name>
- C. Narrow-Stile Auxiliary Locks: ANSI/BHMA A156.36, [Grade 1][Grade 2]; with strike that suits frame.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Accurate Lock & Hardware Co.]**
 - b. **[Adams Rite Manufacturing Company, an ASSA ABLOY Group company]**
 - c. **[Kaba Ilco Corp.]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Accurate Lock & Hardware Co.]**
 - b. **[Adams Rite Manufacturing Company, an ASSA ABLOY Group company]**
 - c. **[Kaba Ilco Corp.]**
 - d. **<Insert manufacturer's name>**

D. Push-Button Combination Locks: ANSI/BHMA A156.36, cylindrical, Grade 1; lock opens by entering a one- to five-digit code by pushing correct buttons in correct sequence; automatically relocks when door is closed; with strike that suits frame.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Kaba Ilco Corp.]**
 - b. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Kaba Ilco Corp.]**
 - b. **<Insert manufacturer's name>**

2.10 ELECTRIC STRIKES

- A. Electric Strikes: ANSI/BHMA A156.31, **[Grade 1][Grade 2]**; with faceplate to suit lock and frame.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Adams Rite Manufacturing Company, an ASSA ABLOY Group company]**
 - b. **[Allegion plc]**
 - c. **[ASSA ABLOY Electronic Security Hardware; ASSA ABLOY]**
 - d. **[Dortronics Systems, Inc]**
 - e. **[DynaLock Corp]**
 - f. **[Hager Companies]**
 - g. **[Hanchett Entry Systems (HES), Inc.; ASSA ABLOY Group]**

- h. [PDQ Industries, Inc.]
 - i. [Rutherford Controls Int'l. (RCI); dormakaba Group]
 - j. [Security Door Controls]
 - k. [STANLEY; dormakaba USA, Inc.]
 - l. [Trine Access Technology]
 - m. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Adams Rite Manufacturing Company, an ASSA ABLOY Group company]
 - b. [Allegion plc]
 - c. [ASSA ABLOY Electronic Security Hardware; ASSA ABLOY]
 - d. [Dortronics Systems, Inc]
 - e. [DynaLock Corp]
 - f. [Hager Companies]
 - g. [Hanchett Entry Systems (HES), Inc.; ASSA ABLOY Group]
 - h. [PDQ Industries, Inc.]
 - i. [Rutherford Controls Int'l. (RCI); dormakaba Group]
 - j. [Security Door Controls]
 - k. [STANLEY; dormakaba USA, Inc.]
 - l. [Trine Access Technology]
 - m. <Insert manufacturer's name>

2.11 ELECTROMAGNETIC LOCKS

- A. Electromagnetic Locks: ANSI/BHMA A156.23; electrically powered; with electromagnet attached to frame and armature plate attached to door; full-exterior or full-interior type, as required by application indicated.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- a. [Allegion plc]
 - b. [ASSA ABLOY Electronic Security Hardware; ASSA ABLOY]
 - c. [Door Controls International]
 - d. [dormakaba USA Inc.]
 - e. [Dortronics Systems, Inc]
 - f. [DynaLock Corp]
 - g. [Hager Companies]
 - h. [Rutherford Controls Int'l. (RCI); dormakaba Group]
 - i. [Security Door Controls]
 - j. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Allegion plc]
 - b. [ASSA ABLOY Electronic Security Hardware; ASSA ABLOY]
 - c. [Door Controls International]
 - d. [dormakaba USA Inc.]

- e. [Dortronics Systems, Inc]
- f. [DynaLock Corp]
- g. [Hager Companies]
- h. [Rutherford Controls Int'l. (RCI); dormakaba Group]
- i. [Security Door Controls]
- j. <Insert manufacturer's name>

B. Delayed-Egress Electromagnetic Locks: ANSI/BHMA A156.24; electrically powered; with electromagnet attached to frame and armature plate attached to door; depressing push bar for more than three seconds initiates irreversible alarm and adjustable time delay for egress. When integrated with fire alarm, fire alarm voids time delay.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. [Allegion plc]
- b. [ASSA ABLOY Electronic Security Hardware; ASSA ABLOY]
- c. [Door Controls International]
- d. [DynaLock Corp]
- e. [Rutherford Controls Int'l. (RCI); dormakaba Group]
- f. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. [Allegion plc]
- b. [ASSA ABLOY Electronic Security Hardware; ASSA ABLOY]
- c. [Door Controls International]
- d. [DynaLock Corp]
- e. [Rutherford Controls Int'l. (RCI); dormakaba Group]
- f. <Insert manufacturer's name>

2.12 ELECTROMECHANICAL LOCKS

A. Electromechanical Locks: ANSI/BHMA A156.25, **[Grade 1][Grade 2]**; motor or solenoid driven; with strike that suits frame.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. [Allegion plc]
- b. [BEST Access Solutions, Inc.; dormakaba USA Inc.]
- c. [DynaLock Corp]
- d. [Lawrence Hardware Inc.]
- e. [Marks USA; Napco Security Technologies, Inc.]
- f. [PDQ Industries, Inc.]
- g. [RR Brink Locking Systems, Inc.]
- h. [Rutherford Controls Int'l. (RCI); dormakaba Group]
- i. [SARGENT Manufacturing Company; ASSA ABLOY]

- j. [Security Door Controls]
 - k. [STANLEY; dormakaba USA, Inc.]
 - l. [Weiser; part of the Spectrum Brands Hardware and Home Improvement Group (HHI)]
 - m. [Yale Security Inc; ASSA ABLOY]
 - n. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Allegion plc]
 - b. [BEST Access Solutions, Inc.; dormakaba USA Inc.]
 - c. [DynaLock Corp]
 - d. [Lawrence Hardware Inc.]
 - e. [Marks USA; Napco Security Technologies, Inc.]
 - f. [PDQ Industries, Inc.]
 - g. [RR Brink Locking Systems, Inc.]
 - h. [Rutherford Controls Int'l. (RCI); dormakaba Group]
 - i. [SARGENT Manufacturing Company; ASSA ABLOY]
 - j. [Security Door Controls]
 - k. [STANLEY; dormakaba USA, Inc.]
 - l. [Weiser; part of the Spectrum Brands Hardware and Home Improvement Group (HHI)]
 - m. [Yale Security Inc; ASSA ABLOY]
 - n. <Insert manufacturer's name>
3. Type: [Bored][Mortise latchbolt][Mortise deadbolt][Mortise deadlocking latchbolt].

2.13 SELF-CONTAINED ELECTRONIC LOCKS

- A. Self-Contained Electronic Locks: ANSI/BHMA A156.25, [bored][mortise]; with internal, battery-powered, self-contained electronic locks; consisting of complete lockset, motor-driven lock mechanism, and actuating device; enclosed in zinc-dichromate-plated, wrought-steel case, and strike that suits frame. Provide key override, low-battery detection and warning, LED status indicators, and ability to program at the lock.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- a. [Allegion plc]
 - b. [BEST Access Solutions, Inc.; dormakaba USA Inc.]
 - c. [Kaba Ilco Corp.]
 - d. [Marks USA; Napco Security Technologies, Inc.]
 - e. [Onity; a Honeywell Company]
 - f. [SARGENT Manufacturing Company; ASSA ABLOY]
 - g. [Yale Security Inc; ASSA ABLOY]
 - h. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Allegion plc]
- b. [BEST Access Solutions, Inc.; dormakaba USA Inc.]
- c. [Kaba Ilco Corp.]
- d. [Marks USA; Napco Security Technologies, Inc.]
- e. [Onity; a Honeywell Company]
- f. [SARGENT Manufacturing Company; ASSA ABLOY]
- g. [Yale Security Inc; ASSA ABLOY]
- h. <Insert manufacturer's name>

2.14 EXIT LOCKS AND EXIT ALARMS

A. Exit Locks and Alarms: ANSI/BHMA A156.29, Grade 1.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. [Arrow USA; an ASSA ABLOY Group company]
 - b. [Detex Corporation]
 - c. [Precision Hardware, Inc.; dormakaba Group]
 - d. [SARGENT Manufacturing Company; ASSA ABLOY]
 - e. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. [Arrow USA; an ASSA ABLOY Group company]
 - b. [Detex Corporation]
 - c. [Precision Hardware, Inc.; dormakaba Group]
 - d. [SARGENT Manufacturing Company; ASSA ABLOY]
 - e. <Insert manufacturer's name>

2.15 SURFACE BOLTS

A. Surface Bolts: ANSI/BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. [Allegion plc]
 - b. [Burns Manufacturing Incorporated]
 - c. [Don-Jo Mfg., Inc]
 - d. [Door Controls International]
 - e. [Hiawatha, Inc; a division of the Activar Construction Products Group]
 - f. [Standard Metal Hardware Manufacturing LTD]
 - g. [Trimco]
 - h. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert**

manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Allegion plc]
- b. [Burns Manufacturing Incorporated]
- c. [Don-Jo Mfg., Inc]
- d. [Door Controls International]
- e. [Hiawatha, Inc; a division of the Activar Construction Products Group]
- f. [Standard Metal Hardware Manufacturing LTD]
- g. [Trimco]
- h. <Insert manufacturer's name>

2.16 MANUAL FLUSH BOLTS

- A. Manual Flush Bolts: ANSI/BHMA A156.16; minimum **3/4-inch (19-mm)** throw; designed for mortising into door edge.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. [Adams Rite Manufacturing Company, an ASSA ABLOY Group company]
 - b. [Allegion plc]
 - c. [Burns Manufacturing Incorporated]
 - d. [Don-Jo Mfg., Inc]
 - e. [Door Controls International]
 - f. [Hiawatha, Inc; a division of the Activar Construction Products Group]
 - g. [INOX; Unison Hardware, Inc]
 - h. [Standard Metal Hardware Manufacturing LTD]
 - i. [Trimco]
 - j. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. [Adams Rite Manufacturing Company, an ASSA ABLOY Group company]
 - b. [Allegion plc]
 - c. [Burns Manufacturing Incorporated]
 - d. [Don-Jo Mfg., Inc]
 - e. [Door Controls International]
 - f. [Hiawatha, Inc; a division of the Activar Construction Products Group]
 - g. [INOX; Unison Hardware, Inc]
 - h. [Standard Metal Hardware Manufacturing LTD]
 - i. [Trimco]
 - j. <Insert manufacturer's name>

2.17 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

- A. Automatic Flush Bolts: ANSI/BHMA A156.3, Type 25; minimum **3/4-inch (19-mm)** throw; with dust-proof strikes; designed for mortising into door edge. **[Include wear plates.]**

1. Manufacturers: Subject to compliance with requirements, **[provide products by the**

following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Allegion plc]
- b. [Burns Manufacturing Incorporated]
- c. [Cal-Royal Products, Inc]
- d. [Don-Jo Mfg., Inc]
- e. [Door Controls International]
- f. [Rutherford Controls Int'l. (RCI); dormakaba Group]
- g. [Standard Metal Hardware Manufacturing LTD]
- h. [Trimco]
- i. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Allegion plc]
- b. [Burns Manufacturing Incorporated]
- c. [Cal-Royal Products, Inc]
- d. [Don-Jo Mfg., Inc]
- e. [Door Controls International]
- f. [Rutherford Controls Int'l. (RCI); dormakaba Group]
- g. [Standard Metal Hardware Manufacturing LTD]
- h. [Trimco]
- i. <Insert manufacturer's name>

- B. Self-Latching Flush Bolts: ANSI/BHMA A156.3, Type 27; minimum **3/4-inch (19-mm)** throw; with dust-proof strikes; designed for mortising into door edge.[**Include wear plates.**]

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Allegion plc]
- b. [Burns Manufacturing Incorporated]
- c. [Cal-Royal Products, Inc]
- d. [Don-Jo Mfg., Inc]
- e. [Door Controls International]
- f. [Rutherford Controls Int'l. (RCI); dormakaba Group]
- g. [Standard Metal Hardware Manufacturing LTD]
- h. [Trimco]
- i. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Allegion plc]
- b. [Burns Manufacturing Incorporated]
- c. [Cal-Royal Products, Inc]
- d. [Don-Jo Mfg., Inc]
- e. [Door Controls International]

- f. [Rutherford Controls Int'l. (RCI); dormakaba Group]
- g. [Standard Metal Hardware Manufacturing LTD]
- h. [Trimco]
- i. <Insert manufacturer's name>

2.18 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: ANSI/BHMA A156.3.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. [Adams Rite Manufacturing Company, an ASSA ABLOY Group company]
 - b. [Allegion plc]
 - c. [Arrow USA; an ASSA ABLOY Group company]
 - d. [C.R. Laurence Co., Inc.; CRH Americas, Inc.]
 - e. [Cal-Royal Products, Inc]
 - f. [Corbin Russwin, Inc.; an ASSA ABLOY Group company]
 - g. [Design Hardware; Mesker Openings Group; dormakaba]
 - h. [Detex Corporation]
 - i. [Door Controls International]
 - j. [dormakaba USA Inc.]
 - k. [Hager Companies]
 - l. [INOX; Unison Hardware, Inc]
 - m. [Lawrence Hardware Inc.]
 - n. [PAMEX Inc.]
 - o. [Precision Hardware, Inc.; dormakaba Group]
 - p. [Rutherford Controls Int'l. (RCI); dormakaba Group]
 - q. [SARGENT Manufacturing Company; ASSA ABLOY]
 - r. [STANLEY; dormakaba USA, Inc.]
 - s. [Yale Security Inc; ASSA ABLOY]
 - t. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. [Adams Rite Manufacturing Company, an ASSA ABLOY Group company]
 - b. [Allegion plc]
 - c. [Arrow USA; an ASSA ABLOY Group company]
 - d. [C.R. Laurence Co., Inc.; CRH Americas, Inc.]
 - e. [Cal-Royal Products, Inc]
 - f. [Corbin Russwin, Inc.; an ASSA ABLOY Group company]
 - g. [Design Hardware; Mesker Openings Group; dormakaba]
 - h. [Detex Corporation]
 - i. [Door Controls International]
 - j. [dormakaba USA Inc.]
 - k. [Hager Companies]
 - l. [INOX; Unison Hardware, Inc]
 - m. [Lawrence Hardware Inc.]
 - n. [PAMEX Inc.]
 - o. [Precision Hardware, Inc.; dormakaba Group]
 - p. [Rutherford Controls Int'l. (RCI); dormakaba Group]

- q. [SARGENT Manufacturing Company; ASSA ABLOY]
- r. [STANLEY; dormakaba USA, Inc.]
- s. [Yale Security Inc; ASSA ABLOY]
- t. <Insert manufacturer's name>

2.19 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. **Provide cylinder from same manufacturer of locking devices.**
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. [Allegion plc]
 - b. [Arrow USA; an ASSA ABLOY Group company]
 - c. [ASSA, Inc.]
 - d. [BEST Access Solutions, Inc.; dormakaba USA Inc.]
 - e. [Cal-Royal Products, Inc]
 - f. [Corbin Russwin, Inc.; an ASSA ABLOY Group company]
 - g. [Hager Companies]
 - h. [Medeco Security Locks; an ASSA ABLOY Group company]
 - i. [PAMEX Inc.]
 - j. [PDQ Industries, Inc.]
 - k. [SARGENT Manufacturing Company; ASSA ABLOY]
 - l. [STANLEY; dormakaba USA, Inc.]
 - m. [Yale Security Inc; ASSA ABLOY]
 - n. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Allegion plc]
 - b. [Arrow USA; an ASSA ABLOY Group company]
 - c. [ASSA, Inc.]
 - d. [BEST Access Solutions, Inc.; dormakaba USA Inc.]
 - e. [Cal-Royal Products, Inc]
 - f. [Corbin Russwin, Inc.; an ASSA ABLOY Group company]
 - g. [Hager Companies]
 - h. [Medeco Security Locks; an ASSA ABLOY Group company]
 - i. [PAMEX Inc.]
 - j. [PDQ Industries, Inc.]
 - k. [SARGENT Manufacturing Company; ASSA ABLOY]
 - l. [STANLEY; dormakaba USA, Inc.]
 - m. [Yale Security Inc; ASSA ABLOY]
 - n. <Insert manufacturer's name>
- B. Standard Lock Cylinders: ANSI/BHMA A156.5, **[Grade 1][Grade 1A][Grade 2]** permanent cores; face finished to match lockset.
1. Core Type: **[Interchangeable][Removable]**.

- C. High-Security Lock Cylinders: ANSI/BHMA A156.30, [Grade 1][Grade 2][Grade 3] permanent cores that are removable; face finished to match lockset.
 - 1. [Type M, mechanical][Type E, electrical].
- D. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
- E. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.20 KEYING

- A. Keying System: Factory registered, complying with guidelines in ANSI/BHMA A156.28, appendix. Provide one extra key blank for each lock. [**Incorporate decisions made in keying conference.**]
 - 1. No Master Key System: Only change keys operate cylinders.
 - a. Provide three cylinder change keys.
 - 2. Master Key System: Change keys and a master key operate cylinders.
 - a. Provide three cylinder change keys and five master keys.
 - 3. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.
 - a. Provide three cylinder change keys and five each of master and grand master keys.
 - 4. Great-Grand Master Key System: Change keys, a master key, a grand master key, and a great-grand master key operate cylinders.
 - a. Provide three cylinder change keys and five each of master, grand master, and great-grand master keys.
 - 5. Existing System:
 - a. Master key or grand master key locks to Owner's existing system.
 - b. Re-key Owner's existing master key system into new keying system.
 - 6. Keyed Alike: Key all cylinders to same change key.
- B. Keys: [Nickel silver][Brass].
 - 1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - a. Notation: ["DO NOT DUPLICATE."][Information to be furnished by Owner.]

2.21 KEY CONTROL SYSTEM

- A. Key Control Cabinet: ANSI/BHMA A156.28; metal cabinet with baked-enamel finish, containing key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and

temporary and permanent markers; with key capacity of [150]<Insert number> percent of the number of locks.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[American Key Boxes and Cabinets]**
 - b. **[HPC, a Hudson Lock Company]**
 - c. **[Interlogix; Carrier Global Corporation]**
 - d. **[Lund Equipment Co., Inc]**
 - e. **[MMF Industries]**
 - f. **[TelKee; Oasis International]**
 - g. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[American Key Boxes and Cabinets]**
 - b. **[HPC, a Hudson Lock Company]**
 - c. **[Interlogix; Carrier Global Corporation]**
 - d. **[Lund Equipment Co., Inc]**
 - e. **[MMF Industries]**
 - f. **[TelKee; Oasis International]**
 - g. **<Insert manufacturer's name>**
3. Multiple-Drawer Cabinet: **[Grade 1][Grade 2]** cabinet with drawers equipped with key-holding panels, key envelope storage, and progressive-type ball-bearing suspension slides. Include single cylinder lock to lock all drawers.
4. Wall-Mounted Cabinet: **[Grade 1][Grade 2]** cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.
5. Portable Cabinet: **[Grade 1][Grade 2]** tray for mounting in file cabinet, equipped with key-holding panels, envelopes, and cross-index system.

B. Key Lock Boxes: Designed for storage of **[two][10]<Insert number>** keys.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[HPC, a Hudson Lock Company]**
 - b. **[Kidde; Carrier Global Corporation]**
 - c. **[Knox Company]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[HPC, a Hudson Lock Company]**
 - b. **[Kidde; Carrier Global Corporation]**
 - c. **[Knox Company]**

- d. <Insert manufacturer's name>
- C. Key Control System Software: Multiple-index system for recording and reporting key-holder listings, tracking keys and lock and key history, and printing receipts for transactions. Include instruction manual.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Allegion plc]**
 - b. **[BEST Access Solutions, Inc.; dormakaba USA Inc.]**
 - c. **[HPC, a Hudson Lock Company]**
 - d. **[Interlogix; Carrier Global Corporation]**
 - e. **[TelKee; Oasis International]**
 - f. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Allegion plc]**
 - b. **[BEST Access Solutions, Inc.; dormakaba USA Inc.]**
 - c. **[HPC, a Hudson Lock Company]**
 - d. **[Interlogix; Carrier Global Corporation]**
 - e. **[TelKee; Oasis International]**
 - f. **<Insert manufacturer's name>**

2.22 OPERATING TRIM

- A. Operating Trim: ANSI/BHMA A156.6; **[aluminum][brass][bronze][stainless steel]** unless otherwise indicated.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Allegion plc]**
 - b. **[Burns Manufacturing Incorporated]**
 - c. **[Don-Jo Mfg., Inc]**
 - d. **[Forms+Surfaces]**
 - e. **[Hager Companies]**
 - f. **[Hiawatha, Inc; a division of the Activar Construction Products Group]**
 - g. **[INOX; Unison Hardware, Inc]**
 - h. **[Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - i. **[Standard Metal Hardware Manufacturing LTD]**
 - j. **[Trimco]**
 - k. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. [Allegion plc]
- b. [Burns Manufacturing Incorporated]
- c. [Don-Jo Mfg., Inc]
- d. [Forms+Surfaces]
- e. [Hager Companies]
- f. [Hiawatha, Inc; a division of the Activar Construction Products Group]
- g. [INOX; Unison Hardware, Inc]
- h. [Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
- i. [Standard Metal Hardware Manufacturing LTD]
- j. [Trimco]
- k. <Insert manufacturer's name>

2.23 ACCESSORIES FOR PAIRS OF DOORS

- A. Coordinators: ANSI/BHMA A156.3; consisting of active-leaf, hold-open lever, and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release[; **and with internal override**].
- B. Carry-Open Bars: ANSI/BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.
- C. Astragals: ANSI/BHMA A156.22.

2.24 SURFACE CLOSERS

- A. Surface Closers: ANSI/BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. [Allegion plc]
- b. [Arrow USA; an ASSA ABLOY Group company]
- c. [Cal-Royal Products, Inc]
- d. [Corbin Russwin, Inc.; an ASSA ABLOY Group company]
- e. [Design Hardware; Mesker Openings Group; dormakaba]
- f. [dormakaba USA Inc.]
- g. [Hager Companies]
- h. [INOX; Unison Hardware, Inc]
- i. [Norton Door Controls; ASSA ABLOY]
- j. [PAMEX Inc.]
- k. [Rixson Specialty Door Controls; ASSA ABLOY]
- l. [SARGENT Manufacturing Company; ASSA ABLOY]
- m. [STANLEY; dormakaba USA, Inc.]
- n. [Yale Security Inc; ASSA ABLOY]
- o. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. [Allegion plc]
 - b. [Arrow USA; an ASSA ABLOY Group company]
 - c. [Cal-Royal Products, Inc]
 - d. [Corbin Russwin, Inc.; an ASSA ABLOY Group company]
 - e. [Design Hardware; Mesker Openings Group; dormakaba]
 - f. [dormakaba USA Inc.]
 - g. [Hager Companies]
 - h. [INOX; Unison Hardware, Inc]
 - i. [Norton Door Controls; ASSA ABLOY]
 - j. [PAMEX Inc.]
 - k. [Rixson Specialty Door Controls; ASSA ABLOY]
 - l. [SARGENT Manufacturing Company; ASSA ABLOY]
 - m. [STANLEY; dormakaba USA, Inc.]
 - n. [Yale Security Inc; ASSA ABLOY]
 - o. **<Insert manufacturer's name>**

2.25 CONCEALED CLOSERS

- A. Concealed Closers: ANSI/BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. [Allegion plc]
 - b. [dormakaba USA Inc.]
 - c. [Norton Door Controls; ASSA ABLOY]
 - d. [Rixson Specialty Door Controls; ASSA ABLOY]
 - e. [SARGENT Manufacturing Company; ASSA ABLOY]
 - f. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. [Allegion plc]
 - b. [dormakaba USA Inc.]
 - c. [Norton Door Controls; ASSA ABLOY]
 - d. [Rixson Specialty Door Controls; ASSA ABLOY]
 - e. [SARGENT Manufacturing Company; ASSA ABLOY]
 - f. **<Insert manufacturer's name>**

2.26 CLOSER HOLDER RELEASE DEVICES

- A. Closer Holder Release Devices: ANSI/BHMA A156.15, Grade 1; closer connected with separate or integral releasing and fire- or smoke-detecting devices. Door must become self-closing on interruption of

signal to release device. Automatic release is activated by **[smoke detection system][loss of power]**.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Allegion plc]**
 - b. **[Corbin Russwin, Inc.; an ASSA ABLOY Group company]**
 - c. **[dormakaba USA Inc.]**
 - d. **[Norton Door Controls; ASSA ABLOY]**
 - e. **[Rixson Specialty Door Controls; ASSA ABLOY]**
 - f. **[SARGENT Manufacturing Company; ASSA ABLOY]**
 - g. **[STANLEY; dormakaba USA, Inc.]**
 - h. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Allegion plc]**
 - b. **[Corbin Russwin, Inc.; an ASSA ABLOY Group company]**
 - c. **[dormakaba USA Inc.]**
 - d. **[Norton Door Controls; ASSA ABLOY]**
 - e. **[Rixson Specialty Door Controls; ASSA ABLOY]**
 - f. **[SARGENT Manufacturing Company; ASSA ABLOY]**
 - g. **[STANLEY; dormakaba USA, Inc.]**
 - h. **<Insert manufacturer's name>**

2.27 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: ANSI/BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Allegion plc]**
 - b. **[Architectural Builders Hardware Mfg., Inc]**
 - c. **[ASI-American Specialties, Inc.]**
 - d. **[Baldwin; part of the Spectrum Brands Hardware and Home Improvement Group (HHI)]**
 - e. **[Burns Manufacturing Incorporated]**
 - f. **[Cal-Royal Products, Inc]**
 - g. **[Don-Jo Mfg., Inc]**
 - h. **[Door Controls International]**
 - i. **[Hager Companies]**
 - j. **[Hiawatha, Inc; a division of the Activar Construction Products Group]**
 - k. **[Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - l. **[Trimco]**
 - m. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Allegion plc]**
 - b. **[Architectural Builders Hardware Mfg., Inc]**
 - c. **[ASI-American Specialties, Inc.]**
 - d. **[Baldwin; part of the Spectrum Brands Hardware and Home Improvement Group (HHI)]**
 - e. **[Burns Manufacturing Incorporated]**
 - f. **[Cal-Royal Products, Inc]**
 - g. **[Don-Jo Mfg., Inc]**
 - h. **[Door Controls International]**
 - i. **[Hager Companies]**
 - j. **[Hiawatha, Inc; a division of the Activar Construction Products Group]**
 - k. **[Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - l. **[Trimco]**
 - m. **<Insert manufacturer's name>**

2.28 ELECTROMAGNETIC STOPS AND HOLDERS

- A. Electromagnetic Door Holders: ANSI/BHMA A156.15, Grade 1; **[wall-mounted electromagnetic single][floor-mounted electromagnet single][floor-mounted electromagnet double]** unit with strike plate attached to swinging door; coordinated with fire detectors and interfaced with fire-alarm system for labeled fire-rated door assemblies.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Allegion plc]**
 - b. **[Architectural Builders Hardware Mfg., Inc]**
 - c. **[dormakaba USA Inc.]**
 - d. **[Hager Companies]**
 - e. **[INOX; Unison Hardware, Inc]**
 - f. **[Lawrence Hardware Inc.]**
 - g. **[SARGENT Manufacturing Company; ASSA ABLOY]**
 - h. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Allegion plc]**
 - b. **[Architectural Builders Hardware Mfg., Inc]**
 - c. **[dormakaba USA Inc.]**
 - d. **[Hager Companies]**
 - e. **[INOX; Unison Hardware, Inc]**
 - f. **[Lawrence Hardware Inc.]**
 - g. **[SARGENT Manufacturing Company; ASSA ABLOY]**
 - h. **<Insert manufacturer's name>**

2.29 OVERHEAD STOPS AND HOLDERS

- A. Overhead Stops and Holders: ANSI/BHMA A156.8.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Allegion plc]**
 - b. **[Architectural Builders Hardware Mfg., Inc]**
 - c. **[dormakaba USA Inc.]**
 - d. **[Hager Companies]**
 - e. **[INOX; Unison Hardware, Inc]**
 - f. **[Rixson Specialty Door Controls; ASSA ABLOY]**
 - g. **[SARGENT Manufacturing Company; ASSA ABLOY]**
 - h. **[Standard Metal Hardware Manufacturing LTD]**
 - i. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Allegion plc]**
 - b. **[Architectural Builders Hardware Mfg., Inc]**
 - c. **[dormakaba USA Inc.]**
 - d. **[Hager Companies]**
 - e. **[INOX; Unison Hardware, Inc]**
 - f. **[Rixson Specialty Door Controls; ASSA ABLOY]**
 - g. **[SARGENT Manufacturing Company; ASSA ABLOY]**
 - h. **[Standard Metal Hardware Manufacturing LTD]**
 - i. **<Insert manufacturer's name>**

2.30 DOOR GASKETING

- A. Door Gasketing: ANSI/BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Hager Companies]**
 - b. **[Legacy Manufacturing]**
 - c. **[M-D Building Products, Inc]**
 - d. **[National Guard Products, Inc]**
 - e. **[Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - f. **[Reese Enterprises, Inc]**
 - g. **[Sealeze]**
 - h. **[Zero International; Allegion plc]**
 - i. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. [Hager Companies]
 - b. [Legacy Manufacturing]
 - c. [M-D Building Products, Inc]
 - d. [National Guard Products, Inc]
 - e. [Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - f. [Reese Enterprises, Inc]
 - g. [Sealeze]
 - h. [Zero International; Allegion plc]
 - i. <Insert manufacturer's name>

- B. Maximum Air Leakage: When tested in accordance with ASTM E283/E283M with tested pressure differential of **0.3 inch wg (75 Pa)**, as follows:

1. Smoke-Rated Gasketing: **0.3 cfm/sq. ft. (3 cu. m per minute/sq. m)** of door opening.
2. Gasketing on Single Doors: **0.3 cfm/sq. ft. (3 cu. m per minute/sq. m)** of door opening.
3. Gasketing on Double Doors: **0.50 cfm per ft. (0.000774 cu. m/s per m)** of door opening.

2.31 THRESHOLDS

- A. Thresholds: ANSI/BHMA A156.21; fabricated to full width of opening indicated.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. [Hager Companies]
 - b. [Legacy Manufacturing]
 - c. [M-D Building Products, Inc]
 - d. [National Guard Products, Inc]
 - e. [Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - f. [Reese Enterprises, Inc]
 - g. [Rixson Specialty Door Controls; ASSA ABLOY]
 - h. [Sealeze]
 - i. [Zero International; Allegion plc]
 - j. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. [Hager Companies]
 - b. [Legacy Manufacturing]
 - c. [M-D Building Products, Inc]
 - d. [National Guard Products, Inc]
 - e. [Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - f. [Reese Enterprises, Inc]
 - g. [Rixson Specialty Door Controls; ASSA ABLOY]

- h. [Sealeze]
- i. [Zero International; Allegion plc]
- j. <Insert manufacturer's name>

2.32 SLIDING DOOR HARDWARE

- A. Sliding Door Hardware: ANSI/BHMA A156.14; consisting of complete sets, including rails, hangers, supports, bumpers, floor guides, and accessories indicated.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. [Arthur Cox & Sons, Inc.]
 - b. [Hager Companies]
 - c. [Hettich America L.P.]
 - d. [Johnson, L. E., Products, Inc]
 - e. [K.N. Crowder Mfg. Inc]
 - f. [PC Henderson Inc.]
 - g. [STANLEY; dormakaba USA, Inc.]
 - h. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Arthur Cox & Sons, Inc.]
 - b. [Hager Companies]
 - c. [Hettich America L.P.]
 - d. [Johnson, L. E., Products, Inc]
 - e. [K.N. Crowder Mfg. Inc]
 - f. [PC Henderson Inc.]
 - g. [STANLEY; dormakaba USA, Inc.]
 - h. <Insert manufacturer's name>

2.33 FOLDING DOOR HARDWARE

- A. Folding Door Hardware: ANSI/BHMA A156.14; complete sets, including overhead rails, hangers, supports, bumpers, floor guides, and accessories indicated.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. [Arthur Cox & Sons, Inc.]
 - b. [Johnson, L. E., Products, Inc]
 - c. [PC Henderson Inc.]
 - d. [STANLEY; dormakaba USA, Inc.]
 - e. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert

manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Arthur Cox & Sons, Inc.]
- b. [Johnson, L. E., Products, Inc]
- c. [PC Henderson Inc.]
- d. [STANLEY; dormakaba USA, Inc.]
- e. <Insert manufacturer's name>

2.34 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: ANSI/BHMA A156.6; fabricated from **0.050-inch- (1.3-mm-)** thick **[aluminum][brass][bronze][stainless steel]**; with manufacturer's standard machine or self-tapping screw fasteners.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. [Allegion plc]
 - b. [Burns Manufacturing Incorporated]
 - c. [Don-Jo Mfg., Inc]
 - d. [Hager Companies]
 - e. [Hiawatha, Inc; a division of the Activar Construction Products Group]
 - f. [INOX; Unison Hardware, Inc]
 - g. [inpro Corporation]
 - h. [Pawling Corporation]
 - i. [Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - j. [Standard Metal Hardware Manufacturing LTD]
 - k. [Trimco]
 - l. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert **manufacturer's name; product name or designation**> or comparable product by one of the following:
 - a. [Allegion plc]
 - b. [Burns Manufacturing Incorporated]
 - c. [Don-Jo Mfg., Inc]
 - d. [Hager Companies]
 - e. [Hiawatha, Inc; a division of the Activar Construction Products Group]
 - f. [INOX; Unison Hardware, Inc]
 - g. [inpro Corporation]
 - h. [Pawling Corporation]
 - i. [Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - j. [Standard Metal Hardware Manufacturing LTD]
 - k. [Trimco]
 - l. <Insert manufacturer's name>

2.35 PLASTIC PROTECTION PLATES

- A. Plastic Protection Plates: ANSI/BHMA A156.6; fabricated with four sides beveled; **[plastic laminate; 1/8 inch (3.2 mm) thick; ISO 4586, Grade HGS][rigid plastic; 0.060-inch- (1.5-mm-) thick, PVC or acrylic-modified vinyl plastic][acrylic; 1/8 inch (3.2 mm) thick]**.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Allegion plc]**
 - b. **[American Floor Products Company, Inc]**
 - c. **[Burns Manufacturing Incorporated]**
 - d. **[Don-Jo Mfg., Inc]**
 - e. **[Hiawatha, Inc; a division of the Activar Construction Products Group]**
 - f. **[inpro Corporation]**
 - g. **[Pawling Corporation]**
 - h. **[Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - i. **[Standard Metal Hardware Manufacturing LTD]**
 - j. **[Trimco]**
 - k. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Allegion plc]**
 - b. **[American Floor Products Company, Inc]**
 - c. **[Burns Manufacturing Incorporated]**
 - d. **[Don-Jo Mfg., Inc]**
 - e. **[Hiawatha, Inc; a division of the Activar Construction Products Group]**
 - f. **[inpro Corporation]**
 - g. **[Pawling Corporation]**
 - h. **[Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - i. **[Standard Metal Hardware Manufacturing LTD]**
 - j. **[Trimco]**
 - k. **<Insert manufacturer's name>**

2.36 AUXILIARY DOOR HARDWARE

- A. Auxiliary Door Hardware: ANSI/BHMA A156.16.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Allegion plc]**
 - b. **[Baldwin; part of the Spectrum Brands Hardware and Home Improvement Group (HHI)]**
 - c. **[Cal-Royal Products, Inc]**

- d. [Don-Jo Mfg., Inc]
 - e. [Hager Companies]
 - f. [Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - g. [Trimco]
 - h. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Allegion plc]
 - b. [Baldwin; part of the Spectrum Brands Hardware and Home Improvement Group (HHI)]
 - c. [Cal-Royal Products, Inc]
 - d. [Don-Jo Mfg., Inc]
 - e. [Hager Companies]
 - f. [Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - g. [Trimco]
 - h. <Insert manufacturer's name>

2.37 AUXILIARY ELECTRIFIED DOOR HARDWARE

A. Auxiliary Electrified Door Hardware: ANSI/BHMA A156.35.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- a. [Allegion plc]
 - b. [ASSA ABLOY Electronic Security Hardware; ASSA ABLOY]
 - c. [Door Controls International]
 - d. [dormakaba USA Inc.]
 - e. [DynaLock Corp]
 - f. [Hager Companies]
 - g. [Interlogix; Carrier Global Corporation]
 - h. [PAMEX Inc.]
 - i. [PDQ Industries, Inc.]
 - j. [Precision Hardware, Inc.; dormakaba Group]
 - k. [Rutherford Controls Int'l. (RCI); dormakaba Group]
 - l. [SARGENT Manufacturing Company; ASSA ABLOY]
 - m. [Security Door Controls]
 - n. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Allegion plc]
 - b. [ASSA ABLOY Electronic Security Hardware; ASSA ABLOY]
 - c. [Door Controls International]
 - d. [dormakaba USA Inc.]
 - e. [DynaLock Corp]

- f. [Hager Companies]
- g. [Interlogix; Carrier Global Corporation]
- h. [PAMEX Inc.]
- i. [PDQ Industries, Inc.]
- j. [Precision Hardware, Inc.; dormakaba Group]
- k. [Rutherford Controls Int'l. (RCI); dormakaba Group]
- l. [SARGENT Manufacturing Company; ASSA ABLOY]
- m. [Security Door Controls]
- n. <Insert manufacturer's name>

2.38 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.
 - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and ANSI/BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended; however, aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.
 - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 - 2. Fire-Rated Applications:
 - a. Wood or Machine Screws: For the following:
 - 1) Hinges mortised to doors or frames; **use threaded-to-the-head wood screws for wood doors and frames**.
 - 2) Strike plates to frames.
 - 3) Closers to doors and frames.
 - b. Steel Through Bolts: For the following unless door blocking is provided:
 - 1) Surface hinges to doors.
 - 2) Closers to doors and frames.
 - 3) Surface-mounted exit devices.
 - 3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
 - 4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.39 FINISHES

- A. Provide finishes complying with ANSI/BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames in accordance with ANSI/SDI A250.6.
- B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.3 INSTALLATION OF DOOR HARDWARE

- A. Mounting Heights: Mount door hardware units at heights **[indicated on Drawings][to comply with the following]** unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

- C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every **30 inches (760 mm)** of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every **30 inches (760 mm)** of door height greater than **90 inches (2286 mm)**.
- E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as **[indicated in keying schedule][directed by Owner]**.
 - 2. Furnish permanent cores to Owner for installation.
- F. Key Control System:
 - 1. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
 - 2. Key Lock Boxes: Install where indicated or approved by Architect to provide controlled access for fire and medical emergency personnel.
 - 3. Key Control System Software: Set up multiple-index system based on final keying schedule.
- G. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, **[above accessible ceilings][in equipment room]**. Verify location with Architect.
 - 1. Configuration: Provide **[one power supply for each door opening][least number of power supplies required to adequately serve doors]** with electrified door hardware.
- H. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- I. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- J. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
 - 1. Do not notch perimeter gasketing to install other surface-applied hardware.
- K. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- L. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: **[Owner will engage][Engage]** a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
 - 1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
 - 2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.
 - 3. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
- B. Occupancy Adjustment: Approximately **[three][six]<Insert number>** months after date of Substantial Completion, Installer's Architectural Hardware Consultant is to examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, maintenance service is to include **[six][nine][12]<Insert number>** months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies are to be manufacturer's authorized replacement parts and supplies.

3.8 DEMONSTRATION

- A. **[Engage Installer to train][Train]** Owner's maintenance personnel to adjust, operate, and maintain door hardware.

3.9 DOOR HARDWARE SCHEDULE

- A. Hardware Set 1: Each door to have the following:
 - 1. **<Insert hardware type>**.



08 - Openings

END OF SECTION 08 71 00 00



Task	Specification	Specification Description
08 71 11 00	01 11 19 00	No Specification Required
08 71 11 00	08 71 00 00	Door Hardware
08 71 11 00	11 98 14 00	Detention Door Hardware



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SECTION 08 71 13 00 - POWER DOOR OPERATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Power door operators for swinging doors.
2. Low-energy door operators for swinging doors.
3. Power-assist door operators for swinging doors.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing recessed metal frames for control mats in concrete.
2. Section 084229.33 "Swinging Automatic Entrances" for swinging doors and frames packaged with power door operators.

1.2 DEFINITIONS

- A. AAADM: American Association of Automatic Door Manufacturers.
- B. Activation Device: A control that, when actuated, sends an electrical signal to the door operator to open the door.
- C. Double-Egress (Doors): A pair of doors that simultaneously swing, with the two doors moving in opposite directions with no mullion between them.
- D. Double-Swing (Doors): A pair of doors that swing, with the two doors moving in opposite directions with a mullion between them; each door functioning as a single-swing door.
- E. Safety Device: A control that, to avoid injury, prevents a door from opening or closing.
- F. For automatic door terminology, see [BHMA A156.10][and][BHMA A156.19] for definitions of terms.

1.3 COORDINATION

- A. Coordinate sizes and locations of recesses in concrete floors for recessed control mats that control power door operators. Concrete, reinforcement, and formwork requirements are specified elsewhere.
- B. Templates: Distribute for doors, frames, and other work specified to be factory prepared and reinforced for installing power door operators.
- C. Coordinate hardware for doors with operators to ensure proper size, thickness, hand, function, and finish.
- D. Electrical System Roughing-in: Coordinate layout and installation of power door operators with connections to the following:

1. Power supplies.
2. Access-control system.
3. Remote activation devices.
4. Remote monitoring systems.

- E. Pneumatic System Roughing-in: Coordinate layout and installation of power door operators and power units with compressed-air piping.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for power door operators.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

- B. Shop Drawings: For power door operators.

1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Indicate locations of activation and safety devices.
4. Include diagrams for power, signal, and control wiring.
5. Include plans, elevations, sections, and attachment details for guide rails.

- C. Samples: For each exposed product and for each color and texture specified, **[manufacturer's standard size]<Insert dimensions>**.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[Installer][Certified Inspector]**.

- B. Product Certificates: For each type of power door operator. **[For each operator for fire-rated door assemblies, certify that operator is listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for use on types and sizes of labeled fire doors required.]**

- C. Field quality-control reports.

- D. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For power door operators, safety devices, and control systems, to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation and maintenance of units required for this Project[**and who employs a Certified Inspector**].
 - 1. Maintenance Proximity: Not more than **[two]<Insert number>** hours' normal travel time from Installer's place of business to Project site.
- B. Certified Inspector Qualifications: Certified by AAADM.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of power door operators that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty or sporadic operation of power door operator, including controls.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.
 - 2. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 POWER DOOR OPERATORS, GENERAL

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **[ASSA ABLOY Entrance Systems; ASSA ABLOY]**
 - 2. **[Ditec; Entrematic; ASSA ABLOY]**
 - 3. **[Door Motion Technologies, Inc.]**
 - 4. **[dormakaba USA Inc.]**
 - 5. **[Falcon; Allegion plc]**
 - 6. **[Hager Companies]**
 - 7. **[Horton Automatics; Overhead Door Corporation]**
 - 8. **[KM Systems, Inc]**
 - 9. **[LCN; Allegion plc]**
 - 10. **[NABCO Entrances, Inc]**
 - 11. **[record-usa]**
 - 12. **[SARGENT Manufacturing Company; ASSA ABLOY]**
 - 13. **[STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]**
 - 14. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1. **[ASSA ABLOY Entrance Systems; ASSA ABLOY]**
 - 2. **[Ditec; Entrematic; ASSA ABLOY]**

3. [Door Motion Technologies, Inc.]
 4. [dormakaba USA Inc.]
 5. [Falcon; Allegion plc]
 6. [Hager Companies]
 7. [Horton Automatics; Overhead Door Corporation]
 8. [KM Systems, Inc]
 9. [LCN; Allegion plc]
 10. [NABCO Entrances, Inc]
 11. [record-usa]
 12. [SARGENT Manufacturing Company; ASSA ABLOY]
 13. [STANLEY Access Technologies LLC; STANLEY Security Solutions, Inc.]
 14. <Insert manufacturer's name>
- C. Source Limitations: Obtain power door operators, including activation and safety devices, from **[single source from single manufacturer.]****[same manufacturer as for hardware in Section 087100 "Door Hardware."]****[same manufacturer as for hardware in Section 087111 "Door Hardware (Descriptive Specification)."]**
- D. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated; and in accordance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation and safety devices.
1. Emergency Breakaway: Where indicated for center-pivoted doors, provide emergency breakaway feature for reverse swing of doors. Equip system to discontinue power to power door operator when door is in emergency breakaway position, to return door to closed position after breakaway, and to automatically reset.
 2. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.
 3. Wind Load: Provide door operators on exterior doors that will open and close doors and maintain them in fully closed position when subjected to wind load of **<Insert wind load>**.
- E. Electromechanical Operating System: Self-contained unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, connections for power and activation- and safety-device wiring, and manual operation, including spring closing when power is off.
- F. Electrohydraulic Operating System: Self-contained, low-pressure unit; with separate cylinders for power and checking, connections for power and activation- and safety-device wiring, and manual operation, including spring closing when power is off.
- G. Pneumatic Operating System: Pneumatic operator, air opened and spring closed; with checking in both cycles and manual operation when power is off.
1. Power Unit:
 - a. Control box and compressor unit, complete with tank, compressor, air line to operator, motor, regulator, safety valve, pressure cutoff switch, and automatic air-line filter drain.
 - b. Remote-control box powered by compressed-air system specified in Section 221513 "General-Service Compressed-Air Piping" and Section 221519 "General-Service Packaged Air Compressors and Receivers."
- H. Hinges: See **[Section 087100 "Door Hardware"]****[Section 087111 "Door Hardware (Descriptive Specification)"]** for hinge type for each door that door operator shall accommodate.

- I. Housing for Overhead Concealed Operators: Fabricated from minimum **0.125-inch- (3.2-mm-)** thick, extruded or formed aluminum and extending full width of door opening, including door jambs, to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.
- J. Cover for Surface-Mounted Operators: Fabricated from **0.125-inch- (3.2-mm-)** thick, extruded or formed aluminum[; **manufacturer's standard width**]; **continuous over full width of operator-controlled door opening**[; **continuous over full width of door opening, including door jambs**]; with enclosed end caps, provision for maintenance access, and fasteners concealed when door is in closed position.
- K. Brackets and Reinforcements: Fabricated from aluminum with nonstaining, nonferrous shims for aligning system components.
- L. Fire-Door Package: Consisting of UL-listed latch mechanism, power-reset box, and caution signage for fire-rated doors. Latch mechanism shall allow door to swing free during automatic operation; when fire is detected, latch actuator shall cause exit hardware to latch when door closes. Provide latch actuators with fail-secure design.
- M. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 POWER DOOR OPERATORS FOR SWINGING DOORS

- A. Standard: BHMA A156.10.
- B. Performance Requirements:
 - 1. Opening Force:
 - a. Power-Operated Doors: Not more than **50 lbf (222 N)** required to manually set door in motion if power fails; not more than **15 lbf (67 N)** required to open door to minimum required width.
 - b. Power-Operated Swinging Doors: Not more than **30 lbf (133 N)** required to manually open door if power fails.
 - c. Breakaway Device for Power-Operated Doors: Not more than **50 lbf (222 N)** required for breakaway door or panel to open.
 - 2. Entrapment-Prevention Force: Not more than **40 lbf (178 N)** required to prevent stopped door in the last 10 degrees of opening from moving in the direction of opening; not more than **30 lbf (133 N)** required to prevent stopped door from moving in direction of closing.
- C. Configuration: Operator to control [**single swinging door**][**pair of swinging doors**].
 - 1. Traffic Pattern: [**One way**][**Two way**][**Double swing**][**Double egress**].
 - 2. Operator Mounting: [**Surface**][**Overhead concealed**].
- D. Operation: Power opening and[**power-assisted**] spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.10.
- E. Operating System: [**Electromechanical**][**Electrohydraulic**][**Pneumatic**].
- F. Microprocessor Control Unit: Solid-state controller.
- G. Features:

1. Adjustable **[opening][and][closing]** speed.
2. Adjustable **[opening][and][closing]** force.
3. Adjustable backcheck.
4. Adjustable hold-open time from zero to 30 seconds.
5. Adjustable time delay.
6. Adjustable acceleration.
7. Adjustable limit switch.
8. Obstruction recycle.
9. Power door re-open if stopped while closing.
10. On-off/hold-open switch to control electric power to operator[; **key operated**].
11. **<Insert feature>**.

H. Controls: Activation and safety devices **[as indicated on Drawings and]**in accordance with BHMA standards.

1. Activation Device, Motion Sensor: Mounted on ingress side of door header to detect pedestrians in activating zone and to open door.
2. Activation Device, Control Mat: Installed on ingress side of door to detect pedestrians in activating zone and to open door.
3. Activation Device, Switch: **[Push-plate switch][Touchless switch][Push-button switch][Key switch][on each side of door]**to activate door operator.
4. Safety Device, Presence Sensor: Mounted on **[door header][horizontal door muntin][guide rail]** to detect pedestrians in presence zone and to prevent door from closing.
5. Safety Device, Photoelectric Beam: One photoelectric beam mounted in guide rails to detect pedestrians in presence zone and to prevent door from closing.
6. Safety Device, Control Mat(s): Installed on egress side of door to detect pedestrians in presence and safety zones and to prevent door from closing.

I. Exposed Finish: **[Class I, clear anodic finish][Class II, clear anodic finish][Class I, color anodic finish][Class II, color anodic finish][Baked-enamel or powder-coat finish][Metal cladding][Finish matching door and frame][Finish matching door hardware]<Insert finish>**.

1. Color: **[Light bronze][Medium bronze][Dark bronze][Black][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
2. Metal Cladding: **[No. 4, directional-satin-finish stainless steel][No. 8, mirrorlike-reflective, nondirectional-polish-finish stainless steel][Satin brass][Polished brass][Satin bronze][Polished bronze]<Insert finish>**.

2.3 LOW-ENERGY DOOR OPERATORS FOR SWINGING DOORS

A. Standard: BHMA A156.19.

B. Performance Requirements:

1. Opening Force if Power Fails: Not more than **15 lbf (67 N)** required to release latch if provided, not more than **30 lbf (133 N)** required to manually set door in motion, and not more than **15 lbf (67 N)** required to fully open door.
2. Entrapment-Prevention Force: Not more than **15 lbf (67 N)** required to prevent stopped door from closing or opening.

C. Configuration, Single: Operator to control single swinging door.

1. Traffic Pattern: **[One][Two]** way.

2. Operator Mounting: **[Surface][Overhead concealed]**.
 - D. Configuration, Pair: Operator to control pair of swinging doors.
 1. Traffic Pattern: **[One way][Two way][Double egress][Double swing]**.
 2. Operator Mounting: **[Surface][Overhead concealed]**.
 - E. Operation: Power opening and **[power-assisted]** spring closing. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.19. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.
 - F. Operating System: **[Electromechanical][Electrohydraulic][Pneumatic]**.
 - G. Microprocessor Control Unit: Solid-state controller.
 - H. Features:
 1. Adjustable **[opening][and][closing]** speed.
 2. Adjustable **[opening][and][closing]** force.
 3. Adjustable backcheck.
 4. Adjustable hold-open time from zero to 30 seconds.
 5. Adjustable time delay.
 6. Adjustable acceleration.
 7. Obstruction recycle.
 8. On-off/hold-open switch to control electric power to operator[; **key operated**].
 9. **<Insert feature>**.
 - I. Activation Device: **[Push-plate switch][Touchless switch][Push-button switch][Key switch][on each side of door]** to activate door operator.
 - J. Exposed Finish: **[Class I, clear anodic finish][Class II, clear anodic finish][Class I, color anodic finish][Class II, color anodic finish][Baked-enamel or powder-coat finish][Metal cladding][Finish matching door and frame][Finish matching door hardware]<Insert finish>**.
 1. Color: **[Light bronze][Medium bronze][Dark bronze][Black][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
 2. Metal Cladding: **[No. 4, directional-satin-finish stainless steel][No. 8, mirrorlike-reflective, nondirectional-polish-finish stainless steel][Satin brass][Polished brass][Satin bronze][Polished bronze]<Insert finish>**.
- 2.4 POWER-ASSIST DOOR OPERATORS FOR SWINGING DOORS
- A. Standard: BHMA A156.19.
 - B. Performance Requirements:
 1. Opening Force:
 - a. Opening Force if Power Fails: Not more than **15 lbf (67 N)** required to release latch if provided, not more than **30 lbf (133 N)** required to manually set door in motion, and not more than **15 lbf (67 N)** required to fully open door.
 - b. Accessible Interior Doors: Not more than **5 lbf (22 N)** to push or pull door to fully open position.

2. Entrapment-Prevention Force: Not more than **15 lbf (67 N)** required to prevent stopped door from closing or opening.
 - C. Configuration, Single: Operator to control single swinging door.
 1. Traffic Pattern: **[One][Two]** way.
 2. Operator Mounting: **[Surface][Overhead concealed]**.
 - D. Configuration, Pair: Operator to control pair of swinging doors.
 1. Traffic Pattern: **[One way][Two way][Double egress][Double swing]**.
 2. Operator Mounting: **[Surface][Overhead concealed]**.
 - E. Operation: Power-assisted opening that reduces the force to open door and **[power-assisted]** spring closing. Pushing or pulling on door activates operator. Provide time delay for door to remain open before initiating closing cycle as required by BHMA A156.19. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power.
 - F. Operating System: **[Electromechanical][Electrohydraulic][Pneumatic]**.
 - G. Microprocessor Control Unit: Solid-state controller.
 - H. Features:
 1. Adjustable **[opening][and][closing]** speed.
 2. Adjustable **[opening][and][closing]** force.
 3. Adjustable backcheck.
 4. Adjustable hold-open time from zero to 30 seconds.
 5. Adjustable time delay.
 6. Adjustable acceleration.
 7. Obstruction recycle.
 8. On-off/hold-open switch to control electric power to operator[; **key operated**].
 9. **<Insert feature>**.
 - I. Exposed Finish: **[Class I, clear anodic finish][Class II, clear anodic finish][Class I, color anodic finish][Class II, color anodic finish][Baked-enamel or powder-coat finish][Metal cladding][Finish matching door and frame][Finish matching door hardware]<Insert finish>**.
 1. Color: **[Light bronze][Medium bronze][Dark bronze][Black][As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
 2. Metal Cladding: **[No. 4, directional-satin-finish stainless steel][No. 8, mirrorlike-reflective, nondirectional-polish-finish stainless steel][Satin brass][Polished brass][Satin bronze][Polished bronze]<Insert finish>**.
- 2.5 MATERIALS
- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 1. Extrusions: **ASTM B221 (ASTM B221M)**.
 2. Sheet: **ASTM B209 (ASTM B209M)**.
 - B. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, **[Type 304]<Insert alloy type>**, stretcher-

leveled standard of flatness, in manufacturer's standard thickness.

- C. Brass Sheet: ASTM B36/B36M, Alloy UNS No. C26000 (cartridge brass, 70 percent copper), in manufacturer's standard thickness.
- D. Bronze Sheet: ASTM B36/B36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper) or Alloy UNS No. C23000 (red brass, 85 percent copper), in manufacturer's standard thickness.
- E. Expanded Aluminum Mesh: **[Expanded][Expanded and flattened]** aluminum sheet in accordance with the geometry of ASTM F1267.
- F. Polycarbonate Sheet: ASTM C1349, Appendix X1, Type II, coated, mar-resistant, UV-stabilized polycarbonate with coating on both surfaces.
- G. Fasteners and Accessories: Corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

2.6 CONTROLS

- A. General: Provide controls, including activation and safety devices, in accordance with BHMA standards; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for occupancy type indicated. Coordinate activation and safety devices with door operation and door operator mechanisms.
- B. Motion Sensors: Self-contained, K-band-frequency, microwave-scanner units; fully enclosed in plastic housing; adjustable to provide detection field sizes and functions required by BHMA A156.10.
 - 1. Provide capability for switching between bidirectional and unidirectional detection.
 - 2. For one-way traffic, sensor on egress side shall not be active when doors are fully closed.
- C. Presence Sensors: Self-contained, active-infrared scanner units; adjustable to provide detection field sizes and functions required by BHMA A156.10. Sensors shall remain active at all times.
- D. Photoelectric Beams: Pulsed infrared, sender-receiver assembly for recessed mounting. Beams shall not be active when doors are fully closed.
- E. Control Mats: **1/2-inch- (13-mm-)** thick, synthetic-rubber or flexible-plastic mat in safety-ribbed surface pattern, with extruded-aluminum frame; with pressure switches for low-voltage control wiring; and in accordance with performance requirements in BHMA A156.10.
 - 1. Frame: **[Recessed to fit flush with floor, with concealed anchors][Surface mounted, with tapered safety edge]**.
 - 2. Size: As indicated, but not smaller than required by BHMA A156.10, including Appendix A.
 - 3. Color: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
- F. Push-Plate Switch: Momentary-contact door control switch with flat push-plate actuator[**with contrasting-colored, engraved message**].
 - 1. Configuration:
 - a. Round or Square Push Plate: **4-by-4-inch (100-by-100-mm)** junction box.
 - 1) Mounting: **[As indicated on Drawings][Recess mounted, semiflush in**

wall][Surface mounted on wall].

- b. Rectangular Push Plate: **2-by-4-inch (50-by-100-mm)** junction box.
 - 1) Mounting: [As indicated on Drawings][Recess mounted, semiflush in wall][Recess mounted in door jamb][Surface mounted on wall][Surface mounted on post][Surface mounted on guide rail].
 2. Push-Plate Material: [Stainless steel][Plastic] as selected by Architect from manufacturer's full range.
 3. Message: [Plain face with no message.]["Push to Open."][International symbol of accessibility.][International symbol of accessibility and "Push to Open."]
- G. Touchless Switch: Hands-free activation door-control switch with flat motion sensor face-plate[with contrasting-colored, engraved message].
 1. Configuration: [6-inch (152.4-mm) round][4.56-by-4.56-inch (115.8-by-115.8-mm) (double gang) square][2.77-by-4.56-inch (70-by-115.8-mm) (single gang) rectangular][1.68-by-4.56-inch (42.6-by-115.8-mm) jamb-style] face plate.
 - a. Mounting: [As indicated on Drawings][Recess mounted in wall][Recess mounted in door jamb][Surface mounted on wall].
 2. Face-Plate Material: [Stainless steel][Plastic][Stainless steel with backlight acrylic window][As selected by Architect from manufacturer's full range of options].
 3. Message: ["Wave to Open."]["Wave to Open" and wave symbol.][International symbol of accessibility.][International symbol of accessibility and "Wave to Open" and wave symbol.]
- H. Push-Button Switch: Momentary-contact door control switch with one red-button actuator; enclosed in nominal [2-by-4-inch (50-by-100-mm)][4-by-4-inch (100-by-100-mm)] junction box.
 1. Provide faceplate engraved with "Press to Open" text[and international symbol of accessibility] in contrasting color.
 2. Provide blue plastic cover engraved with "Press Button to Open" in white text and with international symbol of accessibility.
 3. Mounting: [As indicated on Drawings][Surface mounted on wall][Surface mounted on post][Surface mounted on guide rail][Recess mounted in wall].
 4. Faceplate Material: [Stainless steel][Painted metal] as selected by Architect from manufacturer's full range.
- I. Key Switch: Recess-mounted, door control switch with key-controlled actuator; enclosed in **2-by-4-inch (50-by-100-mm)** junction box. Provide faceplate engraved with text indicating switch functions.
 1. Faceplate Material: [Stainless steel][Painted metal] as selected by Architect from manufacturer's full range.
 2. Functions: [On-off, momentary contact][On-off, maintained contact][Two-way automatic, hold open, one-way exit, and off][Two-way automatic, hold open, one-way exit, off, full open, and partial open].
 3. Mounting: [As indicated on Drawings][Recess mounted, semiflush in wall][Recess mounted in door jamb][Surface mounted on wall][Surface mounted on post].
- J. Wireless or Remote Radio-Control Switch: Radio-control system consisting of header-mounted receiver and [wall-mounted][handheld, battery-operated] transmitter switch.
 1. Wall-Mounted Transmitter Switch: One red-button, momentary-contact actuator enclosed in **4-by-**

4-inch (100-by-100-mm) junction box. Provide blue plastic cover engraved with "Press Button to Open" in white text and with international symbol of accessibility.

- K. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

2.7 ACCESSORIES

- A. Signage: As required by cited BHMA standard for type of door and its operation.

1. Application Process: **[Decals][Silk-screened][Operator manufacturer's standard process]<Insert requirement>**.
2. Provide sign materials with instructions for field application when operators are installed.

- B. Guide Rails:

1. **[Anodized aluminum][Baked-enamel or powder-coated aluminum][Stainless steel]**, fabricated from **[bars][or][tubing]**, minimum **30 inches (762 mm)** high, and finished to match doors unless otherwise indicated; positioned and projecting from face of door jamb for distance as indicated, but not less than **[that required by BHMA A156.10 for type of door and direction of travel]<Insert requirement>**; with filler panel.
 - a. Filler Panel: **[Expanded aluminum mesh][Clear polycarbonate sheet][Colored polycarbonate sheet]<Insert material>**.
 - 1) Orient expanded aluminum mesh with long dimension of diamonds **[parallel][perpendicular]** to top rail.
 - 2) Color: **[Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color>**.
 - b. Provide intermediate guide rail suitable for supporting photoelectric beams.
 - c. Mounting: **[As indicated on Drawings][Jamb and floor][Floor, freestanding]**.
 - d. Aluminum Finish: **[Class I, clear anodic finish][Class II, clear anodic finish][Class I, color anodic finish][Class II, color anodic finish][Baked-enamel or powder-coat finish][Finish matching door and frame]<Insert finish>**.
 - 1) Color: **[Light bronze][Medium bronze][Dark bronze][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
 - e. Stainless Steel Finish: **[No. 4, directional-satin-finish stainless steel][Finish matching door and frame]<Insert finish>**.
2. See **[Section 055213 "Pipe and Tube Railings."][Section 057300 "Decorative Metal Railings.]**

2.8 FABRICATION

- A. Factory fabricate power door operators to comply with indicated standards.
- B. Form aluminum shapes before finishing.
- C. Fabricate exterior components to drain condensation and water-passing joints within operator enclosure

to the exterior.

- D. Use concealed fasteners to greatest extent possible. Where exposed fasteners are required, use countersunk Phillips flat-head machine screws, finished to match operator.
- E. Provide metal cladding, completely covering visible surfaces before shipment to Project site. Fabricate cladding with concealed fasteners and connection devices, with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion, and with allowance for thermal expansion at exterior doors.

2.9 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary, protective covering before shipping.
- B. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

2.10 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, [**AA-M12C22A41, Class I, 0.018 mm**][**AA-M12C22A31, Class II, 0.010 mm**] or thicker.
- B. Color Anodic Finish: AAMA 611, [**AA-M12C22A42/A44, Class I, 0.018 mm**][**AA-M12C22A32/A34, Class II, 0.010 mm**] or thicker.
- C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame preparation and reinforcements, and other conditions affecting performance of power door operators.
- B. Examine roughing-in for electrical systems to verify actual locations of power connections before power door operator installation.
- C. Examine roughing-in for compressed-air piping systems to verify actual locations of piping connections before power door operator installation.
- D. Verify that full-height finger guards are installed at each door with pivot hinges, where door has a clearance at hinge side greater than **1/4 inch (6 mm)** and less than **3/4 inch (19 mm)** with door in any position.

- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install power door operators in accordance with manufacturer's written instructions and cited BHMA standard for type of door operation and direction of pedestrian travel, including signage, controls, wiring, remote power units if any, and connection to building's power supply.
 - 1. Do not install damaged components. Fit joints to produce hairline joints free of burrs and distortion.
 - 2. Install operators true in alignment with established lines and door geometry without warp or rack. Anchor securely in place.
- B. Controls: Install activation and safety devices in accordance with manufacturer's written instructions and cited BHMA standard for operator type and direction of pedestrian travel. Connect control wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Access-Control System: Connect operators to access-control system as specified in Section 281500 "Access Control Hardware Devices."
- D. Signage: Apply on both sides of each door as required by cited BHMA standard for type of door operator and direction of pedestrian travel.
- E. Guide Rails: Install in accordance with BHMA A156.10, including Appendix A and manufacturer's written instructions unless otherwise indicated.

3.3 FIELD QUALITY CONTROL

- A. Certified Inspector: **[Owner will engage][Engage]** a Certified Inspector to test and inspect components, assemblies, and installations, including connections.
- B. Perform the following tests and inspections[**with the assistance of a factory-authorized service representative**]:
 - 1. Test and inspect each power door operator installation, using AAADM inspection forms, to determine compliance of installed systems with applicable BHMA standards.
- C. Power door operators will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust power door operators to function smoothly, and lubricate as recommended by manufacturer; comply with requirements of applicable BHMA standards.
 - 1. Adjust operators on exterior doors for tight closure.
- B. After completing installation of power door operators, inspect exposed finishes on doors and operators. Repair damaged finish to match original finish.
- C. Readjust power door operators and controls after repeated operation of completed installation

equivalent to three days' use by normal traffic (100 to 300 cycles).

- D. Occupancy Adjustment: When requested within [12]<Insert number> months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to [two]<Insert number> visits to Project during other-than-normal occupancy hours for this purpose.

3.5 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include [three][six][nine][12] months' full maintenance by skilled employees of power door operator Installer. Include [monthly][quarterly] preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
1. Engage a Certified Inspector to perform safety inspection after each adjustment or repair and at end of maintenance period. Furnish completed inspection reports to Owner.
 2. Perform maintenance, including emergency callback service, during normal working hours.
 3. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain power door operators.

END OF SECTION 08 71 13 00



Task	Specification	Specification Description
08 72 33 00	08 14 16 00	Flush Wood Doors
08 72 33 00	08 71 00 00	Door Hardware
08 72 43 00	08 71 00 00	Door Hardware
08 75 13 00	08 71 00 00	Door Hardware
08 75 13 00	08 71 13 00	Power Door Operators



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SECTION 08 78 00 00 - ALL-GLASS-ENTRANCE HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rail fittings.
2. Patch fittings.
3. U-channels.
4. Headers.
5. Glass clamps.
6. Sliding door hardware.
7. Pivots.
8. Push/pull operating trim.
9. Exit devices and auxiliary items.
10. Electric strikes.
11. Concealed closers.
12. Hinges.
13. Dustproof keepers.
14. Door gasketing.
15. Thresholds.
16. Mechanical stops.
17. Lock cylinders.
18. Keying.
19. Auxiliary electrified door hardware.

B. Related Requirements:

1. Section 087113 "Power Door Operators" for low-energy power operators and low-energy power-assist operators.
2. Section 088000 "Glazing" for glass.
3. Section 102819 "Tub and Shower Enclosures" for tub and shower enclosure hardware.

1.2 ALLOWANCES

- A. See Section 012100 "Allowances" for description of allowances affecting items specified in this Section.

1.3 COORDINATION

- A. Floor-Recessed All-Glass-Entrance Hardware: Coordinate layout and installation with floor construction.
1. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for all-glass-entrance doors and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing all-glass-entrance hardware to comply with indicated requirements.
- C. Security: Coordinate installation of all-glass-entrance door hardware, keying, and access control with

Owner's security consultant.

- D. Electrical System Roughing-In: Coordinate layout and installation of electrified all-glass-entrance door hardware with connections to power supplies and building safety and security systems.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference **[at Project site][by web conference]<Insert location>**.
 - 1. Conference participants to include Installer's Architectural Hardware Consultant[**and Owner's security consultant**].
- B. Keying Conference: Conduct conference at **[Project site]<Insert location>**.
 - 1. Conference participants to include Installer's Architectural Hardware Consultant[**and Owner's security consultant**].
 - 2. Incorporate conference decisions into keying schedule after reviewing all-glass-entrance door hardware keying system, including, but not limited to, the following:
 - a. Flow of traffic and degree of security required.
 - b. Preliminary key system schematic diagram.
 - c. Requirements for key-control system.
 - d. Requirements for access control.
 - e. Address for delivery of keys.
 - f. **<Insert requirements to suit Project>**.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include operating characteristics, electrical characteristics, and furnished accessories.
 - 3. **<Insert requirements>**.
- B. Shop Drawings: For electrified all-glass-entrance door hardware.
 - 1. Include diagrams for power, signal, and control wiring.
 - 2. Include details of interface of electrified all-glass-entrance door hardware and building safety and security systems.
 - 3. **<Insert requirements>**.
- C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.
- D. Samples for Verification: Actual sample of finished products for each type of exposed product.
 - 1. Size: **[Manufacturers' standard size]<Insert size>**.
 - 2. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

3. Tag Samples with full product description to coordinate Samples with all-glass-entrance door hardware schedule.
- E. All-Glass-Entrance Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate all-glass-entrance door hardware schedule with all-glass-entrance doors, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Submittal Sequence: Submit all-glass-entrance door hardware schedule **[after][or][concurrent with]** submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of all-glass-entrance door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 2. Format: Use same scheduling sequence and format **[and use same door numbers]** as in door hardware schedule in the Contract Documents.
 3. Content: Include the following information:
 - a. Identification number, location, hand, size, and material of each door.
 - b. Locations of each all-glass-entrance door hardware set, cross-referenced to Drawings on floor plans and to door schedule.
 - c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each all-glass-entrance door hardware product.
 - d. Description of electrified all-glass-entrance door hardware sequences of operation and interfaces with other building control systems.
 - e. Fastenings and other installation information.
 - f. Explanation of abbreviations, symbols, and designations contained in all-glass-entrance door hardware schedule.
 - g. Mounting locations for all-glass-entrance door hardware.
 - h. List of related door devices specified in other Sections for each all-glass-entrance door.
- F. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.
- 1.6 INFORMATIONAL SUBMITTALS
- A. Product Certificates: For each type of electrified all-glass-entrance door hardware.
 - B. Product Test Reports: For door hardware on all-glass-entrance doors located in accessible routes, for tests performed by manufacturer and witnessed by a qualified testing agency, indicating compliance with accessibility requirements.
 - C. Field quality control reports.
 - D. Qualification Statements: For **[Installer][and][Architectural Hardware Consultant]**.
 - E. Sample warranties.
- 1.7 CLOSEOUT SUBMITTALS
- A. Operation and Maintenance Data: For each type of all-glass-entrance door hardware.
 - B. Schedules: Final **[all-glass-entrance door hardware][and][keying]** schedule.
 - C. Warranty Documentation:

1. Manufacturers' special warranties.
2. Installer's special warranties.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. All-Glass-Entrance Hardware: **<Insert detailed descriptions and specific numbers of units>.**
 2. Electrical Parts: **<Insert detailed descriptions and specific numbers of units>.**

1.9 QUALITY ASSURANCE

- A. Qualifications:
1. Installers: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about all-glass-entrance hardware and keying.
 - a. Warehousing Facilities: In Project's vicinity.
 - b. Scheduling Responsibility: Preparation of all-glass-entrance door hardware and keying schedule.
 2. Engineering Responsibility: Preparation of data for electrified all-glass-entrance door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
 3. Architectural Hardware Consultant: A person who is experienced in providing consulting services for all-glass-entrance door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Inventory all-glass-entrance hardware on receipt and provide secure lock-up for all-glass-entrance door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final all-glass-entrance door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key-control system for subsequent delivery to Owner.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of all-glass-entrance hardware that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures, including excessive deflection, cracking, or breakage.

- b. Faulty operation of all-glass-entrance doors and all-glass-entrance door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
- 2. Warranty Period: **[Two]<Insert number>** years from date of Substantial Completion unless otherwise indicated below:
 - a. Exit Devices: **[Two]<Insert number>** years from date of Substantial Completion.
 - b. Concealed Overhead Closers: **[Five][10][25]<Insert number>** years from date of Substantial Completion.
 - c. Concealed Floor Closers: **[Five][10][25]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Source Limitations: Obtain each type of all-glass-entrance hardware from single manufacturer.
 - 1. Provide electrified all-glass-entrance door hardware from same manufacturer as mechanical all-glass-entrance door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

- A. Electrified All-Glass-Entrance Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Means of Egress Doors: Latches do not require more than **15 lbf (67 N)** to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- C. Accessibility Requirements: For door hardware on all-glass-entrance doors in an accessible route, comply with **[the DOJ's "2010 ADA Standards for Accessible Design"]****[the DOT's "ADA Standards for Transportation Facilities"]****[the ABA standards of the Federal agency having jurisdiction]****[ICC A117.1]****[HUD's "Fair Housing Accessibility Guidelines"]****[and]<Insert regulation>**.
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than **5 lbf (22.2 N)**.
 - 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Hinged Doors: **5 lbf (22.2 N)** applied perpendicular to door.
 - b. Interior, Sliding Doors: **5 lbf (22.2 N)** applied parallel to door at latch.
 - 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than **1/2 inch (13 mm)** high.
 - 4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.

2.3 RAIL FITTINGS

- A. Rail Fittings: In sizes and types recommended by manufacturer for all-glass application indicated on Drawings. For exposed parts, match metal and finish of rail fitting.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ASSA ABLOY Glass Solutions; ASSA ABLOY]**
 - b. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - c. **[Clover Architectural Products, LLC]**
 - d. **[DAMS Incorporated; D. Architectural Metal Solutions Incorporated]**
 - e. **[dormakaba USA Inc.]**
 - f. **[Hafele America Co.]**
 - g. **[PRL Glass Systems Inc.]**
 - h. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ASSA ABLOY Glass Solutions; ASSA ABLOY]**
 - b. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - c. **[Clover Architectural Products, LLC]**
 - d. **[DAMS Incorporated; D. Architectural Metal Solutions Incorporated]**
 - e. **[dormakaba USA Inc.]**
 - f. **[Hafele America Co.]**
 - g. **[PRL Glass Systems Inc.]**
 - h. **<Insert manufacturer's name>**
 3. Full-Length Door Rail Fittings:
 - a. Rail fittings for **[10 mm thick tempered glass][12 mm thick tempered glass][16 mm thick tempered glass][19 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Height:
 - 1) Top Rail: **[2-1/2 inches (63.5 mm)][4 inches (102 mm)][6 inches (152 mm)][As indicated on Drawings]<Insert dimension>**.
 - a) Provide **[pivot][closer]** insert.
 - 2) Bottom Rail: **[2-1/2 inches (63.5 mm)][4 inches (102 mm)][6 inches (152 mm)][10 inches (254 mm)][As indicated on Drawings]<Insert dimension>**.
 - a) Provide **[pivot][closer]** insert.
 - b) Provide door rail lock.
 - c. Profile: **[Tapered][Square][As indicated on Drawings]<Insert profile>**.
 - d. Locking Function: Key operated from secure side; thumbturn on nonsecure side.
 - 1) Type: Deadbolt.
 - 2) Cylinder: **[Standard mortise keyed cylinder; six pin][Mortise cylinder; seven-pin]**

- ## 2.4 PATCH FITTINGS

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- c. **[dormakaba USA Inc.]**
 - d. **[Hafele America Co.]**
 - e. **[PRL Glass Systems Inc.]**
 - f. **<Insert manufacturer's name>**
3. Top Door Patch Fitting:
- a. Door patch fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Patch Insert: **[Pivot][Closer]** insert with **2-3/4-inch (70-mm)** setback.
 - c. Profile: **[Tapered][Square][As indicated on Drawings]**.
 - d. Glazing Gaskets: Manufacturer's standard.
 - e. Snap-On Cover Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum][Stainless steel]**.
4. Bottom Door Patch Fitting:
- a. Door patch fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Patch Insert: **[Pivot][Closer]** insert with **2-3/4-inch (70-mm)** setback.
 - c. Profile: **[Tapered][Square][As indicated on Drawings]**.
 - d. Glazing Gaskets: Manufacturer's standard.
 - e. Snap-On Cover Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum][Stainless steel]**.
5. Curved Top Door Patch Fitting:
- a. Curved door patch fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Patch Insert: **[Pivot][Closer]** insert with **2-11/16-inch (68-mm)** setback.
 - c. Glazing Gaskets: Manufacturer's standard.
 - d. Snap-On Cover Material: Stainless steel.
6. Curved Bottom Door Patch Fitting:
- a. Curved door patch fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Patch Insert: **[Pivot][Closer]** insert with **2-11/16-inch (68-mm)** setback.
 - c. Glazing Gaskets: Manufacturer's standard.
 - d. Snap-On Cover Material: Stainless steel.
7. Offset Top Door Patch Fitting:
- a. Offset door patch fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Offset: **[Right][Left]** handed.
 - c. Glazing Gaskets: Manufacturer's standard.
 - d. Snap-On Cover Material: Stainless steel.
8. Offset Bottom Door Patch Fitting:
- a. Offset door patch fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Offset: **[Right][Left]** handed.
 - c. Glazing Gaskets: Manufacturer's standard.

- d. Snap-On Cover Material: Stainless steel.
9. Wall Mount Transom Patch Fitting:
- a. Transom patch fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Patch Insert: **[Pivot insert with 2-3/4-inch (70-mm) setback][Stop insert][Keeper insert][Blank insert]**.
 - c. Glazing Gaskets: Manufacturer's standard.
 - d. Snap-On Cover Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum][Stainless steel]**.
10. Wall Mount Curved Transom Patch Fitting:
- a. Transom patch fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Patch Insert: **[Pivot insert with 2-11/16-inch (68-mm) setback][Stop insert]**.
 - c. Glazing Gaskets: Manufacturer's standard.
 - d. Snap-On Cover Material: Stainless steel.
11. Sidelite Mount Transom Patch Fitting:
- a. Transom patch fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Patch Insert: **[Pivot insert with 2-3/4-inch (70-mm) setback][Stop insert][Keeper insert][Blank insert]**.
 - c. Glazing Gaskets: Manufacturer's standard.
 - d. Snap-On Cover Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum][Stainless steel]**.
12. Sidelite Mount Transom Patch Fitting with Support Fin Bracket:
- a. Transom patch fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Patch Insert: **[Pivot insert with 2-3/4-inch (70-mm) setback][Stop insert][Keeper insert][Blank insert]**.
 - c. Support Fin Bracket: **[Right][Left]** handed.
 - d. Glazing Gaskets: Manufacturer's standard.
 - e. Snap-On Cover Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum][Stainless steel]**.
13. Sidelite Mount Curved Transom Patch Fitting:
- a. Transom patch fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Patch Insert: **[Pivot insert with 2-11/16-inch (68-mm) setback][Stop insert]**.
 - c. Glazing Gaskets: Manufacturer's standard.
 - d. Snap-On Cover Material: Stainless steel.
14. Sidelite Mount Curved Transom Patch Fitting with Support Fin Bracket:
- a. Transom patch fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Patch Insert: **[Pivot insert with 2-11/16-inch (68-mm) setback][Stop insert]**.
 - c. Glazing Gaskets: Manufacturer's standard.
 - d. Snap-On Cover Material: Stainless steel.

15. Sidelite Mount Offset Transom Patch Fitting:
 - a. Transom patch fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Offset: **[Right][Left]** handed.
 - c. Glazing Gaskets: Manufacturer's standard.
 - d. Snap-On Cover Material: Stainless steel.
16. Sidelite Mount Transom Patch Connector Fitting:
 - a. Transom patch connector fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Patch Insert: **[Reversible stop insert][Blank insert]**.
 - c. Glazing Gaskets: Manufacturer's standard.
 - d. Snap-On Cover Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum][Stainless steel]**.
17. Sidelite Mount Transom Patch Connector Fitting with Support Fin Bracket:
 - a. Transom patch connector fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Patch Insert: **[Reversible stop insert][Blank insert]**.
 - c. Support Fin Bracket: **[Right][Left]** handed.
 - d. Glazing Gaskets: Manufacturer's standard.
 - e. Snap-On Cover Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum][Stainless steel]**.
18. Transom Mount Patch Connector Fitting:
 - a. Transom patch connector fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Patch Insert: **[One reversible stop insert][Two reversible stop inserts][Blank insert]**.
 - c. Glazing Gaskets: Manufacturer's standard.
 - d. Snap-On Cover Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum][Stainless steel]**.
19. Transom Mount Patch Connector Fitting with Support Fin Bracket:
 - a. Transom patch connector fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Patch Insert: **[One reversible stop insert][Two reversible stop inserts][Blank insert]**.
 - c. Glazing Gaskets: Manufacturer's standard.
 - d. Snap-On Cover Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum][Stainless steel]**.
20. Patch Connector Fitting:
 - a. Patch connector fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Glazing Gaskets: Manufacturer's standard.
 - c. Snap-On Cover Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum][Stainless steel]**.
21. Patch Connector Fitting with Support Fin Bracket:

- a. Patch connector fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Glazing Gaskets: Manufacturer's standard.
 - c. Snap-On Cover Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum][Stainless steel]**.
22. Ceiling Mount Support Fin Bracket:
- a. Support fin bracket for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Glazing Gaskets: Manufacturer's standard.
 - c. Snap-On Cover Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum][Stainless steel]**.
23. Patch Lock Fitting:
- a. Patch lock fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Patch Lock: Manufacturer's standard **[top][bottom][side]** mount with lock mechanism and strike plate.
 - c. Locking Function: Key operated from secure side; thumbturn on nonsecure side.
 - 1) Type: Deadbolt.
 - 2) Cylinder: **[Standard mortise keyed cylinder; six pin]<Insert type>**.
 - 3) Thumbturn: **[Standard thumbturn][ADA thumbturn]<Insert type>**.
 - 4) Strike/Keeper: **[Dustproof keeper][Patch lock keeper]**.
 - a) Dustproof Keeper: **[Locking][Nonlocking]** dustproof keeper; **[floor mounted with mounting plate][threshold mounted with mounting plate][threshold mounted; no mounting plate]**.
 - d. Glazing Gaskets: Manufacturer's standard.
 - e. Snap-On Cover Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum][Stainless steel]**.
24. Center Lock Fitting with Mortise Lock:
- a. Center lock fitting for **[12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Size: **[6-by-10-inch (152-by-254-mm)][As indicated on Drawings]**.
 - c. Lever: **[Wrought][Forged][Cast]**.
 - 1) Style: **<Insert model number and description>**.
 - 2) Construction: **[Solid][Tube]**.
 - d. Escutcheons (Roses): **[Wrought][Forged][Cast]**.
 - e. Auxiliary Mortise Lock: ANSI/BHMA A156.13; **[Operational Grade 1][Operational Grade 2]**; stamped steel case with steel or brass parts; Series 1000.
 - 1) Type: Deadlatch.
 - 2) Locking Function: **[Office][Entrance][Passage][Storeroom][Classroom]**.
 - a) Cylinder: **[Standard mortise keyed cylinder; six pin]<Insert type>**.
 - b) Thumbturn: **[Standard thumbturn][ADA thumbturn]<Insert type>**.
 - c) Lock Throw: **3/4-inch (19-mm)** latchbolt throw.

- 3) Lock Backset: **2-3/4 inches (70 mm)**.
 - f. Strike: **[Manufacturer's standard glass keeper with strike plate for center lock fitting indicated][Strike with dust box]**.
 - g. Fitting Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum]**.
25. Glass Mount Patch Lock Keeper Fitting:
- a. Keeper fitting for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Glazing Gaskets: Manufacturer's standard.
 - c. Type: Glass keeper to accept deadlock.
 - d. Snap-On Cover Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum][Stainless steel]**.
26. Center Lock Glass Keeper Fitting:
- a. Keeper fitting for **[12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Glazing Gaskets: Manufacturer's standard.
 - c. Type: Glass keeper to accept deadlatch.
 - d. Size: **[4-by-10-inch (102-by-254-mm)][6-by-10-inch (152-by-254-mm)][As indicated on Drawings]**.
 - e. Keeper Fitting Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum]**.

2.5 U-CHANNELS

- A. U-Channels: In sizes, quantities, and types recommended by manufacturer for all-glass application indicated on Drawings. For exposed parts, match metal and finish of channel.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ASSA ABLOY Glass Solutions; ASSA ABLOY]**
 - b. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - c. **[PRL Glass Systems Inc.]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ASSA ABLOY Glass Solutions; ASSA ABLOY]**
 - b. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - c. **[PRL Glass Systems Inc.]**
 - d. **<Insert manufacturer's name>**
 3. Dry Glaze U-Channel:
 - a. U-Channels for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered**

- ## 2.6 HEADERS

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manufacturer's name; product name or designation> or comparable product by one of the following:

- a. **[ASSA ABLOY Glass Solutions; ASSA ABLOY]**
 - b. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - c. **[Clover Architectural Products, LLC]**
 - d. **[dormakaba USA Inc.]**
 - e. **[PRL Glass Systems Inc.]**
 - f. **<Insert manufacturer's name>**
3. Solid Header:
- a. Extruded aluminum tube header.
 - b. Size: **[1-3/4-by-4-inch (45-by-102-mm)][1-3/4-by-4-1/2-inch (45-by-114-mm)][2-by-2-inch (51-by-51-mm)][2-by-6-inch (51-by-152-mm)][As indicated on Drawings]<Insert dimensions>**.
 - c. Header Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum]**.
4. Overhead Concealed Closer Header:
- a. Header channel with flat snap-in overhead concealed door closer cover plate for **[single][double]** door. Mounting brackets and clips are pre-installed.
 - b. Size: **[1-3/4-by-4-inch (45-by-102-mm)][1-3/4-by-4-1/2-inch (45-by-114-mm)][As indicated on Drawings]<Insert dimensions>**.
 - c. Header Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum]**.
5. Overhead Concealed Closer and Sidelite Header:
- a. Header channel with flat snap-in overhead concealed door closer cover plate for **[single][double]** door, and snap-in glazing pocket with manufacturer's standard glazing gaskets, at sidelite(s). Mounting brackets and clips are pre-installed.
 - 1) Glazing pocket for **[10 mm thick tempered glass][12 mm thick tempered glass][16 mm thick tempered glass][19 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Size: **[1-3/4-by-4-inch (45-by-102-mm)][1-3/4-by-4-1/2-inch (45-by-114-mm)][As indicated on Drawings]<Insert dimensions>**.
 - c. Header Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum]**.
6. Walking Beam Pivot Header:
- a. Header channel with flat snap-in walking beam pivot cover plate. Mounting brackets and clips are pre-installed.
 - b. Size: **[1-7/8-by-1-5/8-inch (47-by-41-mm)][2-by-1-11/16-inch (51-by-43-mm)][As indicated on Drawings]<Insert dimensions>**.
 - c. Header Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum]**.
7. Floating Header:
- a. Header channel prepared to receive overhead concealed door closer and glass transom,

- with manufacturer's standard glazing gaskets.
- b. Size: **[1-3/4-by-4-inch (45-by-102-mm)]****[As indicated on Drawings]****<Insert dimensions>**.
- c. Header for **[12 mm thick tempered glass]****[tempered glass thickness as indicated on Drawings]****<Insert thickness>**.
- d. Installation: Glass to glass.
- e. End Caps: Manufacturer's standard precision-fit end caps for floating headers.
- f. Header Material: **[Aluminum]****[Bronze-clad aluminum]****[Brass-clad aluminum]****[Stainless steel clad aluminum]**.

2.7 GLASS CLAMPS

- A. Glass Clamps: In sizes, quantities, and types recommended by manufacturer for all-glass application indicated on Drawings.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following]****[provide products by one of the following]****[available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - b. **[Vetroglass Hardware]**
 - c. **[Wagner Companies (The); R&B Wagner, Inc.]**
 - d. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - b. **[Vetroglass Hardware]**
 - c. **[Wagner Companies (The); R&B Wagner, Inc.]**
 - d. **<Insert manufacturer's name>**
3. Glass-to-Glass Clamps:
 - a. Clamps for **[10 mm thick tempered glass]****[12 mm thick tempered glass]****[tempered glass thickness as indicated on Drawings]**.
 - b. Profile: **[90]****[180]****[135]****<Insert number>** degree.
 - c. Style: **[2 inch (51 mm) square]****[2-inch (51-mm) diameter, round]****[As indicated on Drawings]****<Insert style>**.
 - d. Clamp Material: **[Stainless steel]****[Brass]****<Insert material>**.
4. Glass-to-Glass Bracing Clamps:
 - a. Clamps for **[10 mm thick tempered glass]****[12 mm thick tempered glass]****[tempered glass thickness as indicated on Drawings]**.
 - b. Profile: **[90 degree]****[180 degree]****[Adjustable]**.
 - c. Size: **[Manufacturer's standard]****[As indicated on Drawings]**.
 - d. Clamp Material: **[Stainless steel]****<Insert material>**.
5. Wall Mount Clamps:
 - a. Clamps for **[10 mm thick tempered glass]****[12 mm thick tempered glass]****[tempered glass thickness as indicated on Drawings]**.

- b. Style: **[2-inch (51-mm) square][2-inch (51-mm) diameter, round][As indicated on Drawings]<Insert style>**.
- c. Clamp Material: **[Stainless steel][Brass]<Insert material>**.

6. Wall Mount Bracing Clamps:

- a. Clamps for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
- b. Size: **[Manufacturer's standard][As indicated on Drawings]**.
- c. Clamp Material: **[Stainless steel]<Insert material>**.

2.8 SLIDING DOOR HARDWARE

A. Sliding Door Hardware: Components in sizes, quantities, and types recommended by manufacturer for all-glass application indicated on Drawings.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - b. **[DAMS Incorporated; D. Architectural Metal Solutions Incorporated]**
 - c. **[dormakaba USA Inc.]**
 - d. **[Hafele America Co.]**
 - e. **[Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - f. **[PRL Glass Systems Inc.]**
 - g. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - b. **[DAMS Incorporated; D. Architectural Metal Solutions Incorporated]**
 - c. **[dormakaba USA Inc.]**
 - d. **[Hafele America Co.]**
 - e. **[Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - f. **[PRL Glass Systems Inc.]**
 - g. **<Insert manufacturer's name>**
3. Bottom Rolling, Sliding Door Hardware: Consisting of complete sets, including tracks, rollers, supports, and accessories indicated.
 - a. Horizontal sliding door hardware for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Horizontal Sliding Door Hardware: Rated for maximum door weight of **[125 lb (57 kg)][286 lb (130 kg)]<Insert weight>**.
 - c. Operation: **[Single][Bi-parting]** door.
 - d. Top Guide Track: Manufacturer's standard extruded aluminum top guide track **[with glazing pocket]** and cover.

- 1) Size: **[1-1/2-by-2-inch (38-by-51-mm)]<Insert dimensions>**.
 - 2) Mounting Brackets: Manufacturer's standard mounting brackets and hardware for **[wall][ceiling]** mount.
 - 3) Length: As indicated on Drawings.
 - 4) Top Track Stop: Manufacturer's standard right- and left-hand track-mounted stop.
 - 5) End Caps: Manufacturer's standard precision-fit track end caps.
 - 6) Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum]**.
- e. Top Roller Guides:
- 1) Manufacturer's standard top roller guide with nylon rollers.
 - a) Material: **[Stainless steel]<Insert material>**.
- f. Bottom Roller:
- 1) Type: **[Heavy-duty rail mount assembly][Glass mount roller]<Insert style>**.
 - 2) Material: **[Stainless steel]<Insert material>**.
- g. Bottom Track:
- 1) Profile: Manufacturer's standard for bottom roller type indicated.
- h. Accessories:
- 1) Floor/Wall Mount Door Stop: **<Insert style>**.
 - 2) Flush Pull:
 - a) Style: **[Open][Closed]<Insert description>**.
 - b) Size: **[2-1/4-inch (57-mm) diameter]<Insert dimensions>**.
 - c) Pull Material: Stainless steel.
4. Top-Hung, Sliding Door Hardware: ANSI/BHMA A156.14; consisting of complete sets, including tracks, hangers, supports, and accessories indicated.
- a. Horizontal sliding door hardware for **[8 mm thick tempered glass][10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Horizontal Sliding Door Hardware: Grade 1; rated for maximum door weight of **[176 lb (80 kg)][264 lb (120 kg)][330 lb (150 kg)]<Insert weight>**.
 - c. Operation: **[Single][Bi-parting]** door.
 - d. Top Track: Extruded aluminum track with manufacturer's standard mounting brackets and hardware for **[wall][ceiling]** mount. Track length as indicated on Drawings.
 - e. Hanger: Manufacturer's standard adjustable hanger with tandem ball bearing rollers and gasketed clamp patches.
 - f. Accessories:
 - 1) Snap-on break metal cover:
 - a) Manufacturer's standard, sized to fully conceal hanger assembly.
 - b) Material: **[Aluminum][Bronze-clad aluminum][Brass-clad aluminum][Stainless steel clad aluminum]**.
 - 2) End Caps: Manufacturer's standard precision-fit end caps.
 - 3) Fixed Panel Adaptor:

- a) Manufacturer's standard extruded aluminum adaptor for sidelite on **[one][both]** sides.
 - b) Adaptor for **[8 mm thick tempered glass][10 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - 4) Roller Stops: Manufacturer's standard track-mounted roller stop.
 - 5) Floor Support: Manufacturer's standard **[adjustable floor guide][surface-mounted bottom guide threshold][recessed guide channel]**.
 - a) Material: **[Aluminum]<Insert material>**.
 - 6) Floor/Wall Mount Door Stop: **<Insert style>**.
 - 7) Flush Pull:
 - a) Style: **[Open][Closed]<Insert description>**.
 - b) Size: **[2-1/4-inch (57-mm) diameter]<Insert dimensions>**.
 - c) Pull Material: Stainless steel.
5. Top-Hung Exposed Rail, Sliding Door Hardware: ANSI/BHMA A156.14; consisting of complete sets, including rails, hangers, supports, and accessories indicated.
- a. Horizontal sliding door hardware for **[10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Horizontal Sliding Door Hardware: Grade 1; rated for maximum door weight of **[198 lb (90 kg)][220 lb (100 kg)][240 lb (109 kg)]<Insert weight>**.
 - c. Tube Rail:
 - 1) Profile: **[1-inch (25-mm) diameter, round]<Insert profile>** with end caps.
 - 2) Length: As indicated on Drawings.
 - 3) Mounting Brackets: Manufacturer's standard mounting bracket and hardware for **[wall][glass]** mount.
 - 4) Rail Material: Stainless steel.
 - d. Hanger:
 - 1) Anti-lift, adjustable hangers.
 - 2) Configuration: **<Insert model number and description>**.
 - 3) Glass Fitting Mount: **[Surface][Flush]**.
 - 4) Top Roller: Nylon coated, **[single][double]**.
 - 5) Hanger Material: Stainless steel.
 - e. Accessories:
 - 1) Floor Guide: Manufacturer's standard, adjustable, stainless steel.
 - 2) Floor/Wall Mount Door Stop: **<Insert style>**.
 - 3) Flush Pull:
 - a) Style: **[Open][Closed]<Insert description>**.
 - b) Size: **[2-1/4-inch (57-mm) diameter]<Insert dimensions>**.
 - c) Pull Material: Stainless steel.
 - 4) Track Stop: Manufacturer's standard right- and left-hand track-mounted stop.

2.9 PIVOTS

- A. Pivots: ANSI/BHMA A156.4; components in sizes, quantities, and types recommended by manufacturer for all-glass application indicated on Drawings.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ASSA ABLOY Glass Solutions; ASSA ABLOY]**
 - b. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - c. **[Hafele America Co.]**
 - d. **[PRL Glass Systems Inc.]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[ASSA ABLOY Glass Solutions; ASSA ABLOY]**
 - b. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - c. **[Hafele America Co.]**
 - d. **[PRL Glass Systems Inc.]**
 - e. **<Insert manufacturer's name>**
 3. Surface Mount Top Pivot:
 - a. Type: Manufacturer's standard surface mount top-center-hung free swing pivot[**and rail mount pivot receptor arm**].
 - b. Pivot Material: **[Stainless steel]<Insert material>**.
 4. Walking Beam Top Pivot:
 - a. Type: Manufacturer's standard center-hung walking beam top pivot[**and rail mount pivot receptor arm**].
 - b. Pivot Material: **[Stainless steel]<Insert material>**.
 5. Offset Top Pivot:
 - a. Type: Manufacturer's standard full mortise, nonhanded, offset top pivot with **[3/4 inches (19 mm)][1-1/2 inches (38 mm)]** offset[**and rail mount right-handed offset pivot receptor arm with cover plate to match rail**][**and rail mount left-handed offset pivot receptor arm with cover plate to match rail**].
 - b. Pivot Material: **[Stainless steel]<Insert material>**.
 6. Threaded Top Pivot:
 - a. Type: Manufacturer's standard top threaded free swing pivot[**with masonry anchor**].
 - b. Pivot Material: **[Stainless steel]<Insert material>**.
 7. Floor Mount Bottom Pivot:
 - a. Type: Manufacturer's standard floor mount center-hung free swing pivot[**and rail mount right-handed offset pivot receptor arm with cover plate to match rail**][**and rail mount left-handed offset pivot receptor arm with cover plate to match rail**].

- b. Pivot Material: **[Stainless steel]<Insert material>**.
- 8. Adjustable Floor Mount Bottom Pivot:
 - a. Type: Manufacturer's standard adjustable floor mount free swing pivot[**and rail mount right handed offset pivot receptor arm with cover plate to match rail**][**and rail mount left handed offset pivot receptor arm with cover plate to match rail**].
 - b. Pivot Material: **[Stainless steel]<Insert material>**.
- 9. Door Rail End Load Bottom Pivot Set:
 - a. Type: Manufacturer's standard end load floor mount pivot with end load rail mount pivot receptor arm.
 - b. Pivot Material: **[Stainless steel]<Insert material>**.
- 10. Door Rail Adjustable End Load Bottom Pivot Set:
 - a. Type: Manufacturer's standard adjustable end load floor mount pivot with end load rail mount pivot receptor arm.
 - b. Pivot Material: **[Stainless steel]<Insert material>**.

2.10 PUSH/PULL OPERATING TRIM

- A. Push/Pull Operating Trim: Components in sizes, quantities, and types recommended by manufacturer for all-glass application indicated on Drawings.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - b. **[dormakaba USA Inc.]**
 - c. **[PRL Glass Systems Inc.]**
 - d. **[Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - e. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - b. **[dormakaba USA Inc.]**
 - c. **[PRL Glass Systems Inc.]**
 - d. **[Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - e. **<Insert manufacturer's name>**
 - 3. Locking Ladder Pulls:
 - a. Pulls for **[12 mm thick tempered glass][16 mm thick tempered glass][19 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Profile: **[1-1/4-inch (32-mm) diameter, round][As indicated on Drawings]<Insert**

- profile>.**
- c. Style:
- 1) Full height, bolt [up][down].
 - 2) Half height, bolt [up][down].
 - 3) [L-shaped inside/outside][L-shaped inside with 48-inch (1219-mm) straight outside][L-shaped outside with 48-inch (1219-mm) straight inside], bolt [up][down].
 - 4) [48 inches (1219 mm) straight][72 inches (1829 mm) straight][84 inches (2134 mm) straight], bolt [up][down].
 - 5) [As indicated on Drawings.]
 - 6) <Insert style>.
- d. Mounting: Back to back[/decorative through bolt].
- e. Minimum Pull Clearance: [1-1/2 inches (38 mm)]<Insert dimension> from face of door.
- f. Locking Function: Key operated from secure side; thumbturn on nonsecure side.
- 1) Type: Deadbolt.
 - 2) Cylinder: [Standard rim keyed cylinder; six pin][Rim cylinder; seven-pin small format interchangeable core]<Insert type>.
 - 3) Thumbturn: [Standard thumbturn][ADA thumbturn]<Insert type>.
 - 4) Lock Throw: Minimum [1-inch (25-mm)]<Insert dimension> deadbolt throw.
 - 5) Overhead Strike: [Deadbolt receiver for header][Surface strike selected from manufacturer's full range][Transom strike selected from manufacturer's full range][As indicated on Drawings]<Insert strike>.
 - 6) Floor Strike: [Locking][Nonlocking] dustproof keeper; [Floor mounted with mounting plate][Threshold mounted with mounting plate][Threshold mounted; no mounting plate].
- g. Pull Material: [Stainless steel tubing]<Insert material>.
4. Ladder Pulls:
- a. Pulls for [10 mm thick tempered glass][12 mm thick tempered glass][16 mm thick tempered glass][19 mm thick tempered glass][tempered glass thickness as indicated on Drawings].
 - b. Profile/Style: [1-1/4-inch (32-mm) diameter with round mounting posts][1-1/4-inch (32 mm) diameter with offset mounting posts][1 inch (25 mm) square with round mounting posts][1 inch (25 mm) square with square mounting posts][1-1/4-inch (32-mm) diameter S-shape, right hand, with round mounting posts][1-1/4-inch (32-mm) diameter S-shape, left hand, with round mounting posts][1-inch (25-mm) diameter with acrylic semi-insert and round mounting posts][As indicated on Drawings]<Insert profile>.
 - c. Length: [24 inches (610 mm)][30 inches (762 mm)][36 inches (914 mm)][42 inches (1067 mm)][48 inches (1219 mm)][54 inches (1372 mm)][60 inches (1524 mm)][66 inches (1676 mm)][72 inches (1829 mm)][78 inches (1981 mm)][84 inches (2134 mm)][As indicated on Drawings]<Insert length>.
 - d. Mounting: Back to back.
 - e. Minimum Pull Clearance: [1-1/2 inches (38 mm)]<Insert dimension> from face of door.
 - f. Pull Material: [Stainless steel tubing]<Insert material>.
5. Door Pulls:
- a. Pulls for [10 mm thick tempered glass][12 mm thick tempered glass][16 mm thick tempered glass][19 mm thick tempered glass][tempered glass thickness as indicated on Drawings].

- b. Profile/Style: [1-inch (25-mm) diameter, straight][1-inch (25-mm) diameter, offset][1-inch (25-mm) diameter, curved][As indicated on Drawings]<Insert profile>.
 - c. Offset: [3 inches (76 mm)]<Insert dimension> from center.
 - d. Length: [10 inches (254 mm)][12 inches (305 mm)][18 inches (457 mm)][24 inches (610 mm)][48 inches (1219 mm)][As indicated on Drawings]<Insert length>.
 - e. Mounting: [Single-sided with decorative through bolt][Back to back][Heavy-duty back to back].
 - f. Minimum Pull Clearance: [1-1/2 inches (38 mm)][2-1/4 inches (57 mm)]<Insert dimension> from face of door.
 - g. Pull Material: [Aluminum tubing][Stainless steel tubing][Brass tubing][Solid aluminum][Solid stainless steel]<Insert material>.
6. Combination Push-Pull:
- a. Pulls for [10 mm thick tempered glass][12 mm thick tempered glass][16 mm thick tempered glass][19 mm thick tempered glass][tempered glass thickness as indicated on Drawings].
 - b. Profile/Style: [1-inch (25 mm) diameter, straight][1-inch (25 mm) diameter, offset][As indicated on Drawings]<Insert profile>.
 - c. Offset: [3 inches (76 mm)]<Insert dimension> from center.
 - d. Length: [10-by-28-inch (254-by-711-mm)][12-by-28-inch (305-by-711-mm)][As indicated on Drawings]<Insert length>.
 - e. Mounting: [Back to back/decorative through bolt][Heavy-duty back-to-back/decorative through bolt].
 - f. Minimum Pull Clearance: [1-1/2 inches (38 mm)]<Insert dimension> from face of door.
 - g. Pull Material: [Stainless steel tubing][Brass tubing][Solid aluminum]<Insert material>.

2.11 EXIT DEVICES AND AUXILIARY ITEMS

- A. Exit Devices and Auxiliary Items: ANSI/BHMA A156.3, Grade 1; components in sizes, quantities, and types recommended by manufacturer for all-glass application indicated on Drawings.
- 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [ASSA ABLOY Glass Solutions; ASSA ABLOY]
 - b. [Blumcraft; C.R. Laurence Co., Inc.; CRH Americas, Inc.]
 - c. [dormakaba USA Inc.]
 - d. [PRL Glass Systems Inc.]
 - e. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [ASSA ABLOY Glass Solutions; ASSA ABLOY]
 - b. [Blumcraft; C.R. Laurence Co., Inc.; CRH Americas, Inc.]
 - c. [dormakaba USA Inc.]
 - d. [PRL Glass Systems Inc.]
 - e. <Insert manufacturer's name>
 - 3. Panic Exit Device: Listed and labeled by a testing and inspecting agency acceptable to authorities

having jurisdiction, for panic protection, based on testing in accordance with UL 305.

- a. Exit device for [12 mm thick tempered glass][16 mm thick tempered glass][19 mm thick tempered glass][tempered glass thickness as indicated on Drawings].
 - b. Style: [1-1/4-inch (32-mm) diameter upward latching][1-1/4-inch (32-mm) diameter downward latching][1-1/4-inch (32-mm) diameter, upward latching, engraved with word "PUSH" in black letters][1-1/4-inch (32-mm) diameter, downward latching, engraved with word "PUSH" in black letters][As indicated on Drawings]<Insert profile>.
 - c. Mounting: [Glass mount][Rail mount].
 - d. Operation: Concealed operating device with dogging[and exterior keyed cylinder].
 - 1) Cylinder: [Standard mortise keyed cylinder; six pin][Mortise cylinder; seven-pin small-format interchangeable core]<Insert type>.
 - e. Strike:
 - 1) Overhead Strike: [Manual single][Manual double][Electric single][Electric double].
 - 2) Floor Strike: [Floor mount][Threshold mount].
 - f. Device Material: [Stainless steel tubing][Bronze tubing]<Insert material>.
4. Dummy Device: Nonfunctioning push bar matching functional push bar.
- a. Dummy device for [10 mm thick tempered glass][12 mm thick tempered glass][16 mm thick tempered glass][19 mm thick tempered glass][tempered glass thickness as indicated on Drawings].
 - b. Style: [Match exit device][As indicated on Drawings]<Insert profile>.
 - c. Device Material: [Match exit device]<Insert material>.
5. Exit Device Outside Trim:
- a. Exterior pull for [12 mm thick tempered glass][16 mm thick tempered glass][19 mm thick tempered glass][tempered glass thickness as indicated on Drawings].
 - b. Style: [1-1/4-inch (32-mm) diameter, full height, L-shaped up][1-1/4-inch (32-mm) diameter, full height, L-shaped down][1-1/4-inch (32-mm) diameter, half height, L-shaped up][1-1/4-inch (32-mm) diameter, half height, L-shaped down][1-1/4-inch (32-mm) diameter, full height, straight][1-1/4-inch (32-mm) diameter, half height, straight down][1-1/4-inch (32-mm) diameter, half height, straight up][1-1/4-inch (32-mm) diameter, short centered, straight][1-1/4-inch (32-mm) diameter, horizontal straight][As indicated on Drawings]<Insert profile>.
 - c. Device Material: [Stainless steel tubing][Bronze tubing]<Insert material>.

2.12 ELECTRIC STRIKES

- A. Electric Strikes: ANSI/BHMA A156.31, Grade 1; components in sizes, quantities, and types recommended by manufacturer for all-glass application indicated on Drawings.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [ASSA ABLOY Electronic Security Hardware; ASSA ABLOY]

- b. <Insert manufacturer's name>
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. **[ASSA ABLOY Electronic Security Hardware; ASSA ABLOY]**
 - b. <Insert manufacturer's name>
- 3. Electric Strike: Include stop/strike and faceplate.
 - a. Mounting: Header mounted, **[double][single]**.
 - b. Strike Plate:
 - 1) For **[12 mm thick tempered glass][19 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - 2) **3/4-inch (19-mm)** keeper.
 - c. Operation: **[Fail-safe][Fail-secure]**.
 - d. Monitoring: Latchbolt.
 - e. Device Material: **[Stainless steel]<Insert material>**.

2.13 CONCEALED CLOSERS

- A. Concealed Closers: ANSI/BHMA A156.4; in size and type as recommended by manufacturer for all-glass application indicated on Drawings.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[ASSA ABLOY Glass Solutions; ASSA ABLOY]**
 - b. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - c. **[Rixson Specialty Door Controls; ASSA ABLOY]**
 - d. <Insert manufacturer's name>
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. **[ASSA ABLOY Glass Solutions; ASSA ABLOY]**
 - b. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - c. **[Rixson Specialty Door Controls; ASSA ABLOY]**
 - d. <Insert manufacturer's name>
 - 3. Medium-Duty Concealed Overhead Closer:
 - a. Closer Type: Grade 1, center pivoting, with cast-iron body for installation in header channel.
 - b. Arm Type: Concealed end load arm.
 - c. Door Swing Type: Double acting.
 - d. Closing Operation: Adjustable sweep and latch speeds controlled by key-operated valves.
 - e. Spindle: **[3/4 inch (19 mm)]<Insert height>** high.

- f. Function: **[Regular][90-degree hold-open][105-degree hold-open]**.
 - g. Backcheck: **[Factory preset][Adjustable]**.
 - h. Closing Power Adjustment: At least **[50][35]** percent more than minimum tested value.
4. Heavy-Duty Concealed Overhead Closer:
- a. Closer Type: Grade 2, center pivoting, with cast-iron body for installation in header channel.
 - b. Arm Type: Concealed end load arm.
 - c. Door Swing Type: Double acting.
 - d. Closing Operation: Adjustable sweep and latch speeds controlled by key-operated valves.
 - e. Spindle: **[3/4 inch (19 mm)]<Insert height>** high.
 - f. Function: **[Regular][90-degree hold-open][105-degree hold-open]**.
 - g. Backcheck: **[Factory preset][Adjustable]**.
 - h. Closing Power: Spring size 4.
5. Concealed Floor Closer:
- a. Closer Type: Grade 1, **[center pivoting][offset pivoting]**, with cement case and cast-iron closer body case.
 - b. Arm Type: Concealed, **[center hung][offset with cover plate to match fitting]**.
 - c. Top Pivot: Include **[surface mount top pivot][walking beam top pivot][offset top pivot]**.
 - d. Door-Swing Type: **[Single][Double]** acting.
 - e. Closing Operation: Adjustable sweep and latch speeds controlled by key-operated valves.
 - f. Spindle: **[1/8 inch (3 mm)]<Insert height>** high.
 - g. Function: **[Regular][Variable manually selected hold-open][Variable delayed action closing]**.
 - h. Backcheck: **[Factory preset][Adjustable]**.
 - i. Closing Power Adjustment: At least **[50][35]** percent more than minimum tested value.
 - j. Case Depth: **[Regular, 4 inches (102 mm)][Shallow, 2 inches (51 mm)]**.
 - k. Floor Plates: Provide **[flush cover plates matching door hardware finish][recessed floor plates with insert of floor finish material and extended closer spindle to accommodate thickness of floor finish]** unless thresholds are indicated.
- 1) Material: **[Stainless steel]<Insert material>**.

2.14 HINGES

- A. Hinges: Components in sizes, quantities, and types recommended by manufacturer for all-glass application indicated on Drawings.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - b. **[dormakaba USA Inc.]**
 - c. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**

- b. [dormakaba USA Inc.]
 - c. <Insert manufacturer's name>
3. Self-Closing Double-Acting Hinge: Adjustable spring tension and closing position, rated for maximum door weight of **140 lb (63.5 kg)** and maximum door width of **39 inches (990 mm)**.
- a. Hinges for [8 mm thick tempered glass][10 mm thick tempered glass][12 mm thick tempered glass][tempered glass thickness as indicated on Drawings].
 - b. Swing: 90-degree double acting [with positive dead stop].
 - c. Hold-Open: 90 degree.
 - d. Mounting: [Wall mounted with surface-mounting plate][Glass-to-glass mounted].
 - e. Hinge Material: [Solid brass]<Insert material>.

2.15 DUSTPROOF KEEPERS

- A. Dustproof Keepers: ANSI/BHMA A156.16; Grade 1, polished wrought brass, with **3/4-inch- (19-mm-)** diameter, spring-tension plunger.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- a. [C.R. Laurence Co., Inc.; CRH Americas, Inc.]
 - b. [Ives; Allegion plc]
 - c. [PRL Glass Systems Inc.]
 - d. [Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - e. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [C.R. Laurence Co., Inc.; CRH Americas, Inc.]
 - b. [Ives; Allegion plc]
 - c. [PRL Glass Systems Inc.]
 - d. [Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - e. <Insert manufacturer's name>

2.16 DOOR GASKETING

- A. Door Gasketing: Components in sizes, quantities, and types recommended by manufacturer for all-glass application indicated on Drawings.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- a. [C.R. Laurence Co., Inc.; CRH Americas, Inc.]
 - b. [Zero International; Allegion plc]

- c. **<Insert manufacturer's name>**
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - b. **[Zero International; Allegion plc]**
 - c. **<Insert manufacturer's name>**
- 3. Meeting Astragals for Meeting Stiles: Manufacturer's standard **[clear polycarbonate][aluminum extrusion]** weatherstrip channel with replaceable **[black][grey]** wool pile, full height of door, for use with door rails.
 - a. Meeting Astragals for **[12 mm thick tempered glass][tempered glass thickness as indicated on Drawings]**.
 - b. Pile height: **3/16 inch (5 mm)**.
- 4. Door Sweeps: Manufacturer's standard aluminum extrusion with replaceable **[black][grey]** wool pile weather sweep, full width of door, recessed in door rail.
 - a. Pile height: **3/32 inch (2 mm)**.

2.17 THRESHOLDS

- A. Thresholds: ANSI/BHMA A156.21; fabricated to full width of opening indicated.
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - b. **[Hager Companies]**
 - c. **[National Guard Products, Inc]**
 - d. **[Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - e. **[PRL Glass Systems Inc.]**
 - f. **[Reese Enterprises, Inc]**
 - g. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - b. **[Hager Companies]**
 - c. **[National Guard Products, Inc]**
 - d. **[Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - e. **[PRL Glass Systems Inc.]**
 - f. **[Reese Enterprises, Inc]**
 - g. **<Insert manufacturer's name>**
 - 3. Compressing-Top Thresholds:

- a. Type: Metal member with compressible vinyl seal on top of threshold that seals against bottom of door.
 - b. Material: **[Aluminum][Extruded bronze][Stainless steel]**.
- 4. Saddle Thresholds:
 - a. Type: **[Smooth top][Fluted top][Fluted top and offset][Thermal break and fluted top][Applied gasketed stop and fluted top][Carpet separator with fluted top]**.
 - b. Material: **[Aluminum][Extruded bronze][Stainless steel]**.
- 5. Half-Saddle Thresholds:
 - a. Type: Fluted-top metal member.
 - b. Material: **[Aluminum][Extruded bronze]**.
- 6. Plate Thresholds: Solid metal plate.
 - a. Top Surface: Fluted **[with slip-resistant abrasive]**.
 - b. Material: **[Aluminum][Extruded brass or bronze][Stainless steel]**.
- 7. Saddle Thresholds for Floor Closers: Fluted top.
 - a. Type: **[A, for center-hung doors; ends not mitered][B, for offset-hung doors; ends not mitered][C, for center-hung doors; ends mitered][D, for offset-hung doors; ends mitered]**.
 - b. Material: **[Aluminum][Extruded bronze]**.

2.18 MECHANICAL STOPS

A. Wall- and Floor-Mounted Stops: ANSI/BHMA A156.16.

- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Burns Manufacturing Incorporated]**
 - b. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - c. **[Don-Jo Mfg., Inc]**
 - d. **[dormakaba USA Inc.]**
 - e. **[Hager Companies]**
 - f. **[Ives; Allegion plc]**
 - g. **[PRL Glass Systems Inc.]**
 - h. **[Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]**
 - i. **[Trimco]**
 - j. **<Insert manufacturer's name>**
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Burns Manufacturing Incorporated]**
 - b. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**

- c. [Don-Jo Mfg., Inc]
 - d. [dormakaba USA Inc.]
 - e. [Hager Companies]
 - f. [Ives; Allegion plc]
 - g. [PRL Glass Systems Inc.]
 - h. [Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY]
 - i. [Trimco]
 - j. <Insert manufacturer's name>
3. Dome-Type Floor Stop: [Grade 1][Grade 2]; with minimum 1-inch- (25-mm-) high bumper for doors without threshold and 1-3/8-inch- (35-mm-) high bumper for doors with threshold.
- a. Provide with extruded aluminum riser for carpet installations.
 - b. Material: [Polished cast brass][Bronze][Aluminum]<Insert material>.
4. Universal Floor Stop: [Grade 1][Grade 2]; with fasteners for concealed installation.
- a. Bumper Configuration: [1-1/8-inch (29-mm)][1-1/2-inch (38-mm)] diameter cylindrical stop with rubber "O" ring bumper.
 - b. Stop Height: [1-1/2 inches (38 mm) with rubber bumper 1/2 inch (13 mm) from top of stop][2 inches (51 mm) with rubber bumper 1/2 inch (13 mm) from top of stop][As indicated on Drawings]<Insert dimension>.
 - c. Material: [Polished cast brass][Aluminum]<Insert material>.
5. Wall Bumper: [Grade 1][Grade 2]; with rubber bumper; 2-1/2-inch (63.5-mm) diameter, minimum 3/4-inch (19-mm) projection from wall; with backplate for concealed fastener installation.
- a. Bumper Configuration: [Convex][Concave].
 - b. Material: [Polished cast brass][Bronze][Aluminum]<Insert material>.
6. Header-Mounted Door Stop: For single-acting doors.
- a. Configuration:
 - 1) Single Door Stop:
 - a) Length: [2 inches (51 mm)][3 inches (76 mm)][Manufacturer's standard] with full-length rubber bumper.
 - 2) Double Door Stop:
 - a) Length: [6 inches (152 mm)][Manufacturer's standard] with full-length rubber bumper.
 - b. Material: [Stainless steel][Bronze][Brass][Aluminum]<Insert material>.

2.19 LOCK CYLINDERS

- A. Lock Cylinders: ANSI/BHMA A156.5; [Grade 1][Grade 2]; tumbler type, constructed from brass or bronze, stainless steel, or nickel silver; face finished to match lockset.[Provide cylinder from same manufacturer of locking devices.]
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the

following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Allegion plc]
 - b. [BEST Access Solutions, Inc.; dormakaba USA Inc.]
 - c. [C.R. Laurence Co., Inc.; CRH Americas, Inc.]
 - d. [dormakaba USA Inc.]
 - e. [PRL Glass Systems Inc.]
 - f. [Yale Security Inc; ASSA ABLOY]
 - g. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Allegion plc]
 - b. [BEST Access Solutions, Inc.; dormakaba USA Inc.]
 - c. [C.R. Laurence Co., Inc.; CRH Americas, Inc.]
 - d. [dormakaba USA Inc.]
 - e. [PRL Glass Systems Inc.]
 - f. [Yale Security Inc; ASSA ABLOY]
 - g. <Insert manufacturer's name>
3. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
4. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.20 KEYING

- A. Keying System: Factory registered, complying with guidelines in ANSI/BHMA A156.28 appendix. Provide one extra key blank for each lock. [**Incorporate decisions made in keying conference.**]
1. No Master Key System: Only change keys operate cylinders.
 - a. Provide three cylinder change keys.
 2. Master Key System: Change keys and a master key operate cylinders.
 - a. Provide three cylinder change keys and five master keys.
 3. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.
 - a. Provide three cylinder change keys and five each of master and grand master keys.
 4. Great-Grand Master Key System: Change keys, a master key, a grand master key, and a great-grand master key operate cylinders.
 - a. Provide three cylinder change keys and five each of master, grand master, and great-grand master keys.

5. Existing System:

- a. Master key or grand master key locks to Owner's existing system.
- b. Re-key Owner's existing master key system into new keying system.

6. Keyed Alike: Key all cylinders to same change key.

B. Keys: **[Nickel silver][Brass]**.

1. Stamping: Permanently inscribe each key with a visual key-control number and include the following notation:

- a. Notation: **["DO NOT DUPLICATE."][Information to be furnished by Owner.]**

2.21 AUXILIARY ELECTRIFIED DOOR HARDWARE

A. Auxiliary Electrified Door Hardware: Components in sizes, quantities, and types recommended by manufacturer for all-glass application indicated on Drawings.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

- a. **[ASSA ABLOY Electronic Security Hardware; ASSA ABLOY]**
- b. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[ASSA ABLOY Electronic Security Hardware; ASSA ABLOY]**
- b. **<Insert manufacturer's name>**

3. Boxed Power Supplies: Modular unit in NEMA ICS 6, Type 4 enclosure; filtered and regulated; voltage rating and type matching requirements of door hardware served; listed and labeled for use with fire-alarm systems.

4. Monitor Strikes: Dustbox monitor for installation behind standard strike.

2.22 MATERIALS

A. Aluminum: **ASTM B221 (ASTM B221M)** with strength and durability characteristics of not less than Alloy 6063-T5 for extruded bars, rods, profiles, and tubes. **ASTM B209 (ASTM B209M)** for sheet and plate.

B. Brass: ASTM B19 flat products; ASTM B16/B16M rods, shapes, forgings, and flat products with finished edges; or ASTM B30 castings.

C. Bronze Cladding: ASTM B36/B36M alloy **[as standard with manufacturer]<Insert requirements>**.

D. Brass Cladding: ASTM B36/B36M alloy **[as standard with manufacturer]<Insert requirements>**.

E. Chrome Plating: ASTM B456.

- F. Stainless Steel Cladding: ASTM A240/A240M or ASTM A666, Type 304.
- G. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A240/A240M or ASTM A666 austenitic stainless steel, Type 304.
- H. Stainless Steel Tubing: ASTM A240/A240M or ASTM A666 austenitic stainless steel, Type 304.
- I. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.
- J. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
- K. Joint Sealants and Backings: Provide joint sealants, backings, and other related materials in accordance with Section 079200 "Joint Sealants."

2.23 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location.
 - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Anchors and Fasteners: Manufacturer's standard concealed anchors and fasteners. Do not use exposed fasteners.

2.24 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.25 FINISHES

- A. All-Glass-Entrance Door Hardware: Provide finishes complying with ANSI/BHMA A156.18 as indicated in all-glass-entrance door hardware schedule.
- B. Provide finishes as follows for items not scheduled in all-glass-entrance door hardware schedule:
 - 1. Aluminum:
 - a. Clear Anodic Finish: AAMA 611, **[AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm]** or thicker.
 - b. Color Anodic Finish: AAMA 611, **[AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm]** or thicker.
 - 1) Color: **[Light bronze][Medium bronze][Dark bronze][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.

- c. Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of **1.5 mils (0.04 mm)**. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1) Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- 2. Bronze Cladding:
 - a. Finish: **[Polished M21-O6x][Satin M31-M34-O6x][Statuary M31-C5][Match Architect's sample][As selected by Architect from full range of industry finishes]<Insert finish>**.
- 3. Brass Cladding:
 - a. Finish: **[Polished M21-O6x][Satin M31-M34-O6x][As selected by Architect from full range of industry finishes]<Insert finish>**.
- 4. Stainless Steel Cladding:
 - a. Finish: **[ASTM A480/A480M No. 4 directional satin finish][ASTM A480/A480M No. 8 mirrorlike reflective, nondirectional polish]<Insert finish>**.
- 5. Stainless Steel Sheet, Strip, Plate, and Flat Bars:
 - a. Finish: **[ASTM A480/480M No. 4 directional satin finish][ASTM A480/480M No. 6 dull satin finish][ASTM A480/480M No. 7 reflective, directional finish]<Insert finish>**.
- 6. Stainless Steel Tubing:
 - a. Finish: **[180-Grit Polished Finish: Uniform, directionally textured finish][280-Grit Polished Finish: Fine finish][Polished and Buffed Finish: 320-grit finish followed by buffing]<Insert finish>**.
 - 1) Polished and Buffed Finish: Buff to **[a high luster finish][a mirrorlike finish][match Architect's sample]**.
- 7. Stainless Steel Bars and Shapes:
 - a. Finish: **[ASTM A480/480M No. 4 directional satin finish][ASTM A480/480M No. 6 dull satin finish][ASTM A480/480M No. 7 reflective, directional finish]<Insert finish>**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified all-glass-entrance door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ALL-GLASS-ENTRANCE HARDWARE

- A. Install each all-glass-entrance hardware item to comply with manufacturer's written instructions.
- B. Set units level, plumb, and true to line, with uniform joints.
- C. Maintain uniform clearances between adjacent components.
- D. Mounting Heights: Mount all-glass-entrance door hardware units at heights indicated on Drawings unless otherwise indicated or required to comply with governing regulations.
- E. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated.
- F. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as **[indicated in keying schedule][directed by Owner]**.
 - 2. Furnish permanent cores to Owner for installation.
- G. Key-Control System: **[As specified in Section 087100 "Door Hardware"]****[As specified in Section 087111 "Door Hardware (Descriptive Specification)"]**<Insert requirements>.
- H. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, **[above accessible ceilings][in equipment room]**. Verify location with Architect.
 - 1. Configuration: Provide **[one power supply for each door opening][least number of power supplies required to adequately serve doors]** with electrified door hardware.
- I. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant.
- J. Stops: Provide floor stops for doors unless wall or other type stops are indicated in all-glass-entrance door hardware schedule. Do not mount floor stops where they will impede traffic.
- K. Meeting Stile Gasketing: Fasten to meeting stiles where indicated, forming seal when doors are closed.
- L. Door Sweeps: Apply to door bottom rails where indicated, forming seal with threshold when door is closed.
- M. Set, seal, and grout floor closer cases as required to suit hardware and substrate indicated.
- N. Joint Sealants and Backing: Install in accordance with Section 079200 "Joint Sealants."

3.3 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: **[Owner will engage][Engage]** a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
 - 1. Independent Architectural Hardware Consultant will inspect all-glass-entrance door hardware and state in each report whether installed work complies with or deviates from requirements, including whether all-glass-entrance door hardware is properly installed and adjusted.

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of all-glass-entrance door hardware and each all-glass-entrance door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust all-glass-entrance door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
 - 2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.
 - 3. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
- B. Occupancy Adjustment: Approximately ~~[three]~~~~[six]~~**<Insert number>** months after date of Substantial Completion, Installer's Architectural Hardware Consultant to examine and readjust each item of all-glass-entrance door hardware, including adjusting operating forces, as necessary to ensure function of all-glass-entrance doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by all-glass-entrance hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that all-glass-entrance hardware is without damage or deterioration at time of Substantial Completion.

3.6 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of all-glass-entrance hardware.
- B. Beginning at Substantial Completion, verify that maintenance service includes ~~[six]~~~~[nine]~~**[12]****<Insert number>** months' full maintenance by skilled employees of all-glass-entrance hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper all-glass-entrance door and door hardware operation. Verify that parts and supplies are manufacturer's authorized replacement parts and supplies.

3.7 ALL-GLASS-ENTRANCE DOOR HARDWARE SCHEDULE

- A. Hardware Set 1: Each all-glass-entrance door to have the following:
 - 1. **<Insert hardware type>**.

END OF SECTION 08 78 00 00



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Task	Specification	Specification Description
08 78 00 00	11 98 14 00	Detention Door Hardware



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SECTION 08 80 00 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass products.
2. Laminated glass.
3. Insulating glass.
4. Glazing sealants.
5. Glazing tapes.
6. Miscellaneous glazing materials.

B. Related Requirements:

1. Section 057313 "Glazed Decorative Metal Railings" for glazing in railings.
2. Section 084126 "All-Glass Entrances and Storefronts."
3. Section 084233 "Revolving Door Entrances" for glass in revolving door entrances.
4. Section 084423 "Structural-Sealant-Glazed Curtain Walls" for glazing sealants used in structural-sealant-glazed curtain walls.
5. Section 088113 "Decorative Glass Glazing."
6. Section 088300 "Mirrors."
7. Section 088813 "Fire-Rated Glazing."
8. Section 088853 "Security Glazing."

1.2 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at [Project site]<Insert location>.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 1. Product Data: For sealants, indicating VOC content.
 2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
- C. Glass Samples: For each type of **[glass product other than clear monolithic vision glass][the following products]; 12 inches (300 mm) square.**
 1. Tinted glass.
 2. Coated glass.
 3. Laminated glass.
 4. Insulating glass.
 5. Spandrel glass.
- D. Glazing Accessory Samples: For **[sealants][and][colored spacers]**, in **12-inch (300-mm) lengths.[Install sealant Samples between two strips of material representative in color of adjoining framing system.]**
- E. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- F. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **[Installer][manufacturers of fabricated glass units][glass testing agency][and][sealant testing agency]**.
- B. Product Certificates: For glass.
- C. Product Test Reports: For **[fabricated glass][and][glazing sealants]**, for tests performed by a qualified testing agency.
 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

- A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved[**and certified**] by primary glass manufacturer.
- B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors[**and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program**].
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.
- E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Install glazing in mockups specified in [Section 084113 "Aluminum-Framed Entrances and Storefronts"] [Section 085113 "Aluminum Windows"] [Section 084413 "Glazed Aluminum Curtain Walls"] <Insert Section number and title> to match glazing systems required for Project, including glazing methods.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 3. Test no fewer than [eight] <Insert number> Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below **40 deg F (4.4 deg C)**.

1.11 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: **[10]<Insert number>** years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.
- C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: **[10]<Insert number>** years from date of Substantial Completion.
- D. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period. Coverage for any other cause is excluded.
 - 1. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Source Limitations for Glass: Obtain **[tinted][and][coated]** glass from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from

single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
 - 1. Design Wind Pressures: **[As indicated on Drawings][Determine design wind pressures applicable to Project in accordance with ASCE/SEI 7, based on heights above grade indicated on Drawings].**
 - a. Wind Design Data: As indicated on Drawings.
 - b. Basic Wind Speed: **[85 mph (38 m/s)][90 mph (40 m/s)][100 mph (44 m/s)][110 mph (49 m/s)]<Insert value>.**
 - c. Importance Factor: **[1.0]<Insert factor>.**
 - d. Exposure Category: **[B][C][D].**
 - 2. Design Snow Loads: **<Insert design snow load>[As indicated on Drawings].**
 - 3. Probability of Breakage for Sloped Glazing: For glass sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
 - 4. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or **1 inch (25 mm)**, whichever is less.
 - 5. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.
- D. Windborne-Debris-Impact Resistance: Exterior glazing shall pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone **[1][2][3][4]** for **[basic][enhanced]** protection.
 - 1. Large-Missile Test: For glazing located within **[30 feet (9.1 m)]<Insert dimension>** of grade.
 - 2. Small-Missile Test: For glazing located between **30 feet (9.1 m)** and **[60 feet (18.3 m)]<Insert dimension>** above grade.
- E. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- F. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites **[6 mm thick][of thickness indicated].**
 - 2. For laminated-glass lites, properties are based on products of construction indicated.
 - 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current

non-beta version of LBL's WINDOW computer program, expressed as **Btu/sq. ft. x h x deg F (W/sq. m x K)**.

5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

G. Acoustic Performance:

1. Exterior Glazing: **[28][33][35]<Insert number> OITC**.
2. Interior Glazing: **[35][37][41]<Insert number> STC**.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: **["Laminated Glazing Reference Manual" and]"Glazing Manual."**
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of **[the SGCC][the SGCC or another certification agency acceptable to authorities having jurisdiction][or][manufacturer]**. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. **[Provide glass that complies with performance requirements and is not less than thickness indicated.]**

1. Minimum Glass Thickness for Exterior Lites: **[6 mm]<Insert thickness designation>**.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass **[as needed to comply with "Performance Requirements" Article]**. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass **[as needed to comply with "Performance Requirements" Article]**. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. [AGC Glass Company North America, Inc.]
 - b. [Cardinal Glass Industries, Inc.]
 - c. [Guardian Glass LLC]
 - d. [Pilkington North America; NSG Group]
 - e. [Saint-Gobain Glass Corp]
 - f. [Vitro Architectural Glass]
 - g. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [AGC Glass Company North America, Inc.]
 - b. [Cardinal Glass Industries, Inc.]
 - c. [Guardian Glass LLC]
 - d. [Pilkington North America; NSG Group]
 - e. [Saint-Gobain Glass Corp]
 - f. [Vitro Architectural Glass]
 - g. <Insert manufacturer's name>
- B. Low-Iron Annealed Float Glass: ASTM C1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent[and SHGC of not less than 0.87].
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [AGC Glass Company North America, Inc.]
 - b. [Guardian Glass LLC]
 - c. [Pilkington North America; NSG Group]
 - d. [Saint-Gobain Glass Corp]
 - e. [Vitro Architectural Glass]
 - f. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [AGC Glass Company North America, Inc.]
 - b. [Guardian Glass LLC]
 - c. [Pilkington North America; NSG Group]
 - d. [Saint-Gobain Glass Corp]
 - e. [Vitro Architectural Glass]
 - f. <Insert manufacturer's name>
- C. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [AGC Glass Company North America, Inc.]
 - b. [Guardian Glass LLC]
 - c. [Pilkington North America; NSG Group]

- d. **[Saint-Gobain Glass Corp]**
 - e. **[Vitro Architectural Glass]**
 - f. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[AGC Glass Company North America, Inc.]**
 - b. **[Guardian Glass LLC]**
 - c. **[Pilkington North America; NSG Group]**
 - d. **[Saint-Gobain Glass Corp]**
 - e. **[Vitro Architectural Glass]**
 - f. **<Insert manufacturer's name>**
- D. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
- 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- E. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
- 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- F. Pyrolytic-Coated, Low-Maintenance Glass: Clear float glass with coating on first surface having both photocatalytic and hydrophilic properties that act to loosen dirt and to cause water to sheet evenly over the glass instead of beading.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Cardinal Glass Industries, Inc.]**
 - b. **[Pilkington North America; NSG Group]**
 - c. **[Saint-Gobain Glass Corp]**
 - d. **<Insert manufacturer's name>**
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Cardinal Glass Industries, Inc.]**
 - b. **[Pilkington North America; NSG Group]**
 - c. **[Saint-Gobain Glass Corp]**
 - d. **<Insert manufacturer's name>**
- G. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.
- 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering**

products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Cardinal Glass Industries, Inc.]
 - b. [Guardian Glass LLC]
 - c. [Pilkington North America; NSG Group]
 - d. [Saint-Gobain Glass Corp]
 - e. [Vitro Architectural Glass]
 - f. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Cardinal Glass Industries, Inc.]
 - b. [Guardian Glass LLC]
 - c. [Pilkington North America; NSG Group]
 - d. [Saint-Gobain Glass Corp]
 - e. [Vitro Architectural Glass]
 - f. <Insert manufacturer's name>
- H. Ceramic-Coated Vision Glass: ASTM C1048, Condition C, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3; and complying with Specification No. 95-1-31 in NGA's "Engineering Standards Manual."
- I. Ceramic-Coated Spandrel Glass: ASTM C1048, Type I, Condition B, Quality-Q3.
- J. Silicone-Coated Spandrel Glass: ASTM C1048, Type I, Condition C, Quality-Q3.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- a. [Dreamwalls by Gardner Glass Products]
 - b. [Guardian Glass LLC]
 - c. [ICD High Performance Coatings]
 - d. [OldCastle BuildingEnvelope (OBE)]
 - e. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Dreamwalls by Gardner Glass Products]
 - b. [Guardian Glass LLC]
 - c. [ICD High Performance Coatings]
 - d. [OldCastle BuildingEnvelope (OBE)]
 - e. <Insert manufacturer's name>
- K. Reflective- and Low-E-Coated Spandrel Glass: ASTM C1376, Kind CS.

2.5 LAMINATED GLASS

- A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble,

discolor, or lose physical and mechanical properties after fabrication and installation.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Dreamwalls by Gardner Glass Products]**
 - b. **[Kuraray America, Inc.]**
 - c. **[Pilkington North America; NSG Group]**
 - d. **[Saflex; Eastman]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Dreamwalls by Gardner Glass Products]**
 - b. **[Kuraray America, Inc.]**
 - c. **[Pilkington North America; NSG Group]**
 - d. **[Saflex; Eastman]**
 - e. **<Insert manufacturer's name>**
 3. Construction: Laminate glass with **[polyvinyl butyral interlayer][ionoplast interlayer][or][cast-in-place and cured-transparent-resin interlayer]** to comply with interlayer manufacturer's written instructions.
 4. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 5. Interlayer Color: Clear unless otherwise indicated.
- B. Windborne-Debris-Impact-Resistant Laminated Glass: Comply with requirements specified above for laminated glass except laminate glass with **[one of]** the following to comply with interlayer manufacturer's written instructions:
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Kuraray America, Inc.]**
 - b. **[Saflex; Eastman]**
 - c. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Kuraray America, Inc.]**
 - b. **[Saflex; Eastman]**
 - c. **<Insert manufacturer's name>**
 3. Construction: Laminate glass with **[polyvinyl butyral interlayer reinforced with polyethylene terephthalate film][ionoplast interlayer][or][cast-in-place and cured-transparent-resin interlayer reinforced with polyethylene terephthalate film]** to comply with interlayer manufacturer's written instructions.

4. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
5. Interlayer Color: Clear unless otherwise indicated.

2.6 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
 1. Sealing System: Dual seal, with **[manufacturer's standard][polyisobutylene and polysulfide][polyisobutylene and silicone][polyisobutylene and hot-melt butyl][polyisobutylene and polyurethane]<Insert description>** primary and secondary sealants.
 2. Perimeter Spacer: **[Manufacturer's standard spacer material and construction][Aluminum with mill or clear anodic finish][Aluminum with black, color anodic finish][Aluminum with bronze, color anodic finish][Aluminum with powdered metal paint finish in color selected by Architect][Galvanized steel][Stainless steel][Polypropylene-covered stainless steel in color selected by Architect][Thermally broken aluminum][Nonmetallic laminate][Nonmetallic tube][Silicone with integral desiccant and vapor barrier]<Insert material>**.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1) **[Saint-Gobain Glass Corp]**
 - 2) **[Technoform Glass Insulation North America]**
 - 3) **[Thermix; a brand of Ensinger USA]**
 - 4) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[Saint-Gobain Glass Corp]**
 - 2) **[Technoform Glass Insulation North America]**
 - 3) **[Thermix; a brand of Ensinger USA]**
 - 4) **<Insert manufacturer's name>**
 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.7 GLAZING SEALANTS

- A. General:
 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical

- Emissions from Indoor Sources Using Environmental Chambers."
4. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
5. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
6. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
8. Colors of Exposed Glazing Sealants: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range of industry colors].**

B. Neutral-Curing Silicone Glazing Sealant, Class 100/50: Complying with ASTM C920, Type S, Grade NS, Use NT.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - b. **[Pecora Corporation]**
 - c. **[Sika Corporation]**
 - d. **[The Dow Chemical Company]**
 - e. **[Tremco Incorporated]**
 - f. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - b. **[Pecora Corporation]**
 - c. **[Sika Corporation]**
 - d. **[The Dow Chemical Company]**
 - e. **[Tremco Incorporated]**
 - f. **<Insert manufacturer's name>**
3. Applications: **<Describe types of glazing applications where sealant is required>.**

C. Neutral-Curing Silicone Glazing Sealant, Class 50: Complying with ASTM C920, Type S, Grade NS, Use NT.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**

-
- a. **[Adfast]**
 - b. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - c. **[Pecora Corporation]**
 - d. **[Polymeric Systems, Inc.; PPG Industries, Inc.]**
 - e. **[Sika Corporation]**
 - f. **[The Dow Chemical Company]**
 - g. **[Tremco Incorporated]**
 - h. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Adfast]**
 - b. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - c. **[Pecora Corporation]**
 - d. **[Polymeric Systems, Inc.; PPG Industries, Inc.]**
 - e. **[Sika Corporation]**
 - f. **[The Dow Chemical Company]**
 - g. **[Tremco Incorporated]**
 - h. **<Insert manufacturer's name>**
 3. Applications: **<Describe types of glazing applications where sealant is required>**.
- D. Neutral-Curing Silicone Glazing Sealant, Class 25: Complying with ASTM C920, Type S, Grade NS, Use NT.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Bostik; Arkema]**
 - b. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - c. **[Pecora Corporation]**
 - d. **[Permthane; a Holcim brand]**
 - e. **[Polymeric Systems, Inc.; PPG Industries, Inc.]**
 - f. **[Sika Corporation]**
 - g. **[The Dow Chemical Company]**
 - h. **[Tremco Incorporated]**
 - i. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Bostik; Arkema]**
 - b. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - c. **[Pecora Corporation]**
 - d. **[Permthane; a Holcim brand]**
 - e. **[Polymeric Systems, Inc.; PPG Industries, Inc.]**
 - f. **[Sika Corporation]**
 - g. **[The Dow Chemical Company]**
 - h. **[Tremco Incorporated]**
 - i. **<Insert manufacturer's name>**

3. Applications: **<Describe types of glazing applications where sealant is required>**.

E. Acid-Curing Silicone Glazing Sealant, Class 25: Complying with ASTM C920, Type S, Grade NS, Use NT.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. **[Adfast]**
- b. **[Bostik; Arkema]**
- c. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
- d. **[Pecora Corporation]**
- e. **[Permthane; a Holcim brand]**
- f. **[Polymeric Systems, Inc.; PPG Industries, Inc.]**
- g. **[Sika Corporation]**
- h. **[The Dow Chemical Company]**
- i. **[Tremco Incorporated]**
- j. **<Insert manufacturer's name>**

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- a. **[Adfast]**
- b. **[Bostik; Arkema]**
- c. **[GE Construction Sealants; Momentive Performance Materials Inc.]**
- d. **[Pecora Corporation]**
- e. **[Permthane; a Holcim brand]**
- f. **[Polymeric Systems, Inc.; PPG Industries, Inc.]**
- g. **[Sika Corporation]**
- h. **[The Dow Chemical Company]**
- i. **[Tremco Incorporated]**
- j. **<Insert manufacturer's name>**

3. Applications: **<Describe types of glazing applications where sealant is required>**.

2.8 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

- 1. AAMA 804.3 tape, where indicated.
- 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
- 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

- 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
- 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead

of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks:
 - 1. **[EPDM][Silicone]<Insert type>** with Shore A durometer hardness of 85, plus or minus 5.
 - 2. Type recommended in writing by sealant or glass manufacturer.
- D. Spacers:
 - 1. **[Neoprene]<Insert type>** blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 - 2. Type recommended in writing by sealant or glass manufacturer.
- E. Edge Blocks:
 - 1. **[EPDM][Silicone]<Insert type>** with Shore A durometer hardness per manufacturer's written instructions.
 - 2. Type recommended in writing by sealant or glass manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature change>**.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than **50 inches (1270 mm)**.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide **1/8-inch- (3-mm-)** minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE

- A. Clear Glass Type : **[Annealed][Heat-strengthened][Fully tempered]** float glass.
 - 1. Minimum Thickness: **[6 mm]<Insert thickness>**.
 - 2. Safety glazing required.
- B. Low-Iron Glass Type : **[Annealed][Heat-strengthened][Fully tempered]** float glass.
 - 1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
 - 2. Minimum Thickness: **[6 mm]<Insert thickness>**.

3. Safety glazing required.
- C. Pyrolytic-Coated, Low-Maintenance Glass Type : Clear **[annealed][heat-strengthened][fully tempered]** float glass.
1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
 2. Minimum Thickness: **[6 mm]<Insert thickness>**.
 3. Safety glazing required.
- D. Tinted Glass Type : **[Annealed][Heat-strengthened][Fully tempered]** float glass.
1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
 2. Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
 3. Minimum Thickness: **[6 mm]<Insert thickness>**.
 4. Winter Nighttime U-Factor: **<Insert value>** maximum.
 5. Summer Daytime U-Factor: **<Insert value>** maximum.
 6. Visible Light Transmittance: **<Insert number>** percent minimum.
 7. SHGC: **<Insert value>** maximum.
 8. Safety glazing required.
- E. Ceramic-Coated Vision Glass Type : **[Heat-strengthened][Fully tempered]** float glass.
1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
 2. Glass: **[Clear][Low-iron][Tinted]** float glass.
 3. Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
 4. Ceramic Coating Color and Pattern: **[As selected by Architect from manufacturer's full range][Match Architect's samples]<Insert one manufacturer's color and pattern designation if matching is required><Insert manufacturer's name; color and pattern designation>**.
 5. Minimum Thickness: **[6 mm]<Insert thickness>**.
 6. Coating Location: Second surface.
 7. Winter Nighttime U-Factor: **<Insert value>** maximum.
 8. Summer Daytime U-Factor: **<Insert value>** maximum.
 9. Visible Light Transmittance: **<Insert number>** percent minimum.
 10. SHGC: **<Insert value>** maximum.
 11. Safety glazing required.
- F. Reflective-Coated Vision Glass Type : **[Annealed][Heat-strengthened][Fully tempered]** float glass.
1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
 2. Kind CV (coated vision glass)[, **except that Kind CO (coated overhead glass) may be used where lower edge of glass is more than 6 feet (1.8 m) above the adjacent floor level or cannot be approached closer than 10 feet (3.0 m).**]
 3. Coating Type: **[Pyrolytic][Sputter-coating (vacuum deposition process)]**.
 4. Coating Color: **[Gold][Pewter][Silver]<Insert color>**.
 5. Glass: **[Clear][Tinted]** float glass.
 6. Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
 7. Minimum Thickness: **[6 mm]<Insert thickness>**.
 8. Coating Location: **[First][Second]** surface.
 9. Outdoor Visible Reflectance: **<Insert number>** percent maximum.
 10. Winter Nighttime U-Factor: **<Insert value>** maximum.
 11. Summer Daytime U-Factor: **<Insert value>** maximum.
 12. Visible Light Transmittance: **<Insert number>** percent minimum.
 13. SHGC: **<Insert value>** maximum.
 14. Low-Maintenance Coating: Pyrolytic coating on first surface.
 15. Safety glazing required.

G. Ceramic-Coated Spandrel Glass Type : **[Heat-strengthened][Fully tempered]** float glass.

1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
2. Glass: **[Clear][Low-iron][Tinted]** float glass.
3. Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
4. Coating Color: **[As selected by Architect from manufacturer's full range][Match Architect's samples]<Insert one manufacturer's color designation if matching is required><Insert manufacturer's name; color designation>**.
5. Minimum Thickness: **[6 mm]<Insert thickness>**.
6. Coating Location: Second surface.
7. Winter Nighttime U-Factor: **<Insert value>** maximum.
8. Summer Daytime U-Factor: **<Insert value>** maximum.
9. Fallout Resistance: Passes fallout-resistance test in ASTM C1048 for an assembly of glass and adhered reinforcing material.

H. Silicone-Coated Spandrel Glass Type : **[Heat-strengthened][Fully tempered]** float glass.

1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
2. Glass: **[Clear][Low-iron][Tinted]** float glass.
3. Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
4. Coating Color: **[As selected by Architect from manufacturer's full range][Match Architect's samples]<Insert one manufacturer's color designation if matching is required><Insert manufacturer's name; color designation>**.
5. Minimum Thickness: **[6 mm]<Insert thickness>**.
6. Coating Location: Second surface.
7. Winter Nighttime U-Factor: **<Insert value>** maximum.
8. Summer Daytime U-Factor: **<Insert value>** maximum.
9. Fallout Resistance: Passes fallout-resistance test in ASTM C1048 for an assembly of glass and adhered reinforcing material.

I. Reflective-Coated Spandrel Glass Type : **[Heat-strengthened][Fully tempered]** float glass.

1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
2. Coating Type: **[Pyrolytic][Sputter-coating (vacuum deposition process)]**.
3. Coating Color: **[Gold][Pewter][Silver]<Insert color>**.
4. Glass: **[Clear][Low-iron][Tinted]** float glass.
5. Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
6. Minimum Thickness: **[6 mm]<Insert thickness>**.
7. Coating Location: **[First][Second]** surface.
8. Outdoor Visible Reflectance: **<Insert number>** percent maximum.
9. Winter Nighttime U-Factor: **<Insert value>** maximum.
10. Summer Daytime U-Factor: **<Insert value>** maximum.
11. Fallout Resistance: Passes fallout-resistance test in ASTM C1048 for an assembly of glass and adhered reinforcing material.
12. Factory apply manufacturer's standard opacifier of the following material to coated on second surface of lites, with resulting products complying with Specification No. 89-1-6 in NGA's "Engineering Standards Manual":
 - a. Manufacturer's standard opacifier material.
 - b. Polyester film laminated to glass with solvent-based adhesive.

3.9 LAMINATED GLASS SCHEDULE

A. Clear Laminated Glass Type : Two plies of **[annealed][heat-strengthened][fully tempered][low-iron]**

annealed][low-iron heat-strengthened][low-iron fully tempered] float glass.

1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
2. Minimum Thickness of Each Glass Ply: **[3 mm][4 mm][5 mm][6 mm][As indicated]<Insert thickness>**.
3. Interlayer Thickness: **[0.030 inch (0.76 mm)][0.060 inch (1.52 mm)][0.090 inch (2.29 mm)]**.
4. Safety glazing required.

B. Laminated Tinted Glass Type : Two plies of **[annealed][heat-strengthened][fully tempered]** float glass with outer ply tinted and inner ply clear.

1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
2. Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
3. Minimum Thickness of Each Glass Ply: **[3 mm][4 mm][5 mm][6 mm][As indicated]<Insert thickness>**.
4. Interlayer Thickness: **[0.030 inch (0.76 mm)][0.060 inch (1.52 mm)][0.090 inch (2.29 mm)]**.
5. Winter Nighttime U-Factor: **<Insert value>** maximum.
6. Summer Daytime U-Factor: **<Insert value>** maximum.
7. Visible Light Transmittance: **<Insert number>** percent minimum.
8. SGHC: **<Insert value>** maximum.
9. Safety glazing required.

C. Tinted Interlayer Laminated Glass Type : Two plies of clear **[annealed][heat-strengthened][fully tempered]** float glass and tinted interlayer.

1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
2. Minimum Thickness of Each Glass Ply: **[3 mm][4 mm][5 mm][6 mm][As indicated]<Insert thickness>**.
3. Interlayer Thickness: **[0.030 inch (0.76 mm)][0.060 inch (1.52 mm)][0.090 inch (2.29 mm)]**.
4. Interlayer Color: **[Blue-green][Bronze light][Gray]<Insert color>**.
5. Winter Nighttime U-Factor: **<Insert value>** maximum.
6. Summer Daytime U-Factor: **<Insert value>** maximum.
7. Visible Light Transmittance: **<Insert number>** percent minimum.
8. SGHC: **<Insert value>** maximum.
9. Safety glazing required.

D. Ceramic-Coated, Laminated Vision Glass Type : Two plies of **[heat-strengthened][fully tempered]** float glass.

1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
2. Outer Ply: **[Clear][Low-iron][Tinted]** float glass.
3. Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
4. Inner Ply: **[Clear][Low-iron]** float glass.
5. Ceramic Coating Color and Pattern: **[As selected by Architect from manufacturer's full range][Match Architect's samples]<Insert one manufacturer's color and pattern designation if matching is required><Insert manufacturer's name; color and pattern designation>**.
6. Minimum Thickness of Each Glass Ply: **[3 mm][4 mm][5 mm][6 mm][As indicated]<Insert thickness>**.
7. Interlayer Thickness: **[0.030 inch (0.76 mm)][0.060 inch (1.52 mm)][0.090 inch (2.29 mm)]**.
8. Coating Location: **[Second][Third][Fourth]** surface.
9. Winter Nighttime U-Factor: **<Insert value>** maximum.
10. Summer Daytime U-Factor: **<Insert value>** maximum.
11. Visible Light Transmittance: **<Insert number>** percent minimum.
12. SGHC: **<Insert value>** maximum.
13. Safety glazing required.

- E. Reflective-Coated, Laminated Vision Glass Type : Two plies of [heat-strengthened][fully tempered] float glass.
1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
 2. Kind CV (coated vision glass)[, except that Kind CO (coated overhead glass) may be used where lower edge of glass is more than 6 feet (1.8 m) above the adjacent floor level or cannot be approached closer than 10 feet (3.0 m)].
 3. Coating Type: [Pyrolytic][Sputter-coating (vacuum deposition process)].
 4. Coating Color: [Gold][Pewter][Silver]<Insert color>.
 5. Outer Ply: [Clear][Tinted] float glass.
 6. Tint Color: [Blue][Blue-green][Bronze][Green][Gray]<Insert color>.
 7. Minimum Thickness of Each Glass Ply: [3 mm][4 mm][5 mm][6 mm][As indicated]<Insert thickness>.
 8. Interlayer Thickness: [0.030 inch (0.76 mm)][0.060 inch (1.52 mm)][0.090 inch (2.29 mm)].
 9. Coating Location: [First][Second][Third] surface.
 10. Outdoor Visible Reflectance: <Insert number> percent maximum.
 11. Winter Nighttime U-Factor: <Insert value> maximum.
 12. Summer Daytime U-Factor: <Insert value> maximum.
 13. Visible Light Transmittance: <Insert number> percent minimum.
 14. SGHC: <Insert value> maximum.
 15. Low-Maintenance Coating: Pyrolytic coating on first surface.
 16. Safety glazing required.
- F. Low-E-Coated, Laminated Vision Glass Type : Two plies of clear [annealed][heat-strengthened][fully tempered] float glass.
1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
 2. Minimum Thickness of Each Glass Ply: [3 mm][4 mm][5 mm][6 mm][As indicated]<Insert thickness>.
 3. Interlayer Thickness: [0.030 inch (0.76 mm)][0.060 inch (1.52 mm)][0.090 inch (2.29 mm)].
 4. Low-E Coating: [Pyrolytic on second][Pyrolytic on third][Sputtered on second][Sputtered on third][Pyrolytic or sputtered on second or third] surface.
 5. Winter Nighttime U-Factor: <Insert value> maximum.
 6. Summer Daytime U-Factor: <Insert value> maximum.
 7. Visible Light Transmittance: <Insert number> percent minimum.
 8. SGHC: <Insert value> maximum.
 9. Safety glazing required.
- G. Reflective-Coated, Laminated Spandrel Glass Type : Two plies of [heat-strengthened][fully tempered] float glass.
1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
 2. Coating Type: [Pyrolytic][Sputter-coating (vacuum deposition process)].
 3. Coating Color: [Gold][Pewter][Silver]<Insert color>.
 4. Outer Ply: [Clear][Tinted] float glass.
 5. Tint Color: [Blue][Blue-green][Bronze][Green][Gray]<Insert color>.
 6. Minimum Thickness of Each Glass Ply: [3 mm][4 mm][5 mm][6 mm][As indicated]<Insert thickness>.
 7. Interlayer Thickness: [0.030 inch (0.76 mm)][0.060 inch (1.52 mm)][0.090 inch (2.29 mm)].
 8. Coating Location: [First][Second][Third] surface.
 9. Outdoor Visible Reflectance: <Insert number> percent maximum.
 10. Winter Nighttime U-Factor: <Insert value> maximum.
 11. Summer Daytime U-Factor: <Insert value> maximum.

3.10 INSULATING GLASS SCHEDULE

A. Clear Insulating Glass Type :

1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
2. Overall Unit Thickness: **[1 inch (25 mm)][5/8 inch (16 mm)]<Insert dimension>**.
3. Minimum Thickness of Each Glass Lite: **[3 mm][4 mm][5 mm][6 mm]<Insert thickness>**.
4. Outdoor Lite: **[Annealed][Heat-strengthened][Fully tempered]** float glass.
5. Interspace Content: **[Air][Argon]**.
6. Indoor Lite: **[Annealed][Heat-strengthened][Fully tempered]** float glass.
7. Winter Nighttime U-Factor: **<Insert value>** maximum.
8. Summer Daytime U-Factor: **<Insert value>** maximum.
9. Safety glazing required.

B. Low-Iron Insulating Glass Type :

1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
2. Overall Unit Thickness: **[1 inch (25 mm)][5/8 inch (16 mm)]<Insert dimension>**.
3. Minimum Thickness of Each Glass Lite: **[3 mm][4 mm][5 mm][6 mm]<Insert thickness>**.
4. Outdoor Lite: Low-iron **[annealed][heat-strengthened][fully tempered]** float glass.
5. Interspace Content: **[Air][Argon]**.
6. Indoor Lite: Low-iron **[annealed][heat-strengthened][fully tempered]** float glass.
7. Winter Nighttime U-Factor: **<Insert value>** maximum.
8. Summer Daytime U-Factor: **<Insert value>** maximum.
9. Safety glazing required.

C. Pyrolytic-Coated, Low-Maintenance Insulating Glass Type :

1. Basis-of-Design Product: **[Cardinal Glass Industries; Neat][Pilkington North America Inc.; Activ]<Insert manufacturer's name; product name or designation>**.
2. Overall Unit Thickness: **[1 inch (25 mm)][5/8 inch (16 mm)]<Insert dimension>**.
3. Minimum Thickness of Each Glass Lite: **[3 mm][4 mm][5 mm][6 mm]<Insert thickness>**.
4. Outdoor Lite: Pyrolytic-coated, low-maintenance, clear **[annealed][heat-strengthened][fully tempered]** float glass.
5. Interspace Content: **[Air][Argon]**.
6. Indoor Lite: **[Annealed][Heat-strengthened][Fully tempered]** float glass.
7. Winter Nighttime U-Factor: **<Insert value>** maximum.
8. Summer Daytime U-Factor: **<Insert value>** maximum.
9. Safety glazing required.

D. Low-E-Coated, Clear Insulating Glass Type :

1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
2. Overall Unit Thickness: **[1 inch (25 mm)][5/8 inch (16 mm)]<Insert dimension>**.
3. Minimum Thickness of Each Glass Lite: **[3 mm][4 mm][5 mm][6 mm]<Insert thickness>**.
4. Outdoor Lite: **[Annealed][Heat-strengthened][Fully tempered][Low-iron annealed][Low-iron heat-strengthened][Low-iron fully tempered]** float glass.
5. Interspace Content: **[Air][Argon]**.
6. Indoor Lite: **[Annealed][Heat-strengthened][Fully tempered][Low-iron annealed][Low-iron heat-strengthened][Low-iron fully tempered]** float glass.
7. Low-E Coating: **[Pyrolytic on second][Pyrolytic on third][Sputtered on second][Sputtered on third][Pyrolytic or sputtered on second or third]** surface.
8. Winter Nighttime U-Factor: **<Insert value>** maximum.
9. Summer Daytime U-Factor: **<Insert value>** maximum.
10. Visible Light Transmittance: **<Insert number>** percent minimum.
11. SGHC: **<Insert value>** maximum.

12. Safety glazing required.

E. Pyrolytic-Coated, Low-Maintenance, Low-E-Coated, Clear Insulating Glass Type :

1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
2. Overall Unit Thickness: [1 inch (25 mm)][5/8 inch (16 mm)]<Insert dimension>.
3. Minimum Thickness of Each Glass Lite: [3 mm][4 mm][5 mm][6 mm]<Insert thickness>.
4. Outdoor Lite: Pyrolytic-coated, low-maintenance, clear [annealed][heat-strengthened][fully tempered] float glass.
5. Interspace Content: [Air][Argon].
6. Indoor Lite: [Annealed][Heat-strengthened][Fully tempered] float glass.
7. Low-E Coating: [Pyrolytic on third][Sputtered on second][Sputtered on third][Pyrolytic or sputtered on second or third] surface.
8. Winter Nighttime U-Factor: <Insert value> maximum.
9. Summer Daytime U-Factor: <Insert value> maximum.
10. Visible Light Transmittance: <Insert number> percent minimum.
11. SGHC: <Insert value> maximum.
12. Safety glazing required.

F. Tinted Insulating Glass Type :

1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
2. Overall Unit Thickness: [1 inch (25 mm)][5/8 inch (16 mm)]<Insert dimension>.
3. Minimum Thickness of Each Glass Lite: [3 mm][4 mm][5 mm][6 mm]<Insert thickness>.
4. Outdoor Lite: Tinted [annealed][heat-strengthened][fully tempered] float glass.
5. Tint Color: [Blue][Blue-green][Bronze][Green][Gray]<Insert color>.
6. Interspace Content: [Air][Argon].
7. Indoor Lite: Clear [annealed][heat-strengthened][fully tempered] float glass.
8. Winter Nighttime U-Factor: <Insert value> maximum.
9. Summer Daytime U-Factor: <Insert value> maximum.
10. Visible Light Transmittance: <Insert number> percent minimum.
11. SGHC: <Insert value> maximum.
12. Safety glazing required.

G. Low-E-Coated, Tinted Insulating Glass Type :

1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
2. Overall Unit Thickness: [1 inch (25 mm)][5/8 inch (16 mm)]<Insert dimension>.
3. Minimum Thickness of Each Glass Lite: [3 mm][4 mm][5 mm][6 mm]<Insert thickness>.
4. Outdoor Lite: Tinted [annealed][heat-strengthened][fully tempered] float glass.
5. Tint Color: [Blue][Blue-green][Bronze][Green][Gray]<Insert color>.
6. Interspace Content: [Air][Argon].
7. Indoor Lite: Clear [annealed][heat-strengthened][fully tempered] float glass.
8. Low-E Coating: [Pyrolytic on second][Pyrolytic on third][Sputtered on second][Sputtered on third][Pyrolytic or sputtered on second or third] surface.
9. Winter Nighttime U-Factor: <Insert value> maximum.
10. Summer Daytime U-Factor: <Insert value> maximum.
11. Visible Light Transmittance: <Insert number> percent minimum.
12. SGHC: <Insert value> maximum.
13. Safety glazing required.

H. Ceramic-Coated, Insulating Vision Glass Type :

1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
2. Ceramic Coating Color and Pattern: [As selected by Architect from manufacturer's full

range][Match Architect's samples]<Insert one manufacturer's color and pattern designation if matching is required><Insert manufacturer's name; color and pattern designation>.

3. Overall Unit Thickness: [1 inch (25 mm)][5/8 inch (16 mm)]<Insert dimension>.
4. Minimum Thickness of Each Glass Lite: [3 mm][4 mm][5 mm][6 mm]<Insert thickness>.
5. Outdoor Lite: [Clear heat-strengthened][Clear fully tempered][Low-iron heat-strengthened][Low-iron fully tempered][Tinted heat-strengthened][Tinted fully tempered] float glass.
6. Tint Color: [Blue][Blue-green][Bronze][Green][Gray]<Insert color>.
7. Interspace Content: [Air][Argon].
8. Indoor Lite: [Clear heat-strengthened][Clear fully tempered][Low-iron annealed][Low-iron heat-strengthened][Low-iron fully tempered] float glass.
9. Coating Location: [Second][Third][Fourth] surface.
10. Winter Nighttime U-Factor: <Insert value> maximum.
11. Summer Daytime U-Factor: <Insert value> maximum.
12. Visible Light Transmittance: <Insert number> percent minimum.
13. SGHC: <Insert value> maximum.
14. Safety glazing required.

I. Reflective-Coated Insulating Glass Type :

1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
2. Kind CV (coated vision glass)[, except that Kind CO (coated overhead glass) may be used where lower edge of glass is more than 6 feet (1.8 m) above the adjacent floor level or cannot be approached closer than 10 feet (3.0 m)].
3. Coating Type: [Pyrolytic][Sputter-coating (vacuum deposition process)].
4. Coating Color: [Gold][Pewter][Silver]<Insert color>.
5. Overall Unit Thickness: [1 inch (25 mm)][5/8 inch (16 mm)]<Insert dimension>.
6. Minimum Thickness of Each Glass Lite: [3 mm][4 mm][5 mm][6 mm]<Insert thickness>.
7. Outdoor Lite: [Clear annealed][Clear heat-strengthened][Clear fully tempered][Tinted heat-strengthened][Tinted fully tempered] float glass.
8. Tint Color: [Blue][Blue-green][Bronze][Green][Gray]<Insert color>.
9. Interspace Content: [Air][Argon].
10. Indoor Lite: Clear [annealed][heat-strengthened][fully tempered] float glass.
11. Coating Location: [First][Second][Third] surface.
12. Outdoor Visible Reflectance: <Insert number> percent maximum.
13. Winter Nighttime U-Factor: <Insert value> maximum.
14. Summer Daytime U-Factor: <Insert value> maximum.
15. Visible Light Transmittance: <Insert number> percent minimum.
16. SGHC: <Insert value> maximum.
17. Low-Maintenance Coating: Pyrolytic coating on first surface.
18. Safety glazing required.

J. [Ceramic][Silicone]-Coated, Insulating Spandrel Glass Type :

1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
2. Coating Color: [As selected by Architect from manufacturer's full range][Match Architect's samples]<Insert one manufacturer's color designation if matching is required><Insert manufacturer's name; color designation>.
3. Overall Unit Thickness: [1 inch (25 mm)]<Insert dimension>.
4. Minimum Thickness of Each Glass Lite: [5 mm][6 mm]<Insert thickness>.
5. Outdoor Lite: [Clear annealed][Clear heat-strengthened][Clear fully tempered][Low-iron annealed][Low-iron heat-strengthened][Low-iron fully tempered] float glass.
6. Interspace Content: [Air][Argon].
7. Indoor Lite: [Clear annealed][Clear heat-strengthened][Clear fully tempered][Low-iron annealed][Low-iron heat-strengthened][Low-iron fully tempered] float glass.

8. Coating Location: Fourth surface.
9. Winter Nighttime U-Factor: **<Insert value>** maximum.
10. Summer Daytime U-Factor: **<Insert value>** maximum.

K. **[Ceramic][Silicone]-Coated, Low-E, Insulating Spandrel Glass Type :**

1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
2. Coating Color: **[As selected by Architect from manufacturer's full range][Match Architect's samples]<Insert one manufacturer's color designation if matching is required><Insert manufacturer's name; color designation>**.
3. Overall Unit Thickness: **[1 inch (25 mm)]<Insert dimension>**.
4. Minimum Thickness of Each Glass Lite: **[5 mm][6 mm]<Insert thickness>**.
5. Outdoor Lite: **[Clear heat-strengthened][Clear fully tempered][Low-iron heat-strengthened][Low-iron fully tempered]** float glass.
6. Interspace Content: **[Air][Argon]**.
7. Indoor Lite: **[Clear heat-strengthened][Clear fully tempered][Low-iron heat-strengthened][Low-iron fully tempered]** float glass.
8. Low-E Coating: **[Pyrolytic on second][Pyrolytic on third][Sputtered on second][Sputtered on third][Pyrolytic or sputtered on second or third]** surface.
9. Opaque Coating Location: Fourth surface.
10. Winter Nighttime U-Factor: **<Insert value>** maximum.
11. Summer Daytime U-Factor: **<Insert value>** maximum.

L. **[Ceramic][Silicone]-Coated, Tinted, Insulating Spandrel Glass Type :**

1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
2. Coating Color: **[As selected by Architect from manufacturer's full range][Match Architect's samples]<Insert one manufacturer's color designation if matching is required><Insert manufacturer's name; color designation>**.
3. Overall Unit Thickness: **[1 inch (25 mm)]<Insert dimension>**.
4. Minimum Thickness of Each Glass Lite: **[5 mm][6 mm]<Insert thickness>**.
5. Outdoor Lite: Tinted **[annealed][heat-strengthened][fully tempered]** float glass.
6. Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
7. Interspace Content: **[Air][Argon]**.
8. Indoor Lite: Clear **[annealed][heat-strengthened][fully tempered]** float glass.
9. Coating Location: Fourth surface.
10. Winter Nighttime U-Factor: **<Insert value>** maximum.
11. Summer Daytime U-Factor: **<Insert value>** maximum.

3.11 INSULATING-LAMINATED-GLASS SCHEDULE

A. **Clear Insulating, Laminated Glass Type :**

1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
2. Overall Unit Thickness: **[1-3/16 inch (30 mm)][1 inch (25 mm)][3/4 inch (19 mm)]<Insert dimension>**.
3. Minimum Thickness of Outdoor Lite: **[3 mm][4 mm][5 mm][6 mm]<Insert thickness>**.
4. Outdoor Lite: Clear **[heat-strengthened][fully tempered]** float glass.
5. Interspace Content: **[Air][Argon]**.
6. Indoor Lite: Clear laminated glass with two plies of **[annealed][heat-strengthened][fully tempered]** float glass.
 - a. Minimum Thickness of Each Glass Ply: **[3 mm][4 mm][5 mm][6 mm][As indicated]<Insert thickness>**.

- b. Interlayer Thickness: [0.030 inch (0.76 mm)][0.060 inch (1.52 mm)][0.090 inch (2.29 mm)].
 7. Winter Nighttime U-Factor: <Insert value> maximum.
 8. Summer Daytime U-Factor: <Insert value> maximum.
 9. SGHC: <Insert value> maximum.
 10. Safety glazing required.
 - B. Low-E-Coated, Clear Insulating Laminated Glass Type :
 1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
 2. Overall Unit Thickness: [1-3/16 inch (30 mm)][1 inch (25 mm)][3/4 inch (19 mm)]<Insert dimension>.
 3. Minimum Thickness of Outdoor Lite: [3 mm][4 mm][5 mm][6 mm]<Insert thickness>.
 4. Outdoor Lite: Clear [heat-strengthened][fully tempered] float glass.
 5. Interspace Content: [Air][Argon].
 6. Indoor Lite: Clear laminated glass with two plies of [annealed][heat-strengthened][fully tempered] float glass.
 - a. Minimum Thickness of Each Glass Ply: [3 mm][4 mm][5 mm][6 mm][As indicated]<Insert thickness>.
 - b. Interlayer Thickness: [0.030 inch (0.76 mm)][0.060 inch (1.52 mm)][0.090 inch (2.29 mm)].
 7. Low-E Coating: [Pyrolytic on second][Pyrolytic on third][Sputtered on second][Sputtered on third][Pyrolytic or sputtered on second or third] surface.
 8. Winter Nighttime U-Factor: <Insert value> maximum.
 9. Summer Daytime U-Factor: <Insert value> maximum.
 10. Visible Light Transmittance: <Insert number> percent minimum.
 11. SGHC: <Insert value> maximum.
 12. Safety glazing required.
 - C. Tinted, Insulating Laminated Glass Type :
 1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
 2. Overall Unit Thickness: [1-3/16 inch (30 mm)][1 inch (25 mm)][3/4 inch (19 mm)]<Insert dimension>.
 3. Minimum Thickness of Outdoor Lite: [3 mm][4 mm][5 mm][6 mm]<Insert thickness>.
 4. Outdoor Lite: Tinted [heat-strengthened][fully tempered] float glass.
 5. Tint Color: [Blue][Blue-green][Bronze][Green][Gray]<Insert color>.
 6. Interspace Content: [Air][Argon].
 7. Indoor Lite: Clear laminated glass with two plies of [annealed][heat-strengthened][fully tempered] float glass.
 - a. Minimum Thickness of Each Glass Ply: [3 mm][4 mm][5 mm][6 mm][As indicated]<Insert thickness>.
 - b. Interlayer Thickness: [0.030 inch (0.76 mm)][0.060 inch (1.52 mm)][0.090 inch (2.29 mm)].
 8. Winter Nighttime U-Factor: <Insert value> maximum.
 9. Summer Daytime U-Factor: <Insert value> maximum.
 10. Visible Light Transmittance: <Insert number> percent minimum.
 11. SGHC: <Insert value> maximum.
 12. Safety glazing required.
 - D. Low-E-Coated, Tinted, Insulating Laminated Glass Type :

1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
2. Overall Unit Thickness: [1-3/16 inch (30 mm)][1 inch (25 mm)][3/4 inch (19 mm)]<Insert dimension>.
3. Minimum Thickness of Outdoor Lite: [3 mm][4 mm][5 mm][6 mm]<Insert thickness>.
4. Outdoor Lite: Tinted [heat-strengthened][fully tempered] float glass.
5. Tint Color: [Blue][Blue-green][Bronze][Green][Gray]<Insert color>.
6. Interspace Content: [Air][Argon].
7. Indoor Lite: Clear laminated glass with two plies of [annealed][heat-strengthened][fully tempered] float glass.
 - a. Minimum Thickness of Each Glass Ply: [3 mm][4 mm][5 mm][6 mm][As indicated]<Insert thickness>.
 - b. Interlayer Thickness: [0.030 inch (0.76 mm)][0.060 inch (1.52 mm)][0.090 inch (2.29 mm)].
8. Low-E Coating: [Pyrolytic on second][Pyrolytic on third][Sputtered on second][Sputtered on third][Pyrolytic or sputtered on second or third] surface.
9. Winter Nighttime U-Factor: <Insert value> maximum.
10. Summer Daytime U-Factor: <Insert value> maximum.
11. Visible Light Transmittance: <Insert number> percent minimum.
12. SGHC: <Insert value> maximum.
13. Safety glazing required.

E. Reflective-Coated, Insulating Laminated Glass Type :

1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
2. Kind CV (coated vision glass)[, except that Kind CO (coated overhead glass) may be used where lower edge of glass is more than 6 feet (1.8 m) above the adjacent floor level or cannot be approached closer than 10 feet (3.0 m)].
3. Coating Type: [Pyrolytic][Sputter-coating (vacuum deposition process)].
4. Coating Color: [Gold][Pewter][Silver]<Insert color>.
5. Overall Unit Thickness: [1-3/16 inch (30 mm)][1 inch (25 mm)]<Insert dimension>.
6. Minimum Thickness of Outdoor Lite: [6 mm]<Insert thickness>.
7. Outdoor Lite: [Clear heat-strengthened][Clear fully tempered][Tinted heat-strengthened][Tinted fully tempered] float glass.
8. Tint Color: [Blue][Blue-green][Bronze][Green][Gray]<Insert color>.
9. Interspace Content: [Air][Argon].
10. Indoor Lite: Clear laminated glass with two plies of [annealed][heat-strengthened][fully tempered] float glass.
 - a. Minimum Thickness of Each Glass Ply: [3 mm][4 mm][5 mm][6 mm][As indicated]<Insert thickness>.
 - b. Interlayer Thickness: [0.030 inch (0.76 mm)][0.060 inch (1.52 mm)][0.090 inch (2.29 mm)].
11. Coating Location: [First][Second][Third] surface.
12. Outdoor Visible Reflectance: <Insert number> percent maximum.
13. Winter Nighttime U-Factor: <Insert value> maximum.
14. Summer Daytime U-Factor: <Insert value> maximum.
15. Visible Light Transmittance: <Insert number> percent minimum.
16. SGHC: <Insert value> maximum.
17. Low-Maintenance Coating: Pyrolytic coating on first surface.
18. Safety glazing required.



END OF SECTION 08 80 00 00



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Task	Specification	Specification Description
08 81 23 13	08 80 00 00	Glazing
08 81 23 23	08 80 00 00	Glazing



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SECTION 08 83 00 00 - MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silvered flat glass mirrors.

B. Related Requirements:

1. Section 088000 "Glazing" for glass with reflective coatings used for vision and spandrel lites.
2. Section 102800 "Toilet, Bath, and Laundry Accessories" for metal-framed mirrors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Mirrors: Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.

C. Samples: For each type of the following:

1. Mirrors: **12 inches (300 mm)** square, including edge treatment on two adjoining edges.
2. Mirror Clips: Full size.
3. Mirror Trim: **12 inches (300 mm)** long.

D. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Data: For adhesives, indicating VOC content.
3. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of mirror[**and mirror mastic**].

B. Preconstruction Test Reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing and substrates on which mirrors are installed.

C. Qualification Statements: For Installer.

D. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For mirrors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified Installer, who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing.
 - 1. Testing is not required if data are submitted based on previous testing of mirror mastic products and mirror backing matching those submitted.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect mirrors in accordance with mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
 - 1. Warranty Period: **[Five]<Insert number> years from date of [Substantial Completion][manufacture].**

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.

- B. Source Limitations for Mirror Accessories: Obtain mirror-glazing accessories from single source.

2.2 SILVERED FLAT GLASS MIRRORS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

1. **[Avalon Glass and Mirror Company]**
2. **[Binswanger Glass Company, Inc.; a division of Vitro Architectural Glass]**
3. **[D & W Incorporated]**
4. **[Donisi Mirror Company]**
5. **[Dreamwalls by Gardner Glass Products]**
6. **[Dulles Glass & Mirror]**
7. **[Gardner Glass, Inc.]**
8. **[Gilded Mirrors, Inc]**
9. **[Glasswerks LA, Inc]**
10. **[Guardian Glass LLC]**
11. **[Head West]**
12. **[Independent Mirror Industries, Inc]**
13. **[Lenoir Mirror Company]**
14. **[National Glass Industries, Inc.]**
15. **[Stroupe Mirror Co., Inc]**
16. **[Sunshine Mirror]**
17. **[Trulite Glass & Aluminum Solutions, LLC.]**
18. **[Virginia Mirror Company, Inc]**
19. **[Walker Glass Co., Ltd]**
20. **<Insert manufacturer's name>**

- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

1. **[Avalon Glass and Mirror Company]**
2. **[Binswanger Glass Company, Inc.; a division of Vitro Architectural Glass]**
3. **[D & W Incorporated]**
4. **[Donisi Mirror Company]**
5. **[Dreamwalls by Gardner Glass Products]**
6. **[Dulles Glass & Mirror]**
7. **[Gardner Glass, Inc.]**
8. **[Gilded Mirrors, Inc]**
9. **[Glasswerks LA, Inc]**
10. **[Guardian Glass LLC]**
11. **[Head West]**
12. **[Independent Mirror Industries, Inc]**
13. **[Lenoir Mirror Company]**
14. **[National Glass Industries, Inc.]**
15. **[Stroupe Mirror Co., Inc]**
16. **[Sunshine Mirror]**
17. **[Trulite Glass & Aluminum Solutions, LLC.]**
18. **[Virginia Mirror Company, Inc]**
19. **[Walker Glass Co., Ltd]**
20. **<Insert manufacturer's name>**

- C. Mirrors, General: ASTM C1503[; **manufactured using copper-free, low-lead mirror coating process**].

- D. Annealed Monolithic Glass Mirrors: Mirror **[Select][Glazing]** Quality **[Q1 clear][Q2 low-iron float glass with a minimum 91 percent visible light transmission][Q2 tinted]**.
1. Nominal Thickness: **[3.0 mm][4.0 mm][5.0 mm][6.0 mm][As indicated]<Insert thickness>**.
 2. Tint Color: **[Blue][Black][Bronze][Gold][Gray][Green]<Insert color>**.
- E. Tempered Glass Mirrors: Mirror Glazing Quality Q3 for blemish requirements and complying with ASTM C1048 for Kind FT, Condition A, tempered float glass before silver coating is applied; **[clear][tinted]**.
1. Nominal Thickness: **[3.0 mm][4.0 mm][5.0 mm][6.0 mm][As indicated]<Insert thickness>**.
 2. Tint Color: **[Blue][Black][Bronze][Gold][Gray][Green]<Insert color>**.
- F. Laminated Mirrors: ASTM C1172, Type II.
1. Glass for Outer Lite: Annealed float glass, Mirror **[Select][Glazing]** Quality, **[clear][low-iron float glass with a minimum 91 percent visible light transmission][tinted]**.
 - a. Tint Color: **[Blue][Black][Bronze][Gold][Gray][Green]<Insert color>**.
 2. Nominal Thickness for Outer Lite: **[3.0 mm][4.0 mm][5.0 mm][6.0 mm][As indicated]<Insert thickness>**.
 3. Glass for Inner Lite: **[Annealed float glass; ASTM C1036, Type I (transparent flat glass), Quality Q1; Class 1 (clear)][Annealed float glass; ASTM C1036, Type I (transparent flat glass), Quality Q2; Class 1 (low-iron)][Annealed float glass; ASTM C1036, Type I (transparent flat glass), Quality Q2; Class 1 (tinted)][Heat-strengthened float glass; ASTM C1048, Type I; Quality Q3; Class I (clear) Kind HS, Condition A][Tempered float glass; ASTM C1048, Type I; Quality Q3; Class I (clear), Kind FT, Condition A]**.
 4. Nominal Thickness: **[3.0 mm][4.0 mm][5.0 mm][6.0 mm][As indicated]<Insert thickness>**.
 5. Interlayer: Mirror manufacturer's standard **0.030-inch- (0.76-mm-)** thick, clear polyvinyl-butylal interlayer with a proven record of showing no tendency to delaminate from, or cause damage to, silver coating.
- G. Safety Glazing Products: For **[film-backed][laminated][tempered]** mirrors, provide products that comply with 16 CFR 1201, Category II.

2.3 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - b. **[Franklin International]**
 - c. **[Liquid Nails; PPG Industries, Inc.]**

- d. **[OSI Sealants; Henkel Corporation]**
 - e. **[Palmer Products Corporation]**
 - f. **[Pecora Corporation]**
 - g. **[Royal Adhesives & Sealants: H.B. Fuller Company]**
 - h. **[Sommer & Maca Industries, Inc]**
 - i. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - b. **[Franklin International]**
 - c. **[Liquid Nails; PPG Industries, Inc.]**
 - d. **[OSI Sealants; Henkel Corporation]**
 - e. **[Palmer Products Corporation]**
 - f. **[Pecora Corporation]**
 - g. **[Royal Adhesives & Sealants: H.B. Fuller Company]**
 - h. **[Sommer & Maca Industries, Inc]**
 - i. **<Insert manufacturer's name>**
3. Adhesives shall have a VOC content of **[70]<Insert value>** g/L or less.
4. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
5. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
6. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit or 33 mcg/cu. m and that of acetaldehyde shall not exceed 9 mcg/cu. m.
- D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.4 MIRROR HARDWARE

- A. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.
1. Aluminum J-Channel Bottom and Side Trim: J-channels formed with front leg and back leg not less than **3/8 and 7/8 inch (9.5 and 22 mm)** in height, respectively, and a thickness of not less than **0.04 inch (1.0 mm)**.
- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - 1) **[Andscot Company, Inc.]**
 - 2) **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**

- 3) **[Stylmark, Inc.]**
 - 4) **<Insert manufacturer's name>**
- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- 1) **[Andscot Company, Inc.]**
 - 2) **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - 3) **[Stylmark, Inc.]**
 - 4) **<Insert manufacturer's name>**
2. Aluminum J-Channel Top Trim: J-channels formed with front leg and back leg not less than **5/8 and 1 inch (16 and 25 mm)** in height, respectively, and a thickness of not less than **0.04 inch (1.0 mm)**.
- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
- 1) **[Andscot Company, Inc.]**
 - 2) **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - 3) **[Stylmark, Inc.]**
 - 4) **<Insert manufacturer's name>**
- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- 1) **[Andscot Company, Inc.]**
 - 2) **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - 3) **[Stylmark, Inc.]**
 - 4) **<Insert manufacturer's name>**
3. Finish: **[Clear][Gold]** bright anodized.
- B. Aluminum J-Channels and Cleat: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of mirrors in a single piece.
1. Aluminum J-Channel and Cleat, Bottom and Side Trim: J-channels formed with front leg and back leg not less than **5/16 and 3/4 inch (7.9 and 19 mm)** in height, respectively.
- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
- 1) **[C.R. Laurence Co., Inc.; CRH Americas, Inc.]**
 - 2) **<Insert manufacturer's name>**
- b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:

- 1) [C.R. Laurence Co., Inc.; CRH Americas, Inc.]
 - 2) <Insert manufacturer's name>
2. Aluminum J-Channel and Cleat, Top Trim: Formed with front leg with a height matching bottom trim and back leg designed to fit into the pocket created by wall-mounted aluminum cleat.
- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - 1) [C.R. Laurence Co., Inc.; CRH Americas, Inc.]
 - 2) <Insert manufacturer's name>
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - 1) [C.R. Laurence Co., Inc.; CRH Americas, Inc.]
 - 2) <Insert manufacturer's name>
3. Finish: **[Clear][Gold]** bright anodized.
- C. Mirror Bottom Clips: **[As indicated]<Insert description and finish or product designation and manufacturer's name>**.
- D. Mirror Top Clips: **[As indicated]<Insert description and finish or product designation and manufacturer's name>**.
- E. Plated Steel Hardware: Formed-steel shapes with plated finish indicated.
1. Profile: As indicated.
 2. Finish: **<Insert manufacturer's finish designation and name>**.
- F. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- G. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield, expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.
- 2.5 FABRICATION
- A. Shop fabricate mirrors to greatest extent possible.
 - B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts, so they fit closely around penetrations in mirrors.
 - C. Mirror Edge Treatment: **[Flat polished][Rounded polished][Flat high polished][Rounded high polished][Beveled polished edge of width shown]**.
 1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
 2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after

cutting to final sizes.

- D. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint, as recommended in writing by film-backing manufacturer, to produce a surface free of bubbles, blisters, and other imperfections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
- B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION OF MIRRORS

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced National Glass Association (NGA) publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
 - 1. NGA Publications: ["**Laminated Glazing Reference Manual**,"]"Glazing Manual" and "Installation Techniques Designed to Prolong the Life of Flat Glass Mirrors."
- B. Provide a minimum airspace of **1/8 inch (3 mm)** between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
- C. Install mirrors with [**mastic and**]mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
 - 1. Aluminum J-Channels: Provide setting blocks **1/8 inch (3 mm)** thick by **4 inches (100 mm)** long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than **1/4 inch (6.4 mm)** wide by **3/8 inch (9.5 mm)** long at bottom channel.
 - 2. Aluminum J-Channels and Cleat: Fasten J-channel directly to wall and attach top trim to continuous cleat fastened directly to wall.
 - 3. Mirror Clips: Place a felt or plastic pad between mirror and each clip to prevent spalling of mirror edges. Locate clips [**where indicated**][**so they are symmetrically placed and evenly spaced**].
 - 4. Install mastic as follows:
 - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.

- b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
- c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of **1/8 inch (3 mm)** between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer and NGA's publication "Proper Procedures for Cleaning Flat Glass Mirrors."

END OF SECTION 08 83 00 00



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Task	Specification	Specification Description
08 83 13 00	08 80 00 00	Glazing
08 83 13 00	08 83 00 00	Mirrors



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SECTION 08 84 00 00 - PLASTIC GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Monolithic acrylic glazing.
2. Monolithic polycarbonate glazing.
3. Multiwalled structured polycarbonate glazing.
4. Glazing gaskets.
5. Glazing sealants.
6. Glazing tapes.
7. Miscellaneous glazing materials.

B. Related Requirements:

1. Section 084513 "Structured-Polycarbonate-Panel Assemblies" for aluminum-framed assemblies glazed with multiwalled structured polycarbonate panels.
2. Section 088000 "Glazing" for glazing sealants installed with plastic glazing.
3. Section 088853 "Security Glazing" for **[laminated polycarbonate glazing] [and] [monolithic polycarbonate glazing]** for security applications.

1.2 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on plastic glazing, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference **[at Project site] [by web conference] <Insert location>**.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Review temporary protection requirements for plastic glazing during and after installation.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each plastic glazing material, gasket, and sealant.
- C. Samples for Verification: Actual sample of each finished product.
1. Plastic Glazing Samples: For each color and finish of plastic glazing indicated, 12 inches (300 mm) square and of same thickness indicated for final Work.

2. Glazing Accessory Samples: For **[gaskets] [and] [sealants]**, in 12-inch (300-mm) lengths. **[Install sealant Samples between two strips of material representative in color of the adjoining framing system.]**

D. Plastic Glazing Schedule: List plastic glazing types and thicknesses for each size opening and location. Use same designations indicated on Drawings. Indicate coordinated dimensions of plastic glazing and construction that receives plastic glazing, including clearances and glazing channel dimensions.

E. Sustainable Design Submittals:

1. <Double click to insert sustainable design text for sealants.>

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For plastic glazing and glazing products.

B. Product Test Reports: For **[plastic glazing] [glazing sealants] [and] [glazing gaskets]**, for tests performed by a qualified testing agency.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

C. Preconstruction adhesion and compatibility test report.

D. Research Reports: For plastic glazing, from **[an agency acceptable to authorities having jurisdiction] [ICC-ES] <Insert evaluation agency>** showing compliance with **[fire-test-response] [safety glazing] [and] [windborne-debris impact-resistance]** requirements.

E. Qualification Statements: For testing agency.

F. Sample Warranties: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For plastic glazing.

1.7 QUALITY ASSURANCE

A. Sealant Testing Agency Qualifications: An independent testing agency qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.8 MOCKUPS

A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Install plastic glazing in mockups specified in **[Section 084113 "Aluminum-Framed Entrances and Storefronts"] [Section 085113 "Aluminum Windows"] <Insert Section number and title>** to match plastic glazing systems required for Project, including glazing methods.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each plastic glazing type, tape sealant, gasket, glazing accessory, and glazing-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 1. Testing is not required if data are submitted based on previous testing of current sealant products and plastic glazing matching those submitted.
 2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glazing, tape sealants, gaskets, and glazing channel substrates.
 3. Test no fewer than **[eight]** **<Insert number>** Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Protect plastic glazing materials in accordance with manufacturer's written instructions. Prevent damage to plastic glazing and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Maintain protective coverings on plastic glazing to avoid exposures to abrasive substances, excessive heat, and other sources of possible deterioration.

1.11 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

1.12 WARRANTY

- A. Manufacturer's Special Warranty for Abrasion- and UV-Resistant Polycarbonate: Manufacturer agrees to replace **[monolithic]** **[multiwalled structured]** polycarbonate products that break or develop defects from normal use that are attributable to manufacturing process and not to practices for maintaining and cleaning plastic glazing contrary to manufacturer's written instructions. Defects include coating delamination, haze, excessive yellowing, and loss of light transmission beyond the limits stated in plastic glazing manufacturer's standard form.
 1. Warranty Period: **[Five]** **<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS**2.1 SOURCE LIMITATIONS**

- A. Obtain plastic glazing from single source from single manufacturer. Obtain **[sealants] [and] [gaskets]** from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

- A. Plastic glazing sheets and glazing materials to withstand normal temperature changes, wind, and impact loads without failure, including loss or breakage of plastic sheets attributable to failure of sealants or gaskets to remain watertight and airtight, deterioration of plastic sheet and glazing materials, or other defects in materials and installation.
- B. Windborne-Debris Impact Resistance: Exterior plastic glazing to pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone **[1] [2] [3] [4]** for **[basic] [enhanced]** protection.
1. Large-Missile Test: For glazing located within **[30 ft. (9.1 m)] <Insert dimension>** of grade.
 2. Small-Missile Test: For glazing located between 30 ft. (9.1 m) and **[60 ft. (18.3 m)] <Insert dimension>** above grade.
- C. Safety Glazing: Plastic glazing to comply with 16 CFR 1201, Category II.
1. Labeling: Permanently mark plastic glazing with certification label of an agency acceptable to authorities having jurisdiction. Label to indicate manufacturer's name, type of plastic, thickness, and safety glazing standard with which plastic glazing complies.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on plastic glazing and glazing framing members.
1. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces] <Insert temperature change>**.
- E. Fire-Test-Response Characteristics of Plastic Glazing: As determined by testing plastic glazing by a qualified testing agency acceptable to authorities having jurisdiction.
1. Self-ignition temperature of 650 deg F (343 deg C) or higher when tested in accordance with ASTM D1929 on plastic sheets in thicknesses indicated for the Work.
 2. Smoke density of 75 or less when tested in accordance with ASTM D2843 on plastic sheets in thicknesses indicated for the Work.
 3. Burning extent of 1 inch (25 mm) or less when tested in accordance with ASTM D635 at a nominal thickness of 0.060 inch (1.52 mm) or thickness indicated for the Work, **where Class CC1 is indicated**.
 4. Burning rate of 2.5 in./min. (1.06 mm/s) or less when tested in accordance with ASTM D635 at a nominal thickness of 0.060 inch (1.52 mm) or thickness indicated for the Work, **where Class CC2 is indicated**.
 5. Flame-spread index of not less than that indicated when tested in accordance with ASTM E84.

2.3 PLASTIC GLAZING, GENERAL

- A. Glazing Publication: Comply with published instructions of plastic glazing manufacturers and with NGA's "GANA Glazing Manual" unless more stringent requirements are indicated. See this manual for definitions of glazing terms not otherwise defined in this Section or in other referenced standards.
- B. Plastic Glazing Labeling: Identify plastic sheets with appropriate markings of applicable testing and inspecting agency, indicating compliance with required fire-test-response characteristics.

2.4 MONOLITHIC ACRYLIC GLAZING

- A. Transparent Acrylic Sheet: ASTM D4802, **[Category A-1 (cell cast)] [Category A-2 (continuously cast)] [or] [Category B-1 (continuously manufactured)]**, Finish 1 (smooth or polished), Type UVF (UV filtering).
 - 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 - 2. Nominal Thickness: **[0.093 inch (2.5 mm)] [0.118 inch (3 mm)] [0.177 inch (4.5 mm)] [0.236 inch (6 mm)] <Insert dimension>**.
 - 3. Color: **[Colorless] [As selected by Architect from manufacturer's full range] <Insert color>**.
 - 4. Combustibility Class: CC2.
- B. Coated Transparent Acrylic Sheet: ASTM D4802, **[Category A-1 (cell cast)] [Category A-2 (continuously cast)] [or] [Category B-1 (continuously manufactured)]**, Finish 3 (abrasion-resistant coating) with coating on **[one side] [both sides]**, Type UVF (UV filtering).
 - 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 - 2. Nominal Thickness: **[0.093 inch (2.5 mm)] [0.118 inch (3 mm)] [0.177 inch (4.5 mm)] [0.236 inch (6 mm)] <Insert dimension>**.
 - 3. Color: **[Colorless] [As selected by Architect from manufacturer's full range] <Insert color>**.
 - 4. Combustibility Class: CC2.
- C. Translucent Acrylic Sheet: ASTM D4802, **[Category A-1 (cell cast)] [Category A-2 (continuously cast)] [or] [Category B-1 (continuously manufactured)]**, Finish 1 (smooth or polished), Type UVF (UV filtering).
 - 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 - 2. Nominal Thickness: **[0.093 inch (2.5 mm)] [0.118 inch (3 mm)] [0.177 inch (4.5 mm)] [0.236 inch (6 mm)] <Insert dimension>**.
 - 3. Color: **[White, with visible light transmittance of not more than 50 percent for 0.117-inch-(2.9-mm-) thick sheet, measured in accordance with ASTM D1003] [As selected by Architect from manufacturer's full range] <Insert color>**.
 - 4. Combustibility Class: CC2.
- D. Patterned Acrylic Sheet: ASTM D4802, Category A-1 (cell cast), Finish 2 (patterned), Type UVF (UV filtering).
 - 1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 - 2. Nominal Thickness: **[0.093 inch (2.5 mm)] [0.118 inch (3 mm)] [0.177 inch (4.5 mm)] [0.236 inch (6 mm)] <Insert dimension>**.
 - 3. Pattern: **[Matte finish] [As selected by Architect from manufacturer's full range] <Insert pattern>**.
 - 4. Color: **[Transparent colorless] [Translucent white] [As selected by Architect from manufacturer's full range] <Insert color>**.
 - 5. Combustibility Class: CC2.

2.5 MONOLITHIC POLYCARBONATE GLAZING

- A. Polycarbonate Sheet: ASTM C1349, Appendix X1, Type I (standard, UV stabilized), with a polished finish.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 2. Nominal Thickness: **[0.093 inch (2.5 mm)] [0.118 inch (3 mm)] [0.177 inch (4.5 mm)] [0.236 inch (6 mm)] <Insert dimension>**.
 3. Color: **[Transparent colorless] [As selected by Architect from manufacturer's full range] <Insert color>**.
 4. Combustibility Class: CC1.
 5. Flame-Spread Index: **[25] [75] [200]** or less.
- B. Coated Polycarbonate Sheet: ASTM C1349, Appendix X1, Type II (coated mar-resistant, UV stabilized), with coating on both sides.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 2. Nominal Thickness: **[0.093 inch (2.5 mm)] [0.118 inch (3 mm)] [0.177 inch (4.5 mm)] [0.236 inch (6 mm)] <Insert dimension>**.
 3. Color: **[Transparent colorless] [As selected by Architect from manufacturer's full range] <Insert color>**.
 4. Combustibility Class: CC1.
 5. Flame-Spread Index: **[25] [75] [200]** or less.

2.6 MULTIWALLED STRUCTURED POLYCARBONATE GLAZING

- A. Multiwalled Structured Polycarbonate Sheet: Manufacturer's standard polycarbonate extruded shape with smooth, flat exterior surfaces and internal ribbing.
1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
 2. Nominal Thickness: **[5/16 inch (8 mm)] [3/8 inch (10 mm)] [5/8 inch (16 mm)] [3/4 inch (20 mm)] [1 inch (25 mm)] <Insert dimension>**.
 3. UV Resistance: **[Not required] [On outer surface] [On both surfaces]**.
 4. Color: **[Transparent colorless] [As selected by Architect from manufacturer's full range] <Insert color>**.
 5. Combustibility Class: **[CC1] [CC2]**.
 6. Flame-Spread Index: **[25] [75] [200]** or less.

2.7 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets, **[EPDM, ASTM C864] [or] [silicone, ASTM C1115]**; and of profile and hardness required to maintain watertight seal.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned **[EPDM] [or] [silicone]** gaskets complying with ASTM C509, Type II, black; and of profile and hardness required to maintain watertight seal.

2.8 GLAZING SEALANTS

- A. Glazing Sealants: **[As recommended by manufacturer.] [Comply with Section 088000 "Glazing."]**

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they contact, including plastic glazing products and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and plastic glazing manufacturers' written instructions for selecting sealants suitable for applications indicated and for conditions existing at time of installation.
3. <Double click to insert sustainable design text for sealants.>

2.9 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
 1. AAMA 804.3 tape, where indicated.
 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.10 MISCELLANEOUS GLAZING MATERIALS

- A. Compatibility: Provide products of material, size, and shape complying with requirements of manufacturers of plastic glazing and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by plastic glazing and sealant or gasket manufacturer.
- C. Setting Blocks: EPDM or silicone as required for compatibility with glazing sealant and plastic glazing, and of hardness recommended by plastic glazing manufacturer for application indicated.
- D. Compressible Filler Rods: Closed cell of waterproof-jacketed rod stock of synthetic rubber or plastic foam, flexible and resilient, with 5 to 10 psi (35 to 70 kPa) compression strength for 25 percent deflection.

2.11 FABRICATION

- A. Sizes: Fabricate plastic glazing to sizes required for openings indicated. Allow for thermal expansion and contraction of plastic glazing without restraint and without withdrawal of edges from frames, with edge clearances and tolerances complying with plastic glazing manufacturer's written instructions.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine plastic glazing framing, with glazing Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Minimum required face or edge clearances.
 - 3. Effective sealing between joints of plastic glazing framing members.
- B. Proceed with glazing only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members immediately before glazing. Remove coatings not firmly bonded to substrates. Remove lacquer from metal surfaces where elastomeric sealants are indicated for use.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of plastic glazing materials, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publication.
- B. Glazing channel dimensions indicated on Drawings are designed to provide the necessary bite on plastic glazing, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust plastic glazing lites during installation to ensure that bite is equal on all sides.
- C. Sand or scrape cut edges of plastic glazing to provide smooth edges, free of chips and hairline cracks.
- D. Remove burrs and other projections from glazing channel surfaces.
- E. Protect plastic glazing surfaces from abrasion and other damage during handling and installation, in accordance with the following requirements:
 - 1. Retain plastic glazing manufacturer's protective covering or protect by other methods in accordance with plastic glazing manufacturer's written instructions.
 - 2. Remove covering at border of each piece before glazing; remove remainder of covering immediately after installation where plastic glazing is exposed to sunlight or where other conditions make later removal difficult.
 - 3. Remove damaged plastic glazing sheets from Project site and legally dispose of off-site. Damaged plastic glazing sheets are those containing imperfections that, when installed, result in weakened glazing and impaired performance and appearance.
- F. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- G. Install elastomeric setting blocks in sill channels, sized and located to comply with referenced glazing publication, unless otherwise instructed by plastic glazing manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

- H. Provide edge blocking to comply with referenced glazing publication unless otherwise instructed by plastic glazing manufacturer.
- I. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- J. Square cut wedge-shaped gaskets at corners and install gaskets, as recommended in writing by gasket manufacturer, to prevent corners from pulling away; seal corner and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

- A. Install tapes continuously, but not in one continuous length. Do not stretch tapes to make them fit opening.
- B. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- C. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant recommended by tape manufacturer.
- D. Do not remove release paper from tape until immediately before each lite is installed.
- E. Apply heel bead of glazing sealant.
- F. Center plastic glazing lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- G. Apply cap bead of glazing sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended in writing by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between plastic glazing and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Center plastic glazing lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in plastic glazing. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers between plastic glazing lites and glazing stops to maintain plastic glazing face clearances and to prevent sealant from extruding into glazing channel weep systems until sealants

cure. Secure spacers in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to plastic glazing and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from plastic glazing.

3.7 CLEANING AND PROTECTION

- A. Protect plastic glazing from contact with contaminating substances from construction operations. If, despite such protection, contaminating substances do come into contact with plastic glazing, remove immediately and wash plastic glazing in accordance with plastic glazing manufacturer's written instructions.
- B. Remove and replace plastic glazing that is broken, chipped, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.
- C. Wash plastic glazing on both faces before date scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Wash plastic glazing in accordance with plastic glazing manufacturer's written instructions.

END OF SECTION 08 84 00 00



Task	Specification	Specification Description
08 87 13 00	08 80 00 00	Glazing
08 88 49 00	13 49 00 00	Radiation Protection



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SECTION 08 88 53 00 - SECURITY GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Laminated-glass security glazing
 - 2. Polycarbonate security glazing.
 - 3. Insulating security glazing.
 - 4. Air-gap security glazing.
- B. Related Requirements:
 - 1. Section 085653 "Security Windows."
 - 2. Section 119821 "Detention Windows."

1.2 DEFINITIONS

- A. Glazing Manufacturers: Firms that produce primary glass, monolithic plastic glazing, or fabricated security glazing, as defined in referenced glazing publications.
- B. Interspace: Space between lites of air-gap security glazing or insulating security glazing.

1.3 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on security glazing, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]<Insert location>**.
 - 1. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review temporary protection requirements for security glazing during and after installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of **[glass tint][glass coating][colored interlayer][sealant][and][colored spacer]**.
- C. Samples for Verification:
 - 1. Glazing: Actual sample of finished products for each type of security glazing.

- a. Size: **[Manufacturers' standard size]<Insert size>**.
2. Glazing Accessories: Actual sample of **[sealants][and][colored spacers]**. **[Install sealant Samples between two strips of material representative in color of the adjoining framing system.]**
3. Size: **[Manufacturers' standard size]<Insert size>**.
- D. Security Glazing Schedule: List security glazing types and thicknesses for each size opening and location. Use same designations indicated on Drawings. Indicate coordinated dimensions of security glazing and construction that receives security glazing, including clearances and glazing channel dimensions.
- E. Delegated Design Submittal: For security glazing, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. Sustainable Design Submittals:
 1. Product Data: For sealants, indicating VOC content.
 2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

1.6 INFORMATIONAL SUBMITTALS

- A. Test and Evaluation Reports:
 1. Product Test Reports:
 - a. For each type of security glazing, for tests performed by **[qualified testing agency][manufacturer and witnessed by a qualified testing agency]**.
 - b. For each type of glazing sealant, for tests performed by a qualified testing agency.
 - 1) Provide test reports based on testing current sealant formulations within previous 36-month period.
 2. Preconstruction Test Reports: For preconstruction adhesion and compatibility testing.
- B. Qualification Statements: For **[installers][manufacturers of insulating or air-gap security glazing with sputter-coated, low-e coatings][glazing testing agency][and][sealant testing agency]**.
- C. Delegated design engineer qualifications.
- D. Sample warranties.

1.7 QUALITY ASSURANCE

- A. Qualifications:
 1. Manufacturers: For insulating or air-gap security glazing units with sputter-coated, low-e coatings, a qualified insulating glazing manufacturer who is approved **[and certified]** by coated-glass manufacturer.
 2. Installers: **[Fabricator of products][Entity that employs installers and supervisors who are trained and approved by manufacturer][Authorized representative who is trained and**

approved by manufacturer].

3. Delegated Design Engineer: A professional engineer who is legally qualified to practice in **[state]<Insert jurisdiction>** where Project is located and who is experienced in providing engineering services of type indicated.
4. Security Glazing Testing Agency: Subject to compliance with requirements, testing agency is one of the following:
 - a. Intertek.
 - b. Underwriters Laboratories, Inc.
 - c. Wiss, Janney, Elstner Associates, Inc.
 - d. **<Insert testing agency name>**.
5. Sealant Testing Agency: An independent testing agency qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.8 MOCKUPS

- A. Build mockups **[to verify selections made under Sample submittals][to demonstrate aesthetic effects][to set quality standards for materials and execution][to set quality standards for fabrication and installation][and][for preconstruction testing]**.
 1. Install security glazing in mockups specified in **[Section 084113 "Aluminum-Framed Entrances and Storefronts"] [Section 084413 "Glazed Aluminum Curtain Walls"] [Section 085113 "Aluminum Windows"] [Section 085653 "Security Windows"] [Section 119821 "Detention Windows"] <Insert Section number and title>** to match glazing systems required for Project, including glazing methods.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each security glazing type, tape sealant, gasket, glazing accessory, and glazing-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 1. Testing will not be required if data based on previous testing of current sealant products and glazing materials match those submitted.
 2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to security glazing, tape sealants, gaskets, and glazing channel substrates.
 3. Test no fewer than **[eight]<Insert number>** Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Protect security glazing and glazing materials according to manufacturer's written instructions. Prevent damage from condensation, temperature changes, direct exposure to sun, or other causes.

- B. Comply with insulating security glazing and with air-gap security glazing manufacturers' written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.11 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below **40 deg F (4.4 deg C)**.

1.12 WARRANTY

- A. Special Warranty, Coated Glass: Manufacturer agrees to replace coated glass that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Defects developed in coated glass from normal use that is not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 2. Warranty Period: **[10]<Insert number>** years from date of Substantial Completion.
- B. Special Warranty, Laminated-Glass Security Glazing: Manufacturer agrees to replace laminated-glass security glazing that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated-glass security glazing contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 2. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.
- C. Special Warranty, Monolithic Polycarbonate Security Glazing: Manufacturer agrees to replace monolithic polycarbonate security glazing that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Defects developed from normal use that are not attributed to maintaining and cleaning monolithic polycarbonate security glazing contrary to manufacturer's written instructions. Defects include yellowing and loss of light transmission.
 - 2. Warranty Period: **[10]<Insert number>** years from date of Substantial Completion.
- D. Special Warranty, Laminated-Polycarbonate Security Glazing: Manufacturer agrees to replace laminated-polycarbonate security glazing that fails in materials or workmanship within specified warranty

period.

1. Failures include, but are not limited to, the following:
 - a. Defects developed from normal use that are not attributed to maintaining and cleaning laminated-polycarbonate security glazing contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced standard, yellowing, and loss of light transmission.
 2. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.
- E. Special Warranty, Glass-Clad Polycarbonate Security Glazing: Manufacturer agrees to replace glass-clad polycarbonate security glazing that fails in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning glass-clad polycarbonate security glazing contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced polycarbonate standard, yellowing, and loss of light transmission.
 2. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.
- F. Special Warranty, Laminated-Glass and -Polycarbonate Security Glazing: Manufacturer agrees to replace laminated-glass and -polycarbonate security glazing that fails in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 2. Defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated-glass and -polycarbonate security glazing contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced polycarbonate standard, yellowing, and loss of light transmission.
 3. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.
- G. Special Warranty, Insulating Security Glazing: Manufacturer agrees to replace insulating security glazing that fails in materials and workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Defects in individual lites developed from normal use or failure of hermetic seal under normal use. Defects in individual lites or failure of hermetic seal that is attributed to glass breakage or to maintaining and cleaning insulating security glazing contrary to manufacturer's written instructions are not included.
 - b. Defects in coated-glass lites include peeling, cracking, and other indications of deterioration in coating.
 - c. Defects in laminated-glass lites include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - d. Defects in glass-clad polycarbonate lites include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced glass-clad polycarbonate standard, yellowing, and loss of light transmission.
 - e. Evidence of hermetic seal failure is the obstruction of vision by dust, moisture, or film on

interior surfaces of glazing.

2. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.

H. Special Warranty, Air-Gap Security Glazing: Manufacturer agrees to replace air-gap security glazing that fails in materials and workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Defects in individual lites developed from normal use or failure of hermetic seal under normal use. Defects in individual lites or failure of hermetic seal that is attributed to glass breakage or to maintaining and cleaning air-gap security glazing contrary to manufacturer's written instructions are not included.
 - b. Defects in coated-glass lites include peeling, cracking, and other indications of deterioration in coating.
 - c. Defects in laminated-glass lites include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - d. Defects in laminated-polycarbonate lites include edge separation, delamination materially obstructing vision through glazing, blemishes exceeding those allowed by referenced standard, yellowing, and loss of light transmission.
 - e. Evidence of hermetic seal failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glazing.
2. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of security glazing from single source from single manufacturer.
 1. Obtain **[tinted][and][coated]** glass from single source from single manufacturer.
- B. Obtain glazing **[sealants][and][gaskets]** from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

- A. General:
 1. Installed security glazing will withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
 2. Installed security glazing will withstand security-related loads and forces without damage to the glazing beyond that allowed by referenced standards.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design security glazing.

- C. Structural Performance: Glazing will withstand the following design loads within limits and under conditions indicated.
1. Design Procedure for Glass: ASTM E1300 and the IBC.
 2. Design Wind Pressures: **[As indicated on Drawings][Determine design wind pressures applicable to Project in accordance with ASCE/SEI 7, based on heights above grade indicated on Drawings].**
 - a. Wind Design Data: As indicated on Drawings.
 - b. Basic Wind Speed: **[85 mph (38 m/s)][90 mph (40 m/s)][100 mph (44 m/s)][110 mph (49 m/s)]<Insert value>.**
 - c. Importance Factor: **<Insert factor>.**
 - d. Exposure Category: **[B][C][D].**
 3. Design Snow Loads: **[As indicated on Drawings]<Insert design snow load>.**
 4. Probability of Breakage for Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
- E. Temperature Change: **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature change>.**
- F. Windborne-Debris Impact Resistance: Exterior security glazing passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for **[Wind Zone 1][Wind Zone 2][Wind Zone 3][Wind Zone 4]** for **[basic][enhanced]** protection.
1. Large-Missile Test: For glazing located within **[30 feet (9.1 m)]<Insert dimension>** of grade.
 2. Small-Missile Test: For glazing located between **30 feet (9.1 m)** and **[60 feet (18.3 m)]<Insert dimension>** above grade.
- G. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

2.3 SECURITY GLAZING, GENERAL

- A. Glazing Publications: Comply with published recommendations of security glazing and glazing material manufacturers and organizations below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. AAMA Publications: AAMA GDSG-1 and AAMA TIR-A7.
 2. IGMA Publication for Sloped Glazing: IGMA TB-3001.
 3. IGMA Publication for Insulating Glass: SIGMA TM-3000.
 4. NGA Publications: **["Laminated Glazing Reference Manual" and]"GANA Glazing Manual."**
- B. Plastic Glazing Labeling: Identify plastic sheets with appropriate markings of applicable testing and inspecting agency, indicating compliance with required fire-test-response characteristics.
- C. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of **[the Safety Glazing Certification Council][the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction][or][manufacturer].** Label will indicate manufacturer's name, type of glazing, glass thickness, and safety glazing standard with which glazing complies.
- D. Insulating Glazing Certification Program: Permanently marked either on spacers or on at least one

component lite of units with appropriate certification label of the Insulating Glass Certification Council.

- E. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- F. Fire-Test-Response Characteristics of Polycarbonate Sheets: As determined by testing polycarbonate sheets identical to those used in security glazing products by a qualified testing agency acceptable to authorities having jurisdiction.
 - 1. Self-ignition temperature of **650 deg F (343 deg C)** or more when tested in accordance with ASTM D1929 on plastic sheets in thicknesses indicated for the Work.
 - 2. Smoke-Developed Index of 450 or less when tested in accordance with ASTM E84 or UL 723, or smoke density of 75 or less when tested in accordance with ASTM D2843 on plastic sheets in thicknesses indicated for the Work.
 - 3. Burning extent of **1 inch (25 mm)** or less when tested in accordance with ASTM D635 at a nominal thickness of **0.060 inch (1.52 mm)** or thickness indicated for the Work.
- G. Thermal and Optical Performance Properties: Provide security glazing with performance properties specified, as indicated in manufacturer's published test data, based on construction products indicated and on procedures indicated below:
 - 1. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as **Btu/sq. ft. x h x deg F (W/sq. m x K)**.
 - 2. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW 7.7 computer program.
 - 3. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.4 GLASS PRODUCTS

- A. Float Glass: ASTM C1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 - 2. For heat-strengthened float glass, comply with requirements for Kind HS.
 - 3. For fully tempered float glass, comply with requirements for Kind FT.
 - 4. For uncoated glass, comply with requirements for Condition A.
 - 5. For coated vision glass, comply with requirements for Condition C (other coated glass).
- C. Chemically Strengthened Glass: Annealed float glass is chemically strengthened to comply with ASTM C1422/C1422M, Surface Compression [**Level 1**][**Level 2**][**Level 3**][**Level 4**][**Level 5**] and Case Depth [**Level A**][**Level B**][**Level C**][**Level D**][**Level E**][**Level F**].
- D. Reflective-Coated Vision Glass: ASTM C1376, Kind CV (coated vision glass), coated by [**pyrolytic process**][**vacuum deposition (sputter-coating) process**], and complying with other requirements specified.

2.5 LAMINATED-GLASS SECURITY GLAZING

- A. Manufacturers: Subject to compliance with requirements, [**provide products by the following**][**provide products by one of the following**][**available manufacturers offering products that may be**

incorporated into the Work include, but are not limited to, the following]:

1. [Dlubak Specialty Glass Corporation; Consolidated Glass Holdings, Inc.]
2. [Global Security Glazing; Consolidated Glass Holdings, Inc.]
3. [McGrory Glass, Inc]
4. [OldCastle BuildingEnvelope (OBE)]
5. [Standard Bent Glass Corp]
6. <Insert manufacturer's name>

- B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [Dlubak Specialty Glass Corporation; Consolidated Glass Holdings, Inc.]
2. [Global Security Glazing; Consolidated Glass Holdings, Inc.]
3. [McGrory Glass, Inc]
4. [OldCastle BuildingEnvelope (OBE)]
5. [Standard Bent Glass Corp]
6. <Insert manufacturer's name>

- C. Laminated-Glass Security Glazing: ASTM C1172. Two or more glass lites bonded with interlayer. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
2. Interlayer Color: Clear unless otherwise indicated.

2.6 POLYCARBONATE SECURITY GLAZING

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. [Dlubak Specialty Glass Corporation; Consolidated Glass Holdings, Inc.]
2. [Global Security Glazing; Consolidated Glass Holdings, Inc.]
3. [McGrory Glass, Inc]
4. [OldCastle BuildingEnvelope (OBE)]
5. [Palram Americas Ltd.]
6. [Plaskolite]
7. [Standard Bent Glass Corp]
8. [Total Security Solutions]
9. <Insert manufacturer's name>

- B. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. [Dlubak Specialty Glass Corporation; Consolidated Glass Holdings, Inc.]
2. [Global Security Glazing; Consolidated Glass Holdings, Inc.]
3. [McGrory Glass, Inc]
4. [OldCastle BuildingEnvelope (OBE)]
5. [Palram Americas Ltd.]
6. [Plaskolite]
7. [Standard Bent Glass Corp]
8. [Total Security Solutions]
9. <Insert manufacturer's name>

- C. Monolithic Polycarbonate Security Glazing: ASTM C1349, Appendix X1, Type II, coated, mar-resistant, UV-stabilized polycarbonate with coating on exposed surfaces and Type I, standard, UV-stabilized polycarbonate where no surfaces are exposed.
- D. Laminated-Polycarbonate Security Glazing: Two or more polycarbonate sheets bonded with clear urethane interlayer that complies with ASTM C1349, Appendix X2, and has a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation. Provide laminated units that comply with requirements of ASTM C1349 for maximum allowable laminating process blemishes and haze.
- E. Glass-Clad Polycarbonate Security Glazing: ASTM C1349. One or more cores of polycarbonate sheet, clad with glass, bonded with clear urethane interlayer. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
- F. Laminated Glass and Polycarbonate: ASTM C1349. Two or more glass lites and polycarbonate bonded with interlayer. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

2.7 INSULATING SECURITY GLAZING

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1. **[Dlubak Specialty Glass Corporation; Consolidated Glass Holdings, Inc.]**
 - 2. **[Global Security Glazing; Consolidated Glass Holdings, Inc.]**
 - 3. **[McGrory Glass, Inc]**
 - 4. **[Viracon, Inc.]**
 - 5. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1. **[Dlubak Specialty Glass Corporation; Consolidated Glass Holdings, Inc.]**
 - 2. **[Global Security Glazing; Consolidated Glass Holdings, Inc.]**
 - 3. **[McGrory Glass, Inc]**
 - 4. **[Viracon, Inc.]**
 - 5. **<Insert manufacturer's name>**
- C. Insulating Security Glazing: Factory-assembled units, consisting of sealed lites of glazing material indicated separated by a dehydrated interspace, qualified in accordance with ASTM E2190
 - 1. Sealing System: Dual seal, with **[manufacturer's standard][polyisobutylene and polysulfide][polyisobutylene and silicone][polyisobutylene and hot-melt butyl][polyisobutylene and polyurethane]<Insert description>** primary and secondary sealants.
 - 2. Spacer: **[Manufacturer's standard spacer material and construction][Aluminum with mill or clear anodic finish][Aluminum with black, color anodic finish][Aluminum with bronze, color anodic finish][Aluminum with powdered metal paint finish in color selected by Architect][Galvanized steel][Stainless steel][Polypropylene-covered stainless steel in color selected by Architect][Thermally broken aluminum][Nonmetallic laminate][Nonmetallic tube]<Insert material>**.
 - 3. Desiccant: Molecular sieve or silica gel, or blend of both.

2.8 AIR-GAP SECURITY GLAZING

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
1. **[Global Security Glazing; Consolidated Glass Holdings, Inc.]**
 2. **<Insert manufacturer's name>**
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
1. **[Global Security Glazing; Consolidated Glass Holdings, Inc.]**
 2. **<Insert manufacturer's name>**
- C. Air-Gap Security Glazing: Factory-assembled units, consisting of sealed lites of glazing material indicated separated by a dehydrated interspace.
1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
 2. Spacer Specifications: Manufacturer's standard **[rigid]** spacer material and construction.

2.9 SPALL-RESISTANT FILM

- A. Spall-Resistant Film: Composite of clear polyvinyl butyral film and clear abrasion-resistant polyester film.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Kuraray America, Inc.]**
 - b. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Kuraray America, Inc.]**
 - b. **<Insert manufacturer's name>**
- B. Laminating Process: Factory laminate spall-resistant film to glazing assemblies to produce laminated lites free of foreign substances, air, and glass pockets.

2.10 GLAZING SEALANTS

- A. General:
1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they contact, including security glazing, seals of insulating security glazing and air-gap security glazing, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and security glazing manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of

installation.

3. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
4. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
5. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
6. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
7. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.
8. Colors of Exposed Glazing Sealants: **[As indicated by manufacturer's designations][Match Architect's samples][As selected by Architect from manufacturer's full range of Industry colors].**

B. Glazing Sealant:

1. Neutral-Curing Silicone Glazing Sealant, Class 100/50: Complying with ASTM C920, Type S, Grade NS, Use NT.
 - a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - 1) **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - 2) **[Pecora Corporation]**
 - 3) **[Sika Corporation]**
 - 4) **[The Dow Chemical Company]**
 - 5) **[Tremco Incorporated]**
 - 6) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - 2) **[Pecora Corporation]**
 - 3) **[Sika Corporation]**
 - 4) **[The Dow Chemical Company]**
 - 5) **[Tremco Incorporated]**
 - 6) **<Insert manufacturer's name>**
 - c. Applications: **<Describe types of glazing applications where this sealant is required>.**
2. Neutral-Curing Silicone Glazing Sealant, Class 50: Complying with ASTM C920, Type S, Grade NS, Use NT.

- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1) **[Adfast]**
 - 2) **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - 3) **[Master Builders Solutions]**
 - 4) **[Pecora Corporation]**
 - 5) **[Polymeric Systems, Inc.; PPG Industries, Inc.]**
 - 6) **[Sika Corporation]**
 - 7) **[The Dow Chemical Company]**
 - 8) **[Tremco Incorporated]**
 - 9) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[Adfast]**
 - 2) **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - 3) **[Master Builders Solutions]**
 - 4) **[Pecora Corporation]**
 - 5) **[Polymeric Systems, Inc.; PPG Industries, Inc.]**
 - 6) **[Sika Corporation]**
 - 7) **[The Dow Chemical Company]**
 - 8) **[Tremco Incorporated]**
 - 9) **<Insert manufacturer's name>**
 - c. Applications: **<Describe types of glazing applications where this sealant is required>**.
3. Neutral-Curing Silicone Glazing Sealant, Class 25: Complying with ASTM C920, Type S, Grade NS, Use NT.
- a. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - 1) **[Bostik; Arkema]**
 - 2) **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - 3) **[Permthane; a Holcim brand]**
 - 4) **[Polymeric Systems, Inc.; PPG Industries, Inc.]**
 - 5) **[Sika Corporation]**
 - 6) **[The Dow Chemical Company]**
 - 7) **[Tremco Incorporated]**
 - 8) **<Insert manufacturer's name>**
 - b. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - 1) **[Bostik; Arkema]**
 - 2) **[GE Construction Sealants; Momentive Performance Materials Inc.]**
 - 3) **[Permthane; a Holcim brand]**
 - 4) **[Polymeric Systems, Inc.; PPG Industries, Inc.]**

- 5) [Sika Corporation]
- 6) [The Dow Chemical Company]
- 7) [Tremco Incorporated]
- 8) <Insert manufacturer's name>

c. Applications: <Describe types of glazing applications where this sealant is required>.

4. Acid-Curing Silicone Glazing Sealant, Class 25: Complying with ASTM C920, Type S, Grade NS, Use NT.

a. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- 1) [Bostik; Arkema]
- 2) [GE Construction Sealants; Momentive Performance Materials Inc.]
- 3) [Master Builders Solutions]
- 4) [Pecora Corporation]
- 5) [Permthane; a Holcim brand]
- 6) [Polymeric Systems, Inc.; PPG Industries, Inc.]
- 7) [Sika Corporation]
- 8) [The Dow Chemical Company]
- 9) [Tremco Incorporated]
- 10) <Insert manufacturer's name>

b. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- 1) [Bostik; Arkema]
- 2) [GE Construction Sealants; Momentive Performance Materials Inc.]
- 3) [Master Builders Solutions]
- 4) [Pecora Corporation]
- 5) [Permthane; a Holcim brand]
- 6) [Polymeric Systems, Inc.; PPG Industries, Inc.]
- 7) [Sika Corporation]
- 8) [The Dow Chemical Company]
- 9) [Tremco Incorporated]
- 10) <Insert manufacturer's name>

c. Applications: <Describe types of glazing applications where this sealant is required>.

C. Security Sealant: Manufacturer's standard, nonsag, tamper-resistant sealant for joints with low movement complying with ASTM C920, Grade NS, Class 12.5 or 25, Use NT, and with a Shore A hardness of at least 45 when tested in accordance with ASTM C661.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Master Builders Solutions]
- b. [Pecora Corporation]
- c. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Master Builders Solutions]**
 - b. **[Pecora Corporation]**
 - c. **<Insert manufacturer's name>**

2.11 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and security glazing manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.12 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of security glazing and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks:
 1. **[EPDM][Silicone]<Insert type>** with Shore A durometer hardness of 85, plus or minus 5.
 2. Type recommended in writing by sealant or glass manufacturer.
- D. Spacers:
 1. **[Neoprene]<Insert type>** blocks or continuous extrusions of hardness required by security glazing manufacturer to maintain security glazing lites in place for installation indicated.
 2. Type recommended in writing by sealant or security glazing manufacturer.
- E. Edge Blocks:
 1. **[EPDM][Silicone]<Insert type>** with Shore A durometer hardness in accordance with manufacturer's written instructions.
 2. Type recommended in writing by sealant or security glazing manufacturer.
- F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.13 FABRICATION OF SECURITY GLAZING

- A. Fabricate security glazing in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Grind smooth and polish exposed security glazing edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing for security glazing, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep system.
 - 3. Minimum required face or edge clearances.
 - 4. Minimum required bite.
 - 5. Effective sealing between joints of framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving security glazing immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of security glazing, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect edges of security glazing from damage during handling and installation. Remove damaged security glazing from Project site and legally dispose of it off Project site. Damaged security glazing includes units with edge or face damage or other imperfections that, when installed, could weaken security glazing and impair performance and appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glazing unit manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

- E. Do not exceed edge pressures stipulated by security glazing manufacturers for installing lites.
- F. Provide spacers for security glazing lites where the length plus width is larger than **50 inches (1270 mm)**.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of security glazing. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with performance requirements.
 - 2. Provide **1/8-inch (3-mm)** minimum bite of spacers on glazing lites and use thickness equal to sealant width. With glazing tape, use thickness of slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent security glazing from moving sideways in glazing channel, as recommended in writing by security glazing manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set security glazing in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set coated security glazing with proper orientation so that coatings and films face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by security glazing, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until just before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center security glazing in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended in writing by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glazing unit and frame or fixed stop, so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center security glazing in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in security glazing. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center security glazing in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in security glazing. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between security glazing and glazing stops to maintain face clearances and to prevent sealant from extruding into glazing channel and blocking weep systems. Secure spacers, or spacers and backings, in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to security glazing and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from security glazing.

3.7 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect security glazing from contact with contaminating substances resulting from construction operations, including weld splatter. Examine security glazing surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do contact with security glazing, remove substances immediately as recommended in writing by security glazing manufacturer. Remove and replace security glazing that cannot be cleaned without damage.
- C. Wash security glazing on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash security glazing as recommended in writing by security glazing manufacturer.

3.8 LAMINATED-GLASS SECURITY GLAZING SCHEDULE

- A. Security Glazing[**Type SG-1**]: [Clear laminated glass][Tinted laminated glass][Clear reflective-coated laminated glass][Tinted reflective-coated laminated glass].
1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
 2. Forced-Entry Resistance, ASTM F1233: [Class 1.0][Class 1.1][Class 1.2][Class 1.3][Class 1.4][Class 1.5]<Insert requirement> in accordance with ASTM F1233.
 3. Forced-Entry Resistance, HPW-TP-0500.03: [Level I]<Insert requirement> in accordance with HPW-TP-0500.03.
 4. Ballistic Resistance, ASTM F1233: [Class HG1][Class HG2][Class HG3][Class HG4][Class SMG][Class R1][Class R2][Class R3][Class R4-AP][Class R5][Class SH1][Class SH2] in accordance with ASTM F1233.
 5. Ballistic Resistance, UL 752: [Level 1][Level 2][Level 3][Level 4][Level 5][Level 6]<Insert requirement> in accordance with UL 752.
 6. Blast Resistance:
 - a. Hazard Rating: [No hazard][Minimal hazard][Very low hazard][Low hazard][Moderate hazard][High hazard] tested in accordance with ASTM F1642/1642M.
 - b. Performance Condition: [1][2][3a][3b][4][5] in accordance with GSA-TS01.
 - c. Peak Pressure: <Insert requirement>.
 - d. Positive Phase Impulse: <Insert requirement>.
 7. Maximum Overall Unit Thickness: <Insert dimension>.
 8. Number of Plies: [Two][Three].
 9. Outer Ply: [3 mm][5 mm][6 mm]<Insert dimension>[float glass][heat-strengthened float glass][fully tempered float glass][chemically strengthened float glass].
 10. Core Ply: [3 mm][5 mm][6 mm]<Insert dimension>[float glass][heat-strengthened float glass][fully tempered float glass][chemically strengthened float glass].
 11. Inner Ply: [3 mm][5 mm][6 mm]<Insert dimension>[float glass][heat-strengthened float glass][fully tempered float glass][chemically strengthened float glass].
 12. Interlayer Material: [Polyvinyl butyral][ionoplast].
 13. Interlayer Thickness: [0.030 inch (0.76 mm)][0.060 inch (1.52 mm)][0.090 inch (2.3 mm)].
 14. Glass Tint Color: [Blue][Blue-green][Bronze][Green][Gray]<Insert color>.
 15. Tinted Glass Location: Outer ply.
 16. Coating Color: [Gold][Pewter][Silver]<Insert color>.
 17. Coating Location: [Second][Third][Fifth] surface.
 18. Overall Visible Light Transmittance: <Insert single percentage or range>.
 19. Outdoor Visible Reflectance: <Insert number> percent maximum.
 20. Winter Nighttime U-Factor: <Insert value> maximum.
 21. Summer Daytime U-Factor: <Insert value> maximum.
 22. Solar-Heat-Gain Coefficient: <Insert value> maximum.
 23. Provide safety glazing labeling.
- B. Security Glazing[**Type SG-2**]: Tinted[reflective-coated] laminated glass with clear glass and tinted interlayer.
1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
 2. Forced-Entry Resistance, ASTM F1233: [Class 1.0][Class 1.1][Class 1.2][Class 1.3][Class 1.4][Class 1.5]<Insert requirement> in accordance with ASTM F1233.
 3. Forced-Entry Resistance, HPW-TP-0500.03: [Level I]<Insert requirement> in accordance with HPW-TP-0500.03.
 4. Ballistic Resistance, ASTM F1233: [Class HG1][Class HG2][Class HG3][Class HG4][Class SMG][Class R1][Class R2][Class R3][Class R4-AP][Class R5][Class SH1][Class SH2] in accordance with ASTM F1233.
 5. Ballistic Resistance, UL 752: [Level 1][Level 2][Level 3][Level 4][Level 5][Level 6]<Insert

- requirement**> in accordance with UL 752.
6. Blast Resistance:
 - a. Hazard Rating: **[No hazard][Minimal hazard][Very low hazard][Low hazard][Moderate hazard][High hazard]** tested in accordance with ASTM F1642/1642M.
 - b. Performance Condition: **[1][2][3a][3b][4][5]** in accordance with GSA-TS01.
 - c. Peak Pressure: **<Insert requirement>**.
 - d. Positive Phase Impulse: **<Insert requirement>**.
 7. Maximum Overall Unit Thickness: **<Insert dimension>**.
 8. Number of Plies: **[Two][Three]**.
 9. Outer Ply: **[3 mm][5 mm][6 mm]<Insert dimension>[float glass][heat-strengthened float glass][fully tempered float glass][chemically strengthened float glass]**.
 10. Core Ply: **[3 mm][5 mm][6 mm]<Insert dimension>[float glass][heat-strengthened float glass][fully tempered float glass][chemically strengthened float glass]**.
 11. Inner Ply: **[3 mm][5 mm][6 mm]<Insert dimension>[float glass][heat-strengthened float glass][fully tempered float glass][chemically strengthened float glass]**.
 12. Interlayer Material: **[Polyvinyl butyral][ionoplast]**.
 13. Interlayer Thickness: **[0.030 inch (0.76 mm)][0.060 inch (1.52 mm)][0.090 inch (2.3 mm)]**.
 14. Interlayer Color: **[Clear][Blue-green][Bronze light][Gray]<Insert color>**.
 15. Coating Color: **[Gold][Pewter][Silver]<Insert color>**.
 16. Coating Location: **[Second][Third][Fifth]** surface.
 17. Overall Visible Light Transmittance: **<Insert single percentage or range>**.
 18. Outdoor Visible Reflectance: **<Insert number>** percent maximum.
 19. Winter Nighttime U-Factor: **<Insert value>** maximum.
 20. Summer Daytime U-Factor: **<Insert value>** maximum.
 21. Solar-Heat-Gain Coefficient: **<Insert value>** maximum.
 22. Provide safety glazing labeling.

3.9 MONOLITHIC POLYCARBONATE SECURITY GLAZING SCHEDULE

- A. Security Glazing[, **Type SG-3**]: Monolithic polycarbonate with mar-resistant coating on both surfaces.
 1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
 2. Detention Security Grade: Grade 4 in accordance with ASTM F1915 **[cold-temperature impact test][warm-temperature impact test][and][torch and small blunt impactor test]**.
 3. Thickness: **[3/8 inch (9.25 mm)][1/2 inch (12.7 mm)]<Insert thickness>**.

3.10 LAMINATED-POLYCARBONATE SECURITY GLAZING SCHEDULE

- A. Security Glazing[, **Type SG-4**]: Laminated polycarbonate.
 1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
 2. Detention Security Grade: **[Grade 1][Grade 2][Grade 3][Grade 4]** in accordance with ASTM F1915 **[cold-temperature impact test][warm-temperature impact test][and][torch and small blunt impactor test]**.
 3. Forced-Entry Resistance, ASTM F1233: **[Class 1.0][Class 1.1][Class 1.2][Class 1.3][Class 1.4][Class 1.5][Class 2.0][Class 2.1][Class 2.2][Class 2.3][Class 2.4][Class 2.5][Class 2.6][Class 2.7][Class 2.8][Class 3.0][Class 3.1][Class 3.2][Class 3.3][Class 3.4][Class 3.5][Class 3.6][Class 3.7][Class 3.8][Class 3.9][Class 3.10][Class 4.0][Class 4.1][Class 4.2][Class 4.3][Class 4.4][Class 4.5][Class 4.6][Class 4.7][Class 4.8][Class 4.9][Class 4.10][Class 4.11][Class 4.12][Class 4.13][Class 5.0]** in accordance with ASTM F1233.
 4. Forced-Entry Resistance, HPW-TP-0500.03: **[Level I][Level II][Level III][Level IV][Level V]** in

- accordance with HPW-TP-0500.03.
5. Ballistic Resistance, ASTM F1233: [Class HG1][Class HG2][Class HG3][Class HG4][Class SMG][Class R1][Class R2][Class R3][Class R4-AP][Class R5][Class SH1][Class SH2] in accordance with ASTM F1233.
 6. Ballistic Resistance, UL 752: [Level 1][Level 2][Level 3][Level 4][Level 5][Level 6]<Insert requirement> in accordance with UL 752.
 7. Blast Resistance:
 - a. Hazard Rating: [No hazard][Minimal hazard][Very low hazard][Low hazard][Moderate hazard][High hazard] tested in accordance with ASTM F1642/1642M.
 - b. Performance Condition: [1][2][3a][3b][4][5] in accordance with GSA-TS01.
 - c. Peak Pressure: <Insert requirement>.
 - d. Positive Phase Impulse: <Insert requirement>.
 8. Maximum Overall Unit Thickness: <Insert dimension>.
 9. Number of Plies: [Two][Three][Four].
 10. Outer and Inner Plies: [0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)] polycarbonate.
 11. [Core Ply][Core Plies]: [0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)] polycarbonate.
 12. Interlayer Material: Polyurethane.
 13. Interlayer Thicknesses: [0.025 inch (0.635 mm)]<Insert dimension>.

3.11 GLASS-CLAD POLYCARBONATE SECURITY GLAZING SCHEDULE

- A. Security Glazing[Type SG-5]: [Clear symmetrical glass-clad polycarbonate][Tinted symmetrical glass-clad polycarbonate][Clear reflective-coated symmetrical glass-clad polycarbonate][Tinted reflective-coated symmetrical glass-clad polycarbonate].
 1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
 2. Detention Security Grade: [Grade 1][Grade 2][Grade 3][Grade 4] in accordance with ASTM F1915 [cold-temperature impact test][warm-temperature impact test][and][torch and small blunt impactor test].
 3. Forced-Entry Resistance, ASTM F1233: [Class 1.0][Class 1.1][Class 1.2][Class 1.3][Class 1.4][Class 1.5][Class 2.0][Class 2.1][Class 2.2][Class 2.3][Class 2.4][Class 2.5][Class 2.6][Class 2.7][Class 2.8][Class 3.0][Class 3.1][Class 3.2][Class 3.3][Class 3.4][Class 3.5][Class 3.6][Class 3.7][Class 3.8][Class 3.9][Class 3.10][Class 4.0][Class 4.1][Class 4.2][Class 4.3][Class 4.4][Class 4.5][Class 4.6][Class 4.7][Class 4.8][Class 4.9][Class 4.10][Class 4.11][Class 4.12][Class 4.13][Class 5.0] in accordance with ASTM F1233.
 4. Forced-Entry Resistance, HPW-TP-0500.03: [Level I][Level II][Level III][Level IV][Level V] in accordance with HPW-TP-0500.03.
 5. Ballistic Resistance, ASTM F1233: [Class HG1][Class HG2][Class HG3][Class HG4][Class SMG][Class R1][Class R2][Class R3][Class R4-AP][Class R5][Class SH1][Class SH2] in accordance with ASTM F1233.
 6. Ballistic Resistance, UL 752: [Level 1][Level 2][Level 3][Level 4][Level 5][Level 6][Level 7][Level 8][Level 1-SG][Level 2-SG][Level 3-SG][Level 4-SG][Level 5-SG][Level 6-SG][Level 7-SG][Level 8-SG] in accordance with UL 752.
 7. Blast Resistance:
 - a. Hazard Rating: [No hazard][Minimal hazard][Very low hazard][Low hazard][Moderate hazard][High hazard] tested in accordance with ASTM F1642/1642M.
 - b. Performance Condition: [1][2][3a][3b][4][5] in accordance with GSA-TS01.
 - c. Peak Pressure: <Insert requirement>.
 - d. Positive Phase Impulse: <Insert requirement>.

8. Maximum Overall Unit Thickness: **<Insert dimension>**.
9. Outer Ply: **[3 mm][5 mm][6 mm]<Insert dimension>[heat-strengthened][chemically strengthened]** float glass.
10. Single Core: **[0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)]** polycarbonate.
11. Multiple Core:
 - a. Outer Core Ply: **[0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)]** polycarbonate.
 - b. **[Single Inner Core Ply][Double Inner Core Plies]**: **[0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)]** polycarbonate.
12. Inner Ply: **[3 mm][5 mm][6 mm]<Insert dimension>[heat-strengthened][chemically strengthened]** float glass.
13. Interlayer Material: Polyurethane.
14. Interlayer Thickness: **[0.025 inch (0.635 mm)][0.050 inch (1.27 mm)]<Insert dimension>**.
15. Glass Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
16. Tinted Glass Location: Outer ply.
17. Coating Color: **[Gold][Pewter][Silver]<Insert color>**.
18. Coating Location: **[Second][Third][Fifth]** surface.
19. Overall Visible Light Transmittance: **<Insert single percentage or range>**.
20. Outdoor Visible Reflectance: **<Insert number>** percent maximum.
21. Winter Nighttime U-Factor: **<Insert value>** maximum.
22. Summer Daytime U-Factor: **<Insert value>** maximum.
23. Solar-Heat-Gain Coefficient: **<Insert value>** maximum.
24. Provide safety glazing labeling.

3.12 LAMINATED-GLASS AND -POLYCARBONATE SECURITY GLAZING SCHEDULE

- A. Security Glazing[**Type SG-6**]: Nonsymmetrical **[clear][tinted][reflective-coated]** laminated glass and polycarbonate with glass plies on the attack or threat side and polycarbonate plies on the witness side.
 1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
 2. Detention Security Grade: **[Grade 1][Grade 2][Grade 3][Grade 4]** in accordance with ASTM F1915 **[cold-temperature impact test][warm-temperature impact test][and][torch and small blunt impactor test]**.
 3. Forced-Entry Resistance, ASTM F1233: **[Class 1.0][Class 1.1][Class 1.2][Class 1.3][Class 1.4][Class 1.5][Class 2.0][Class 2.1][Class 2.2][Class 2.3][Class 2.4][Class 2.5][Class 2.6][Class 2.7][Class 2.8][Class 3.0][Class 3.1][Class 3.2][Class 3.3][Class 3.4][Class 3.5][Class 3.6][Class 3.7][Class 3.8][Class 3.9][Class 3.10][Class 4.0][Class 4.1][Class 4.2][Class 4.3][Class 4.4][Class 4.5][Class 4.6][Class 4.7][Class 4.8][Class 4.9][Class 4.10][Class 4.11][Class 4.12][Class 4.13][Class 5.0]** in accordance with ASTM F1233.
 4. Forced-Entry Resistance, HPW-TP-0500.03: **[Level I][Level II][Level III][Level IV][Level V]** in accordance with HPW-TP-0500.03.
 5. Ballistic Resistance, ASTM F1233: **[Class HG1][Class HG2][Class HG3][Class HG4][Class SMG][Class R1][Class R2][Class R3][Class R4-AP][Class R5][Class SH1][Class SH2]** in accordance with ASTM F1233.
 6. Ballistic Resistance, UL 752: **[Level 1][Level 2][Level 3][Level 4][Level 5][Level 6][Level 7][Level 8][Level 1-SG][Level 2-SG][Level 3-SG][Level 4-SG][Level 5-SG][Level 6-SG][Level 7-SG][Level 8-SG]** in accordance with UL 752.
 7. Blast Resistance:
 - a. Hazard Rating: **[No hazard][Minimal hazard][Very low hazard][Low hazard][Moderate hazard][High hazard]** tested in accordance with ASTM F1642/1642M.

- b. Performance Condition: [1][2][3a][3b][4][5] in accordance with GSA-TS01.
 - c. Peak Pressure: <Insert requirement>.
 - d. Positive Phase Impulse: <Insert requirement>.
- 8. Maximum Overall Unit Thickness: <Insert dimension>.
- 9. Makeup:
 - a. Outer Glass Ply: [3 mm]<Insert dimension> heat-strengthened float glass.
 - 1) Interlayer Thickness: [0.025 inch (0.635 mm)][0.050 inch (1.27 mm)]<Insert dimension>.
 - b. First Inner Glass Ply: [12 mm]<Insert dimension> float glass.
 - 1) Interlayer Thickness: [0.025 inch (0.635 mm)][0.050 inch (1.27 mm)]<Insert dimension>.
 - c. Second Inner Glass Ply: [10 mm]<Insert dimension> float glass.
 - 1) Interlayer Thickness: [0.025 inch (0.635 mm)][0.050 inch (1.27 mm)]<Insert dimension>.
 - d. Inner Polycarbonate Ply: [0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)] Type I (standard, UV-stabilized) polycarbonate.
 - 1) Interlayer Thickness: [0.025 inch (0.635 mm)][0.050 inch (1.27 mm)]<Insert dimension>.
 - e. Outer Polycarbonate Ply: [0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)] Type II (coated, mar-resistant, UV-stabilized) polycarbonate.
- 10. Glass Tint Color: [Blue][Blue-green][Bronze][Green][Gray]<Insert color>.
- 11. Tinted Glass Location: Outer glass ply.
- 12. Coating Color: [Gold][Pewter][Silver]<Insert color>.
- 13. Coating Location: [Second][Third][Fifth] surface.
- 14. Overall Visible Light Transmittance: <Insert single percentage or range>.
- 15. Outdoor Visible Reflectance: <Insert number> percent maximum.
- 16. Winter Nighttime U-Factor: <Insert value> maximum.
- 17. Summer Daytime U-Factor: <Insert value> maximum.
- 18. Solar-Heat-Gain Coefficient: <Insert value> maximum.
- 19. Provide safety glazing labeling.

3.13 INSULATING SECURITY GLAZING SCHEDULE

- A. Security Glazing[**Type SG-7**]: [Clear insulating security glazing][Tinted insulating security glazing][Reflective-coated, clear insulating security glazing][Reflective-coated, tinted insulating security glazing]. Outdoor lite is made of monolithic glass, and indoor lite is made of glass-clad polycarbonate.
 - 1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
 - 2. Detention Security Grade: [Grade 1][Grade 2][Grade 3][Grade 4] in accordance with ASTM F1915 [cold-temperature impact test][warm-temperature impact test][and][torch and small blunt impactor test].
 - 3. Overall Unit Thickness: <Insert dimension>.
 - 4. Outdoor Lite: [Float glass][Heat-strengthened float glass][Fully tempered float glass].

5. Indoor Lite: Glass-clad polycarbonate.
 - a. Outer Ply: [3 mm][5 mm][6 mm]<Insert dimension>[heat-strengthened][chemically strengthened][fully tempered] float glass.
 - b. Single Core: [0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)] polycarbonate.
 - c. Multiple Core:
 - 1) Outer Core Ply: [0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)] polycarbonate.
 - 2) [Single Inner Core Ply][Double Inner Core Plies]: [0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)] polycarbonate.
 - d. Inner Ply: [3 mm][5 mm][6 mm]<Insert dimension>[heat-strengthened][chemically strengthened][fully tempered] float glass.
6. Interspace Content: [Air][Argon].
7. Interspace Dimension: <Insert dimension>.
8. Glass Tint Color: [Blue][Blue-green][Bronze][Green][Gray]<Insert color>.
9. Tinted Glass Location: Outdoor lite.
10. Coating Color: [Gold][Pewter][Silver]<Insert color>.
11. Coating Location: [Second][Third][Fifth] surface.
12. Overall Visible Light Transmittance: <Insert number> percent minimum.
13. Outdoor Visible Reflectance: <Insert value> percent maximum.
14. Winter Nighttime U-Factor: <Insert value> maximum.
15. Summer Daytime U-Factor: <Insert value> maximum.
16. Solar-Heat-Gain Coefficient: <Insert value> maximum.
17. Provide safety glazing labeling.

B. Security Glazing[Type SG-8]: [Low-e-coated, clear insulating security glazing][Low-e-coated, tinted insulating security glazing]. Outdoor lite is made of monolithic glass, and indoor lite is made of glass-clad polycarbonate.

1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
2. Detention Security Grade: [Grade 1][Grade 2][Grade 3][Grade 4] in accordance with ASTM F1915 [cold-temperature impact test][warm-temperature impact test][and][torch and small blunt impactor test].
3. Overall Unit Thickness: <Insert dimension>.
4. Outdoor Lite: [Float glass][Heat-strengthened float glass][Fully tempered float glass].
5. Indoor Lite: Glass-clad polycarbonate.
 - a. Outer Ply: [3 mm][5 mm][6 mm]<Insert dimension>[heat-strengthened][chemically strengthened][fully tempered] float glass.
 - b. Single Core: [0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)] polycarbonate.
 - c. Multiple Core:
 - 1) Outer Core Ply: [0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)] polycarbonate.
 - 2) [Single Inner Core Ply][Double Inner Core Plies]: [0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)] polycarbonate.
 - d. Inner Ply: [3 mm][5 mm][6 mm]<Insert dimension>[heat-strengthened][chemically strengthened][fully tempered] float glass.

6. Interspace Content: **[Air][Argon]**.
 7. Interspace Dimension: **<Insert dimension>**.
 8. Glass Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
 9. Tinted Glass Location: Outer lite.
 10. Low-E Coating: **[Pyrolytic on second surface][Pyrolytic on third surface][Sputtered on second surface][Sputtered on third surface]**.
 11. Overall Visible Light Transmittance: **<Insert number>** percent minimum.
 12. Winter Nighttime U-Factor: **<Insert value>** maximum.
 13. Summer Daytime U-Factor: **<Insert value>** maximum.
 14. Solar-Heat-Gain Coefficient: **<Insert value>** maximum.
 15. Provide safety glazing labeling.
- C. Security Glazing[**Type SG-9**]: **[Clear insulating security glazing][Tinted insulating security glazing][Reflective-coated, clear insulating security glazing][Reflective-coated, tinted insulating security glazing]**. Outdoor lite is made of laminated glass, and indoor lite is made of glass-clad polycarbonate with spall-resistant film on inside face.
1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
 2. Detention Security Grade: **[Grade 1][Grade 2][Grade 3][Grade 4]** in accordance with ASTM F1915 **[cold-temperature impact test][warm-temperature impact test][and][torch and small blunt impactor test]**.
 3. Forced-Entry Resistance, ASTM F1233 **[Class 1.0][Class 1.1][Class 1.2][Class 1.3][Class 1.4][Class 1.5][Class 2.0][Class 2.1][Class 2.2][Class 2.3][Class 2.4][Class 2.5][Class 2.6][Class 2.7][Class 2.8][Class 3.0][Class 3.1][Class 3.2][Class 3.3][Class 3.4][Class 3.5][Class 3.6][Class 3.7][Class 3.8][Class 3.9][Class 3.10][Class 4.0][Class 4.1][Class 4.2][Class 4.3][Class 4.4][Class 4.5][Class 4.6][Class 4.7][Class 4.8][Class 4.9][Class 4.10][Class 4.11][Class 4.12][Class 4.13][Class 5.0]** in accordance with ASTM F1233.
 4. Forced-Entry Resistance, HPW-TP-0500.03: **[Level I][Level II][Level III][Level IV][Level V]** in accordance with HPW-TP-0500.03.
 5. Ballistic Resistance, ASTM F1233: **[Class HG1][Class HG2][Class HG3][Class HG4][Class SMG][Class R1][Class R2][Class R3][Class R4-AP][Class R5][Class SH1][Class SH2]** in accordance with ASTM F1233.
 6. Ballistic Resistance, UL 752: **[Level 1][Level 2][Level 3][Level 4][Level 5][Level 6][Level 7][Level 8][Level 1-SG][Level 2-SG][Level 3-SG][Level 4-SG][Level 5-SG][Level 6-SG][Level 7-SG][Level 8-SG]** in accordance with UL 752.
 7. Blast Resistance:
 - a. Hazard Rating: **[No hazard][Minimal hazard][Very low hazard][Low hazard][Moderate hazard][High hazard]** tested in accordance with ASTM F1642/1642M.
 - b. Performance Condition: **[1][2][3a][3b][4][5]** in accordance with GSA-TS01.
 - c. Peak Pressure: **<Insert requirement>**.
 - d. Positive Phase Impulse: **<Insert requirement>**.
 8. Overall Unit Thickness: **<Insert dimension>**.
 9. Outdoor Lite: Laminated glass with **[two plies of heat-strengthened float glass][three plies of heat-strengthened float glass][two outer plies of heat-strengthened float glass and two inner plies of annealed float glass]**.
 - a. Outer Ply Thickness: **[3 mm][5 mm][6 mm]<Insert dimension>**.
 - b. Core Ply Thickness: **[3 mm][5 mm][6 mm]<Insert dimension>**.
 - c. Inner Ply Thickness: **[3 mm][5 mm][6 mm]<Insert dimension>**.
 - d. Interlayer Thickness: **[0.030 inch (0.76 mm)][0.060 inch (1.52 mm)][0.090 inch (2.3 mm)]**.
 10. Indoor Lite: Glass-clad polycarbonate faced with a **0.037-inch- (0.94-mm-)** thick, spall-resistant polyester film laminated to indoor face.

- a. Outer Ply: [3 mm][5 mm][6 mm]<Insert dimension>[heat-strengthened][chemically strengthened] float glass.
- b. Single Core: [0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)] polycarbonate.
- c. Multiple Core:
 - 1) Outer Core Ply: [0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)] polycarbonate.
 - 2) [Single Inner Core Ply][Double Inner Core Plies]: [0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)] polycarbonate.
- d. Inner Ply: [3 mm][5 mm][6 mm]<Insert dimension>[heat-strengthened][chemically strengthened] float glass.

- 11. Interspace Content: [Air][Argon].
- 12. Interspace Dimension: <Insert dimension>.
- 13. Glass Tint Color: [Blue][Blue-green][Bronze][Green][Gray]<Insert color>.
- 14. Tinted Glass Location: [Outer][Inner] ply of outdoor lite.
- 15. Coating Color: [Gold][Pewter][Silver]<Insert color>.
- 16. Coating Location: [Second][Third][Fifth] surface.
- 17. Overall Visible Light Transmittance: <Insert number> percent minimum.
- 18. Outdoor Visible Reflectance: <Insert number> percent maximum.
- 19. Winter Nighttime U-Factor: <Insert value> maximum.
- 20. Summer Daytime U-Factor: <Insert value> maximum.
- 21. Solar-Heat-Gain Coefficient: <Insert value> maximum.
- 22. Provide safety glazing labeling.

- D. Security Glazing[**Type SG-10**]: [Low-e-coated, clear insulating security glazing][Low-e-coated, tinted insulating security glazing]. Outdoor lite is made of laminated glass, and indoor lite is made of glass-clad polycarbonate with spall-resistant film on inside face.

- 1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
- 2. Detention Security Grade: [Grade 1][Grade 2][Grade 3][Grade 4] in accordance with ASTM F1915 [cold-temperature impact test][warm-temperature impact test][and][torch and small blunt impactor test].
- 3. Forced-Entry Resistance, ASTM F1233: [Class 1.0][Class 1.1][Class 1.2][Class 1.3][Class 1.4][Class 1.5][Class 2.0][Class 2.1][Class 2.2][Class 2.3][Class 2.4][Class 2.5][Class 2.6][Class 2.7][Class 2.8][Class 3.0][Class 3.1][Class 3.2][Class 3.3][Class 3.4][Class 3.5][Class 3.6][Class 3.7][Class 3.8][Class 3.9][Class 3.10][Class 4.0][Class 4.1][Class 4.2][Class 4.3][Class 4.4][Class 4.5][Class 4.6][Class 4.7][Class 4.8][Class 4.9][Class 4.10][Class 4.11][Class 4.12][Class 4.13][Class 5.0] in accordance with ASTM F1233.
- 4. Forced-Entry Resistance, HPW-TP-0500.03: [Level I][Level II][Level III][Level IV][Level V] in accordance with HPW-TP-0500.03.
- 5. Ballistic Resistance, ASTM F1233: [Class HG1][Class HG2][Class HG3][Class HG4][Class SMG][Class R1][Class R2][Class R3][Class R4-AP][Class R5][Class SH1][Class SH2] in accordance with ASTM F1233.
- 6. Ballistic Resistance, UL 752: [Level 1][Level 2][Level 3][Level 4][Level 5][Level 6][Level 7][Level 8][Level 1-SG][Level 2-SG][Level 3-SG][Level 4-SG][Level 5-SG][Level 6-SG][Level 7-SG][Level 8-SG] in accordance with UL 752.
- 7. Blast Resistance:
 - a. Hazard Rating: [No hazard][Minimal hazard][Very low hazard][Low hazard][Moderate hazard][High hazard] tested in accordance with ASTM F1642/1642M.
 - b. Performance Condition: [1][2][3a][3b][4][5] in accordance with GSA-TS01.
 - c. Peak Pressure: <Insert requirement>.

- d. Positive Phase Impulse: <Insert requirement>.
8. Overall Unit Thickness: <Insert dimension>.
9. Outdoor Lite: Laminated glass with [two plies of heat-strengthened float glass][three plies of heat-strengthened float glass][two outer plies of heat-strengthened float glass and two inner plies of annealed float glass].
 - a. Outer Ply Thickness: [3 mm][5 mm][6 mm]<Insert dimension>.
 - b. Core Ply Thickness: [3 mm][5 mm][6 mm]<Insert dimension>.
 - c. Inner Ply Thickness: [3 mm][5 mm][6 mm]<Insert dimension>.
 - d. Interlayer Thickness: [0.030 inch (0.76 mm)][0.060 inch (1.52 mm)][0.090 inch (2.3 mm)].
10. Indoor Lite: Glass-clad polycarbonate faced with a 0.037-inch- (0.94-mm-) thick, spall-resistant polyester film laminated to indoor face.
 - a. Outer Ply: [3 mm][5 mm][6 mm]<Insert dimension>[heat-strengthened][chemically strengthened] float glass.
 - b. Inner Ply: [3 mm][5 mm][6 mm]<Insert dimension>[heat-strengthened][chemically strengthened] float glass.
 - c. Single Core: [0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)] polycarbonate.
 - d. Multiple Core:
 - 1) Outer Core Ply: [0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)] polycarbonate.
 - 2) [Single Inner Core Ply][Double Inner Core Plies]: [0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)] polycarbonate.
11. Interspace Content: [Air][Argon].
12. Interspace Dimension: <Insert dimension>.
13. Glass Tint Color: [Blue][Blue-green][Bronze][Green][Gray]<Insert color>.
14. Tinted Glass Location: Outer lite.
15. Low-E Coating: [Pyrolytic on second surface][Pyrolytic on third surface][Sputtered on second surface][Sputtered on third surface].
16. Overall Visible Light Transmittance: <Insert number> percent minimum.
17. Winter Nighttime U-Factor: <Insert value> maximum.
18. Summer Daytime U-Factor: <Insert value> maximum.
19. Solar-Heat-Gain Coefficient: <Insert value> maximum.
20. Provide safety glazing labeling.

3.14 AIR-GAP SECURITY GLAZING SCHEDULE

- A. Security Glazing[**Type SG-11**]: [Clear air-gap security glazing][Tinted air-gap security glazing][Clear reflective-coated air-gap security glazing][Tinted reflective-coated air-gap security glazing]. Outdoor lite is made of laminated glass, and indoor lite is made of laminated polycarbonate.
 1. Basis-of-Design Product: <Insert manufacturer's name; product name or designation>.
 2. Forced-Entry Resistance, ASTM F1233: [Class 1.0][Class 1.1][Class 1.2][Class 1.3][Class 1.4][Class 1.5][Class 2.0][Class 2.1][Class 2.2][Class 2.3][Class 2.4][Class 2.5][Class 2.6][Class 2.7][Class 2.8][Class 3.0][Class 3.1][Class 3.2][Class 3.3][Class 3.4][Class 3.5][Class 3.6][Class 3.7][Class 3.8][Class 3.9][Class 3.10][Class 4.0][Class 4.1][Class 4.2][Class 4.3][Class 4.4][Class 4.5][Class 4.6][Class 4.7][Class 4.8][Class 4.9][Class 4.10][Class 4.11][Class 4.12][Class 4.13][Class 5.0] in accordance with ASTM F1233.
 3. Forced-Entry Resistance, HPW-TP-0500.03: [Level I][Level II][Level III][Level IV][Level V] in accordance with HPW-TP-0500.03.

4. Ballistic Resistance, ASTM F1233: **[Class HG1][Class HG2][Class HG3][Class HG4][Class SMG][Class R1][Class R2][Class R3][Class R4-AP][Class R5][Class SH1][Class SH2]** in accordance with ASTM F1233.
 5. Ballistic Resistance, UL 752: **[Level 1][Level 2][Level 3][Level 4][Level 5][Level 6][Level 7][Level 8][Level 1-SG][Level 2-SG][Level 3-SG][Level 4-SG][Level 5-SG][Level 6-SG][Level 7-SG][Level 8-SG]** in accordance with UL 752.
 6. Blast Resistance:
 - a. Hazard Rating: **[No hazard][Minimal hazard][Very low hazard][Low hazard][Moderate hazard][High hazard]** tested in accordance with ASTM F1642/1642M.
 - b. Performance Condition: **[1][2][3a][3b][4][5]** in accordance with GSA-TS01.
 - c. Peak Pressure: **<Insert requirement>**.
 - d. Positive Phase Impulse: **<Insert requirement>**.
 7. Overall Unit Thickness: **<Insert dimension>**.
 8. Outdoor Lite: Laminated glass with **[two][three]** plies of **[float glass][heat-strengthened float glass][fully tempered float glass][chemically strengthened float glass]**.
 - a. Outer Ply Thickness: **[3 mm][5 mm][6 mm]<Insert dimension>**.
 - b. Core Ply Thickness: **[3 mm][5 mm][6 mm]<Insert dimension>**.
 - c. Inner Ply Thickness: **[3 mm][5 mm][6 mm]<Insert dimension>**.
 - d. Interlayer Thickness: **[0.030 inch (0.76 mm)][0.060 inch (1.52 mm)][0.090 inch (2.3 mm)]**.
 9. Indoor Lite: Laminated polycarbonate with **[two][three][four]** polycarbonate plies.
 - a. Overall Unit Thickness: **<Insert dimension>**.
 - b. Outer and Inner Plies: **[0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)]** polycarbonate.
 - c. **[Core Ply][Core Plies]**: **[0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)]** polycarbonate.
 - d. Interlayer Thicknesses: **[0.025 inch (0.635 mm)]<Insert dimension>**.
 10. Air-Gap Dimension: **<Insert dimension>**.
 11. Glass Tint Color: **[Blue][Blue-green][Bronze][Green][Gray]<Insert color>**.
 12. Tinted Glass Location: **[Outer][Inner]** ply of outdoor lite.
 13. Coating Color: **[Gold][Pewter][Silver]<Insert color>**.
 14. Coating Location: **[Second][Third][Fifth]** surface.
 15. Overall Visible Light Transmittance: **<Insert number>** percent minimum.
 16. Outdoor Visible Reflectance: **<Insert number>** percent maximum.
 17. Winter Nighttime U-Factor: **<Insert value>** maximum.
 18. Summer Daytime U-Factor: **<Insert value>** maximum.
 19. Solar-Heat-Gain Coefficient: **<Insert value>** maximum.
 20. Provide safety glazing labeling.
- B. Security Glazing **[Type SG-12]**: **[Low-e-coated, clear air-gap security glazing][Low-e-coated, tinted air-gap security glazing]**. Outdoor lite is made of laminated glass, and indoor lite is made of laminated polycarbonate.
1. Basis-of-Design Product: **<Insert manufacturer's name; product name or designation>**.
 2. Forced-Entry Resistance, ASTM F1233: **[Class 1.0][Class 1.1][Class 1.2][Class 1.3][Class 1.4][Class 1.5][Class 2.0][Class 2.1][Class 2.2][Class 2.3][Class 2.4][Class 2.5][Class 2.6][Class 2.7][Class 2.8][Class 3.0][Class 3.1][Class 3.2][Class 3.3][Class 3.4][Class 3.5][Class 3.6][Class 3.7][Class 3.8][Class 3.9][Class 3.10][Class 4.0][Class 4.1][Class 4.2][Class 4.3][Class 4.4][Class 4.5][Class 4.6][Class 4.7][Class 4.8][Class 4.9][Class 4.10][Class 4.11][Class 4.12][Class 4.13][Class 5.0]** in accordance with ASTM F1233.

3. Forced-Entry Resistance, HPW-TP-0500.03: [Level I][Level II][Level III][Level IV][Level V] in accordance with HPW-TP-0500.03.
4. Ballistic Resistance, ASTM F1233: [Class HG1][Class HG2][Class HG3][Class HG4][Class SMG][Class R1][Class R2][Class R3][Class R4-AP][Class R5][Class SH1][Class SH2] in accordance with ASTM F1233.
5. Ballistic Resistance, UL 752: [Level 1][Level 2][Level 3][Level 4][Level 5][Level 6][Level 7][Level 8][Level 1-SG][Level 2-SG][Level 3-SG][Level 4-SG][Level 5-SG][Level 6-SG][Level 7-SG][Level 8-SG] in accordance with UL 752.
6. Blast Resistance:
 - a. Hazard Rating: [No hazard][Minimal hazard][Very low hazard][Low hazard][Moderate hazard][High hazard] tested in accordance with ASTM F1642/1642M.
 - b. Performance Condition: [1][2][3a][3b][4][5] in accordance with GSA-TS01.
 - c. Peak Pressure: <Insert requirement>.
 - d. Positive Phase Impulse: <Insert requirement>.
7. Overall Unit Thickness: <Insert dimension>.
8. Outdoor Lite: Laminated glass with [two][three] plies of [float glass][heat-strengthened float glass][fully tempered float glass][chemically strengthened float glass].
 - a. Outer Ply Thickness: [3 mm][5 mm][6 mm]<Insert dimension>.
 - b. Core Ply Thickness: [3 mm][5 mm][6 mm]<Insert dimension>.
 - c. Inner Ply Thickness: [3 mm][5 mm][6 mm]<Insert dimension>.
 - d. Interlayer Thickness: [0.030 inch (0.76 mm)][0.060 inch (1.52 mm)][0.090 inch (2.3 mm)].
9. Indoor Lite: Laminated polycarbonate with [two][three][four] polycarbonate plies.
 - a. Overall Unit Thickness: <Insert dimension>.
 - b. Outer and Inner Plies: [0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)] polycarbonate.
 - c. [Core Ply][Core Plies]: [0.118-inch (4.57-mm)][0.177-inch (2.97-mm)][0.236-inch (5.99-mm)] polycarbonate.
 - d. Interlayer Thicknesses: [0.025 inch (0.635 mm)]<Insert dimension>.
10. Air-Gap Dimension: <Insert dimension>.
11. Glass Tint Color: [Blue][Blue-green][Bronze][Green][Gray]<Insert color>.
12. Tinted Glass Location: [Outer][Inner] ply of outdoor lite.
13. Low-E Coating: [Pyrolytic on second surface][Pyrolytic on third surface][Sputtered on second surface][Sputtered on third surface].
14. Overall Visible Light Transmittance: <Insert number> percent minimum.
15. Winter Nighttime U-Factor: <Insert value> maximum.
16. Summer Daytime U-Factor: <Insert value> maximum.
17. Solar Heat-Gain Coefficient: <Insert value> maximum.
18. Provide safety glazing labeling.

END OF SECTION 08 88 53 00



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Task	Specification	Specification Description
08 88 53 00	08 80 00 00	Glazing



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SECTION 08 91 16 00 - OPERABLE WALL LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Operable, ~~extruded-aluminum~~~~and~~~~formed-metal~~ louvers.
2. Operable, ~~extruded-aluminum~~~~and~~~~formed-metal~~ insulated louvers.
3. Blank-off panels for louvers.

B. Related Requirements:

1. Section 099113 "Exterior Painting" for field painting exterior louvers.
2. Section 099123 "Interior Painting" for field painting interior louvers.
3. Section 221513 "General-Service Compressed-Air Piping" for connecting pneumatic-operated louvers.

1.2 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
3. Environmental Product Declaration (EPD): For each product.
4. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
5. Environmental Product Declaration: For each product.
6. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
7. Environmental Product Declaration: For each product.

8. Environmental Product Declaration: For each product.
9. Third-Party Certifications: For each product.
10. Third-Party Certified Life Cycle Assessment: For each product.
11. Environmental Product Declaration: For each product.
12. Health Product Declaration: For each product.
13. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
14. Environmental Product Declaration: For each product.
15. Environmental Product Declaration: For each product.
16. Environmental Product Declaration: For each product.
17. Third-Party Certifications: For each product.
18. Third-Party Certified Life Cycle Assessment: For each product.

- C. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
2. Show mullion profiles and locations.
3. Wiring Diagrams: For power, signal, and control wiring for motorized operable louvers.

- D. Samples: For each type of metal finish required.

- E. Delegated Design Submittal: For louvers indicated to comply with structural[**and seismic**] performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed in accordance with AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.
- B. Sample Warranties: For manufacturer's special warranties.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 WARRANTY

- A. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: **[Five][10][20]<Insert number>** years from date of Substantial Completion.
- B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, peeling, or chipping.
 2. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain operable **[and fixed]** louvers from single source from single manufacturer **[where indicated to be of same type, design, or factory-applied color finish].**

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural **[and seismic]** performance requirements and design criteria indicated.
- B. Structural Performance: Louvers withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures to the face of the building are considered to act normal.
1. Wind Loads:
 - a. Determine loads based on pressures as indicated on Drawings.
 - b. Determine loads based on a uniform pressure of **[20 lbf/sq. ft. (957 Pa)][30 lbf/sq. ft. (1436 Pa)]<Insert value>**, acting inward or outward.
 - c. Determine loads based on pressures indicated below:
 - 1) Corner Zone: Within **<Insert distance>** of building corners, uniform pressure of **<Insert design wind pressure>**, acting inward, and **<Insert design wind pressure>**, acting outward.
 - 2) Other Than Corner Zone: Uniform pressure of **<Insert design wind pressure>**, acting inward, and **<Insert design wind pressure>**, acting outward.
- C. Seismic Performance:

1. As indicated on Drawings.
2. Louvers, including attachments to other construction, withstand the effects of earthquake motions determined in accordance with **[ASCE/SEI 7]<Insert requirement>**.
 - a. Design earthquake spectral response acceleration, short period (Sds) for Project is **<Insert value>**.
 - b. Component Importance Factor: **[1.5][1.0]**.
- D. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width in accordance with AMCA 500-L.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 1. Temperature Change (Range): **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature range>**.
- F. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.
- G. UL and NEMA Compliance: Provide motors and related components for motor-operated louvers that are listed and labeled by UL and comply with applicable NEMA standards.

2.3 OPERABLE EXTRUDED-ALUMINUM LOUVERS

- A. Louver Construction and Operation: Provide operable louvers with extruded-aluminum frames and blades of not less than **0.080-inch (2.03-mm)** nominal thickness, and with operating mechanisms to suit louver sizes.
 1. Hand operation with push bars.
 2. Crank operation with removable-crank operator in sill or jamb.
 3. Chain operation with tension spring, wall clip, pull chain, and **160 deg F (71 deg C)** fusible link.
 4. Motor operation with **[two-position, spring-return application (with power on, motor opens louver; with power off, spring closes louver); 110-V, 60-Hz motor and limit switch][two-direction, 110-V, 60-Hz motor and limit switches]**; equipped with **[frame-mounted switch][remote-mounted switch with indicator light][terminals for controlling devices]**.
 5. Pneumatic piston operation for use with **80- to 100-psi (550- to 690-kPa)** compressed air for **[two-position][modulating]** operation; power open, power close **[with spring-return fail-safe]**.
- B. Operable, Extruded-Aluminum, Single-Blade Louver :
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Air Balance; MESTEK, Inc.]**
 - b. **[Air Flow Company, Inc.]**
 - c. **[Airline Louvers; Mestek, Inc.]**
 - d. **[Airolite Company, LLC (The)]**
 - e. **[All-Lite Architectural Products]**
 - f. **[American Warming and Ventilating (AWV); Mestek, Inc.]**
 - g. **[Arrow United Industries; Mestek, Inc.]**
 - h. **[Carnes Company]**

- i. [Cesco Products; MESTEK, Inc.]
 - j. [Construction Specialties, Inc.]
 - k. [Greenheck Fan Corporation]
 - l. [Industrial Louvers Inc.]
 - m. [Louvers & Dampers, Inc.; Mestek, Inc.]
 - n. [Metal Form Manufacturing LLC; United Enertech Corp.]
 - o. [NCA Manufacturing, Inc.; Metal Industries, Inc.]
 - p. [North East Louvers, Inc.]
 - q. [Pottorff]
 - r. [Reliable Products, Inc.]
 - s. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
 - t. [Safe Air - Dowco]
 - u. [United Enertech Corp.]
 - v. [Vent Products Co., Inc]
 - w. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Air Balance; MESTEK, Inc.]
 - b. [Air Flow Company, Inc.]
 - c. [Airline Louvers; Mestek, Inc.]
 - d. [Airolite Company, LLC (The)]
 - e. [All-Lite Architectural Products]
 - f. [American Warming and Ventilating (AWV); Mestek, Inc.]
 - g. [Arrow United Industries; Mestek, Inc.]
 - h. [Carnes Company]
 - i. [Cesco Products; MESTEK, Inc.]
 - j. [Construction Specialties, Inc.]
 - k. [Greenheck Fan Corporation]
 - l. [Industrial Louvers Inc.]
 - m. [Louvers & Dampers, Inc.; Mestek, Inc.]
 - n. [Metal Form Manufacturing LLC; United Enertech Corp.]
 - o. [NCA Manufacturing, Inc.; Metal Industries, Inc.]
 - p. [North East Louvers, Inc.]
 - q. [Pottorff]
 - r. [Reliable Products, Inc.]
 - s. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
 - t. [Safe Air - Dowco]
 - u. [United Enertech Corp.]
 - v. [Vent Products Co., Inc]
 - w. <Insert manufacturer's name>
3. Louver Depth: [4 inches (100 mm)][6 inches (150 mm)]<Insert dimension>.
4. Blade Type: [Drainable][Plain].
5. Accessories: Equip louvers as follows:
 - a. Vinyl blade-edge gaskets for each louver blade.
 - b. [Stainless steel jamb seals][or][vinyl blade-end gaskets].
6. Louver Performance Ratings:
 - a. Free Area: Not less than [6.5 sq. ft. (0.60 sq. m)][7.0 sq. ft. (0.65 sq. m)][7.5 sq. ft. (0.70 sq. m)][8.0 sq. ft. (0.74 sq. m)]<Insert value> for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.

- b. Point of Beginning Water Penetration: Not less than [500 fpm (2.5 m/s)][600 fpm (3.0 m/s)][700 fpm (3.6 m/s)][800 fpm (4.1 m/s)][900 fpm (4.6 m/s)][1000 fpm (5.1 m/s)]<Insert value>.
 - c. Air Performance: Not more than [0.10-inch wg (25-Pa)]<Insert value> static pressure drop at [500-fpm (2.5-m/s)][600-fpm (3.0-m/s)][700-fpm (3.6-m/s)][800-fpm (4.1-m/s)][900-fpm (4.6-m/s)]<Insert value> free-area [exhaust][intake] velocity.
 - d. Air Leakage: Not more than [3.5 cfm/sq. ft. (17.8 L/s per sq. m)]<Insert value> of louver gross area at a differential static pressure of 0.15-inch wg (37 Pa) with operable louver blades closed.
 7. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
- C. Operable, Extruded-Aluminum, Dual-Blade Louver : Fixed drainable blades and operable plain blades combined in single frame.
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Air Balance; MESTEK, Inc.]
 - b. [Air Flow Company, Inc.]
 - c. [Airline Louvers; Mestek, Inc.]
 - d. [Airolite Company, LLC (The)]
 - e. [All-Lite Architectural Products]
 - f. [American Warming and Ventilating (AWV); Mestek, Inc.]
 - g. [Arrow United Industries; Mestek, Inc.]
 - h. [Cesco Products; MESTEK, Inc.]
 - i. [Construction Specialties, Inc.]
 - j. [Greenheck Fan Corporation]
 - k. [Industrial Louvers Inc.]
 - l. [Louvers & Dampers, Inc.; Mestek, Inc.]
 - m. [Moffitt Corporation]
 - n. [NCA Manufacturing, Inc.; Metal Industries, Inc.]
 - o. [North East Louvers, Inc.]
 - p. [Pottorff]
 - q. [Reliable Products, Inc.]
 - r. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
 - s. [Safe Air - Dowco]
 - t. [United Enertech Corp.]
 - u. [Vent Products Co., Inc]
 - v. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Air Balance; MESTEK, Inc.]
 - b. [Air Flow Company, Inc.]
 - c. [Airline Louvers; Mestek, Inc.]
 - d. [Airolite Company, LLC (The)]
 - e. [All-Lite Architectural Products]
 - f. [American Warming and Ventilating (AWV); Mestek, Inc.]
 - g. [Arrow United Industries; Mestek, Inc.]
 - h. [Cesco Products; MESTEK, Inc.]

- i. [Construction Specialties, Inc.]
 - j. [Greenheck Fan Corporation]
 - k. [Industrial Louvers Inc.]
 - l. [Louvers & Dampers, Inc.; Mestek, Inc.]
 - m. [Moffitt Corporation]
 - n. [NCA Manufacturing, Inc.; Metal Industries, Inc.]
 - o. [North East Louvers, Inc.]
 - p. [Pottorff]
 - q. [Reliable Products, Inc.]
 - r. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
 - s. [Safe Air - Dowco]
 - t. [United Enertech Corp.]
 - u. [Vent Products Co., Inc]
 - v. <Insert manufacturer's name>
- 3. Louver Depth: [4 inches (100 mm)][6 inches (150 mm)]<Insert dimension>, overall.
 - 4. Fixed Drainable-Blade Angle: [30][35][37.5][45]<Insert number> degrees.
 - 5. Louver Performance Ratings:
 - a. Free Area: Not less than [6.0 sq. ft. (0.56 sq. m)][6.5 sq. ft. (0.60 sq. m)][7.0 sq. ft. (0.65 sq. m)][7.5 sq. ft. (0.70 sq. m)][8.0 sq. ft. (0.74 sq. m)]<Insert value> for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - b. Point of Beginning Water Penetration: Not less than [750 fpm (3.8 m/s)][800 fpm (4.1 m/s)][850 fpm (4.3 m/s)][900 fpm (4.6 m/s)][950 fpm (4.8 m/s)][1000 fpm (5.1 m/s)]<Insert value>.
 - c. Air Performance: Not more than [0.10-inch wg (25-Pa)]<Insert value> static pressure drop at [750-fpm (3.8-m/s)][800-fpm (4.1-m/s)][850-fpm (4.3-m/s)][900-fpm (4.6-m/s)]<Insert value> free-area [exhaust][intake] velocity.
 - d. Air Leakage: Not more than [1.5 cfm/sq. ft. (7.6 L/s per sq. m)]<Insert value> of louver gross area at a differential static pressure of 0.15-inch wg (37 Pa) with operable louver blades closed.
 - 6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 OPERABLE FORMED-METAL LOUVERS

- A. Louver Operation: Provide operable louvers with operating mechanisms to suit louver sizes.
 - 1. Hand operation with push bars.
 - 2. Crank operation with removable-crank operator in sill or jamb.
 - 3. Chain operation with tension spring, wall clip, pull chain, and **160 deg F (71 deg C)** fusible link.
 - 4. Motor operation with **[two-position, spring-return application (with power on, motor opens louver; with power off, spring closes louver); 110-V, 60-Hz motor and limit switch][two-direction, 110-V, 60-Hz motor and limit switches]**; equipped with **[frame-mounted switch][remote-mounted switch with indicator light][terminals for controlling devices]**.
 - 5. Pneumatic piston operation for use with **80- to 100-psi (550- to 690-kPa)** compressed air for **[two-position][modulating]** operation; power open, power close **[with spring-return fail-safe]**.
- B. Operable, Formed-Metal, Single-Blade Louver :
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:

- a. [Air Balance; MESTEK, Inc.]
 - b. [Air Flow Company, Inc.]
 - c. [Airline Louvers; Mestek, Inc.]
 - d. [Airolite Company, LLC (The)]
 - e. [All-Lite Architectural Products]
 - f. [American Warming and Ventilating (AWV); Mestek, Inc.]
 - g. [Arrow United Industries; Mestek, Inc.]
 - h. [Carnes Company]
 - i. [Cesco Products; MESTEK, Inc.]
 - j. [Greenheck Fan Corporation]
 - k. [Industrial Louvers Inc.]
 - l. [Louvers & Dampers, Inc.; Mestek, Inc.]
 - m. [Metal Form Manufacturing LLC; United Enertech Corp.]
 - n. [NCA Manufacturing, Inc.; Metal Industries, Inc.]
 - o. [North East Louvers, Inc.]
 - p. [Pottorff]
 - q. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
 - r. [Safe Air - Dowco]
 - s. [United Enertech Corp.]
 - t. [Vent Products Co., Inc]
 - u. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Air Balance; MESTEK, Inc.]
 - b. [Air Flow Company, Inc.]
 - c. [Airline Louvers; Mestek, Inc.]
 - d. [Airolite Company, LLC (The)]
 - e. [All-Lite Architectural Products]
 - f. [American Warming and Ventilating (AWV); Mestek, Inc.]
 - g. [Arrow United Industries; Mestek, Inc.]
 - h. [Carnes Company]
 - i. [Cesco Products; MESTEK, Inc.]
 - j. [Greenheck Fan Corporation]
 - k. [Industrial Louvers Inc.]
 - l. [Louvers & Dampers, Inc.; Mestek, Inc.]
 - m. [Metal Form Manufacturing LLC; United Enertech Corp.]
 - n. [NCA Manufacturing, Inc.; Metal Industries, Inc.]
 - o. [North East Louvers, Inc.]
 - p. [Pottorff]
 - q. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
 - r. [Safe Air - Dowco]
 - s. [United Enertech Corp.]
 - t. [Vent Products Co., Inc]
 - u. <Insert manufacturer's name>
3. Louver Depth: [4 inches (100 mm)][6 inches (150 mm)]<Insert dimension>.
4. Blade Type: [Drainable][Plain].
5. Frame and Blade Material and Nominal Thickness:
- a. Galvanized-steel sheet, not less than [0.052 inch (1.32 mm) for frames and 0.040 inch (1.02 mm) for blades][0.052 inch (1.32 mm)][0.064 inch (1.63 mm)].
 - b. Stainless steel sheet, not less than [0.050 inch (1.27 mm)][0.062 inch (1.59 mm)].

6. Accessories: Equip louvers as follows:
 - a. Vinyl blade-edge gaskets for each louver blade.
 - b. **[Stainless steel jamb seals][or][vinyl blade-end gaskets].**
 7. Louver Performance Ratings:
 - a. Free Area: Not less than **[6.5 sq. ft. (0.60 sq. m)][7.0 sq. ft. (0.65 sq. m)][7.5 sq. ft. (0.70 sq. m)][8.0 sq. ft. (0.74 sq. m)]<Insert value>** for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - b. Point of Beginning Water Penetration: Not less than **[500 fpm (2.5 m/s)][600 fpm (3.0 m/s)][700 fpm (3.6 m/s)][800 fpm (4.1 m/s)][900 fpm (4.6 m/s)][1000 fpm (5.1 m/s)]<Insert value>**.
 - c. Air Performance: Not more than **[0.10-inch wg (25-Pa)]<Insert value>** static pressure drop at **[500-fpm (2.5-m/s)][600-fpm (3.0-m/s)][700-fpm (3.6-m/s)][800-fpm (4.1-m/s)][900-fpm (4.6-m/s)]<Insert value>** free-area **[exhaust][intake]** velocity.
 - d. Air Leakage: Not more than **[3.5 cfm/sq. ft. (17.8 L/s per sq. m)]<Insert value>** of louver gross area at a differential static pressure of **0.15-inch wg (37 Pa)** with operable louver blades closed.
 8. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
- C. Operable, Formed-Metal, Dual-Blade Louver : Fixed drainable blades and operable plain blades combined in single frame.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:**
 - a. **[Metal Form Manufacturing LLC; United Enertech Corp.]**
 - b. **[North East Louvers, Inc.]**
 - c. **[Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]**
 - d. **[Safe Air - Dowco]**
 - e. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Metal Form Manufacturing LLC; United Enertech Corp.]**
 - b. **[North East Louvers, Inc.]**
 - c. **[Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]**
 - d. **[Safe Air - Dowco]**
 - e. **<Insert manufacturer's name>**
 3. Louver Depth: **[4 inches (100 mm)][6 inches (150 mm)]<Insert dimension>**, overall.
 4. Fixed Drainable-Blade Angle: **[30][35][37.5][45]<Insert number>** degrees.
 5. Frame and Blade Material and Nominal Thickness:
 - a. Galvanized-steel sheet, not less than **[0.052 inch (1.32 mm) for frames and 0.040 inch (1.02 mm) for blades][0.052 inch (1.32 mm)][0.064 inch (1.63 mm)]**.
 - b. Stainless steel sheet, not less than **[0.050 inch (1.27 mm)][0.062 inch (1.59 mm)]**.
 6. Louver Performance Ratings:

- a. Free Area: Not less than **<Insert value>** for **48-inch- (1220-mm-)** wide by **48-inch- (1220-mm-)** high louver.
 - b. Point of Beginning Water Penetration: Not less than **<Insert velocity>**.
 - c. Air Performance: Not more than **<Insert pressure>** static pressure drop at **<Insert velocity>** free-area **[exhaust][intake]** velocity.
 - d. Air Leakage: Not more than **[1.5 cfm/sq. ft. (7.6 L/s per sq. m)]<Insert value>** of louver gross area at a differential static pressure of **0.15-inch wg (37 Pa)** with operable louver blades closed.
7. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.5 OPERABLE INSULATED LOUVERS

- A. Louver Operation: Provide operable louvers with operating mechanisms to suit louver sizes.
1. Hand operation with push bars.
 2. Crank operation with removable-crank operator in sill or jamb.
 3. Chain operation with tension spring, wall clip, pull chain, and **160 deg F (71 deg C)** fusible link.
 4. Motor operation with **[two-position, spring-return application (with power on, motor opens louver; with power off, spring closes louver); 110-V, 60-Hz motor and limit switch][two-direction, 110-V, 60-Hz motor and limit switches]**; equipped with **[frame-mounted switch][remote-mounted switch with indicator light][terminals for controlling devices]**.
 5. Pneumatic piston operation for use with **80- to 100-psi (550- to 690-kPa)** compressed air for **[two-position][modulating]** operation; power open, power close **[with spring-return fail-safe]**.
- B. Operable, Insulated, Extruded-Aluminum Louver : Single-blade, operable louver with gasketed, insulated blades. Frames and blade frames have urethane thermal break. Frames are made of extruded aluminum, not less than **0.080-inch (2.03-mm)** nominal thickness. Blade facings are made of aluminum sheet, not less than **0.032-inch (0.81-mm)** nominal thickness.
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Airolite Company, LLC (The)]**
 - b. **[Construction Specialties, Inc.]**
 - c. **[North East Louvers, Inc.]**
 - d. **<Insert manufacturer's name>**
 2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Airolite Company, LLC (The)]**
 - b. **[Construction Specialties, Inc.]**
 - c. **[North East Louvers, Inc.]**
 - d. **<Insert manufacturer's name>**
 3. Louver Depth: **[6 inches (150 mm)][9 inches (225 mm)]**.
 4. Insulation: **[Extruded-polystyrene foam, 2 inches (50 mm) thick][Foamed-in-place polyurethane]**.
- C. Operable, Insulated, Formed-Metal Louver : Single-blade, operable louver with gasketed, insulated

blades.

1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Airline Louvers; Mestek, Inc.]**
 - b. **[Arrow United Industries; Mestek, Inc.]**
 - c. **[Carnes Company]**
 - d. **[North East Louvers, Inc.]**
 - e. **[Vent Products Co., Inc]**
 - f. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
 - a. **[Airline Louvers; Mestek, Inc.]**
 - b. **[Arrow United Industries; Mestek, Inc.]**
 - c. **[Carnes Company]**
 - d. **[North East Louvers, Inc.]**
 - e. **[Vent Products Co., Inc]**
 - f. **<Insert manufacturer's name>**
3. Louver Depth: **[6 inches (150 mm)][8 inches (200 mm)]<Insert dimension>**.
4. Frame Material and Nominal Thickness:
 - a. Galvanized-steel sheet, not less than **[0.052 inch (1.32 mm)][0.064 inch (1.63 mm)]**.
 - b. Stainless steel sheet, not less than **[0.050 inch (1.27 mm)][0.062 inch (1.59 mm)]**.
5. Blade Material and Nominal Thickness:
 - a. Galvanized-steel sheet, not less than **[0.028 inch (0.71 mm)][0.040 inch (1.02 mm)][0.052 inch (1.32 mm)][0.064 inch (1.63 mm)]**.
 - b. Stainless steel sheet, not less than **[0.025 inch (0.64 mm)][0.038 inch (0.95 mm)][0.050 inch (1.27 mm)][0.062 inch (1.59 mm)]**.
6. Insulation: **[Extruded-polystyrene foam, 1 inch (25 mm) thick][Rigid, glass-fiber-board insulation, 1 inch (25 mm) thick][Foamed-in-place polyurethane, 1/2 inch (13 mm) thick]<Insert insulation description and thickness>**.

2.6 LOUVER SCREENS

- A. General: Provide screen at **[each exterior louver][louvers indicated]**.
 1. Screen Location: **[Interior][Exterior]** face unless otherwise indicated.
 2. Screening Type: **[Bird screening][Bird screening, except where insect screening is indicated][Insect screening]**.
- B. Secure screen frames to louver frames with **[stainless steel machine screws][machine screws with heads finished to match louver]**, spaced a maximum of **6 inches (150 mm)** from each corner and at **12 inches (300 mm)** o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same type and form of metal as indicated for louver to which screens are attached.[**Reinforce extruded-aluminum screen frames at corners with clips.**]
2. Finish: [**Same finish as louver frames to which louver screens are attached**][**Mill finish unless otherwise indicated**].
3. Type: [**Rewirable frames with a driven spline or insert**][**Non-rewirable, U-shaped frames**].

D. Louver Screening for Aluminum Louvers:

1. Bird Screening, Aluminum: **1/2-inch- (13-mm-)** square mesh, **0.063-inch (1.60-mm)** wire.
2. Bird Screening, Stainless Steel: **1/2-inch- (13-mm-)** square mesh, **0.047-inch (1.19-mm)** wire.
3. Bird Screening, Flattened, Expanded Aluminum: **3/4 by 0.050 inch (19 by 1.27 mm)** thick.
4. Insect Screening, Aluminum: **18-by-16 (1.4-by-1.6-mm)** mesh, **0.012-inch (0.30-mm)** wire.
5. Insect Screening, Stainless Steel: **18-by-18 (1.4-by-1.4-mm)** mesh, **0.009-inch (0.23-mm)** wire.

E. Louver Screening for Galvanized-Steel Louvers:

1. Bird Screening, Galvanized Steel: **1/2-inch- (13-mm-)** square mesh, **0.041-inch (1.04-mm)** wire.
2. Bird Screening, Stainless Steel: **1/2-inch- (13-mm-)** square mesh, **0.047-inch (1.19-mm)** wire.
3. Insect Screening, Galvanized Steel: **18-by-14 (1.4-by-1.8-mm)** mesh, **0.011-inch (0.28-mm)** wire.
4. Insect Screening, Stainless Steel: **18-by-18 (1.4-by-1.4-mm)** mesh, **0.009-inch (0.23-mm)** wire.

F. Louver Screening for Stainless Steel Louvers:

1. Bird Screening, Stainless Steel: **1/2-inch- (13-mm-)** square mesh, **0.047-inch (1.19-mm)** wire.
2. Insect Screening, Stainless Steel: **18-by-18 (1.4-by-1.4-mm)** mesh, **0.009-inch (0.23-mm)** wire.

2.7 BLANK-OFF PANELS

A. Uninsulated Blank-Off Panels: Metal sheet attached to back of louver.

1. Aluminum sheet for aluminum louvers, not less than **0.050-inch (1.27-mm)** nominal thickness.
2. Galvanized-steel sheet for galvanized-steel louvers, not less than [**0.040-inch (1.02-mm)**][**0.052-inch (1.32-mm)**] nominal thickness.
3. Stainless steel sheet for stainless steel louvers, not less than [**0.038-inch (0.95-mm)**][**0.050-inch (1.27-mm)**] nominal thickness, with grain running in same direction as grain of louver blades.
4. Panel Finish: [**Same finish applied to louvers**][**Same finish type applied to louvers, but black color**].
5. Attach blank-off panels with [**clips**][**sheet metal screws**]<Insert method>.

B. Insulated Blank-Off Panels: Laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver.

1. Thickness: [**1 inch (25 mm)**][**2 inches (50 mm)**].
2. Metal Facing Sheets, Aluminum: Not less than **0.032-inch (0.81-mm)** nominal thickness.
3. Metal Facing Sheets, Galvanized-Steel Sheet: Not less than **0.028-inch (0.71-mm)** nominal thickness.
4. Metal Facing Sheets, Stainless Steel Sheet: Not less than **0.031-inch (0.79-mm)** nominal thickness.
5. Insulating Core: [**Rigid, glass-fiber-board insulation**][**or**][**extruded-polystyrene foam**]<Insert insulation material>.
6. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard [**extruded-aluminum-channel frames, not less than 0.080-inch (2.03-mm) nominal thickness**][**channel frames**], with corners mitered and with same finish as panels.

7. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
8. Panel Finish: **[Same finish applied to louvers][Same finish type applied to louvers, but black color]**.
9. Attach blank-off panels with **[clips][sheet metal screws]<Insert method>**.

2.8 MATERIALS

- A. Aluminum Extrusions: **ASTM B221 (ASTM B221M)**, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: **ASTM B209 (ASTM B209M)**, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Galvanized-Steel Sheet: ASTM A653/A653M, **[G60 (Z180)][G90 (Z275)]** zinc coating, mill phosphatized.
- D. Stainless Steel Sheet: ASTM A240/A240M, Type 304, **[No. 2B finish][No. 2D finish][No. 4 finish, with grain running parallel to length of blades and frame members][No. 4 finish, with grain running perpendicular to length of blades and frame members][No. 4 finish, with grain running perpendicular to length of blades and parallel to length of frame members][No. 6 finish]**.
- E. Fasteners: Use types and sizes to suit unit installation conditions.
 1. Use **[Phillips flat-head][hex-head or Phillips pan-head][tamper-resistant]** screws for exposed fasteners unless otherwise indicated.
 2. For fastening aluminum, use aluminum or 300 series stainless steel fasteners.
 3. For fastening galvanized steel, use hot-dip-galvanized-steel or 300 series stainless steel fasteners.
 4. For fastening stainless steel, use 300 series stainless steel fasteners.
 5. For color-finished louvers, use fasteners with heads that match color of louvers.
- F. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless steel components, with allowable load or strength design capacities calculated in accordance with ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing in accordance with ASTM E488/E488M conducted by a qualified testing agency.
- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- H. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- I. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25][50]<Insert value>** percent.
- J. Regional Materials: Products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- K. Regional Materials: Products shall be manufactured within **500 miles (800 km)** of Project site.
- L. Regional Materials: Products shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- M. Indigenous Materials: Products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or

water shall be multiplied by 0.25 to determine the distance to Project site.

- N. Regional Materials: Products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.

2.9 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern **[unless horizontal mullions are indicated][where indicated]**.
 2. Horizontal Mullions: Provide horizontal mullions at joints **[unless continuous vertical assemblies are indicated][where indicated]**.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
1. Frame Type: **[Channel][Exterior flange][Interior flange]** unless otherwise indicated.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or **72 inches (1830 mm)** o.c., whichever is less.
- F. Provide **[subsills made of same material as louvers][or][extended sills]** for recessed louvers.
- G. Join frame members to each other and to fixed louver blades with fillet welds **[concealed from view][, threaded fasteners, or both, as standard with louver manufacturer]** unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.10 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. Clear Anodic Finish: AAMA 611, **[AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm]** or thicker.
- C. Color Anodic Finish: AAMA 611, **[AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm]** or thicker.
1. Color: **[Champagne][Light bronze][Medium bronze][Dark bronze][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.
- D. Conversion-Coated Finish: AA-C12C42, nonetched, cleaned with inhibited chemicals, and chemical

conversion coated with acid chromate-fluoride-phosphate.

- E. Factory-Primed Finish: AA-C12C42R1x with air-dried primer of not less than **2-mil (0.05-mm)** dry film thickness.
- F. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- G. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with **[AAMA 2604][AAMA 2605]** and containing not less than **[50][70]** percent PVDF resin by weight in color coat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- H. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- I. Superior-Performance Organic Finish, Four-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- J. Superior-Performance Organic Finish, Single-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**
- K. Superior-Performance Organic Finish, Two-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
 - 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>.**

2.11 GALVANIZED-STEEL SHEET FINISHES

- A. Finish louvers after assembly.

- B. Surface Preparation: Clean surfaces of oil and other contaminants. Use cleaning methods that do not leave residue. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A780/A780M.
- C. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of **2 mils (0.05 mm)**.
 - 1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.

2.12 STAINLESS STEEL SHEET FINISHES

- A. Repair sheet finish by grinding and polishing irregularities, weld spatter, scratches, and forming marks to match surrounding finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants

applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Test operable louvers and adjust as needed to produce fully functioning units that comply with requirements.
- B. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- D. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 91 16 00



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SECTION 08 91 19 00 - FIXED LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fixed ~~[extruded-aluminum]~~~~[and]~~~~[formed-metal]~~ louvers.
2. Fixed formed-metal acoustical louvers.
3. Blank-off panels for louvers

B. Related Requirements:

1. Section 081113 "Hollow Metal Doors and Frames" for louvers in hollow-metal doors.
2. Section 081416 "Flush Wood Doors" for louvers in flush wood doors.
3. Section 099113 "Exterior Painting" for field painting exterior louvers.
4. Section 099123 "Interior Painting" for field painting interior louvers.

1.2 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axis of the blades are horizontal).
- C. Vertical Louver: Louver with vertical blades (i.e., the axis of the blades are vertical).
- D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing in accordance with AMCA 500-L.
- F. Windborne-Debris-Impact-Resistant Louver: Louver that provides specified windborne-debris-impact resistance, as determined by testing in accordance with AMCA 540.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for

- each regional material.
- 3. Environmental Product Declaration (EPD): For each product.
- 4. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
- 5. Environmental Product Declaration: For each product.
- 6. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
- 7. Environmental Product Declaration: For each product.
- 8. Environmental Product Declaration: For each product.
- 9. Third-Party Certifications: For each product.
- 10. Third-Party Certified Life Cycle Assessment: For each product.
- 11. Environmental Product Declaration: For each product.
- 12. Health Product Declaration: For each product.
- 13. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
- 14. Environmental Product Declaration: For each product.
- 15. Environmental Product Declaration: For each product.
- 16. Environmental Product Declaration: For each product.
- 17. Third-Party Certifications: For each product.
- 18. Third-Party Certified Life Cycle Assessment: For each product.

C. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

- 1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
- 2. Show mullion profiles and locations.

D. Samples: For each type of metal finish required.

E. Delegated Design Submittal: For louvers indicated to comply with structural[**and seismic**] performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed in accordance with AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.
- B. Windborne-debris-impact-resistance test reports.
- C. Sample Warranties: For manufacturer's special warranties.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
 - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 WARRANTY

- A. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
- b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
- c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: **[Five][10][20]<Insert number>** years from date of Substantial Completion.

- B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
- b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
- c. Cracking, peeling, or chipping.

2. Warranty Period: **[Five][10]<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain fixed[**and operable**] louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural[**and seismic**] performance requirements and design criteria indicated.

- B. Structural Performance: Louvers withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures are considered to act normal to the face of the building.

1. Wind Loads:

- a. Determine loads based on pressures as indicated on Drawings.

- b. Determine loads based on a uniform pressure of **[20 lbf/sq. ft. (957 Pa)][30 lbf/sq. ft. (1436 Pa)]<Insert value>**, acting inward or outward.
- c. Determine loads based on pressures indicated below:
 - 1) Corner Zone: Within **<Insert distance>** of building corners, uniform pressure of **<Insert design wind pressure>**, acting inward, and **<Insert design wind pressure>**, acting outward.
 - 2) Other Than Corner Zone: Uniform pressure of **<Insert design wind pressure>**, acting inward, and **<Insert design wind pressure>**, acting outward.
- C. Windborne-Debris-Impact Resistance: Louvers located within **30 feet (9.1 m)** of grade pass **[basic][enhanced]** protection, when tested in accordance with AMCA 540.
- D. Seismic Performance:
 - 1. As indicated on Drawings.
 - 2. Louvers, including attachments to other construction, withstand the effects of earthquake motions determined in accordance with **[ASCE/SEI 7]<Insert requirement>**.
 - a. Design earthquake spectral response acceleration, short period (Sds) for Project is **<Insert value>**.
 - b. Component Importance Factor: **[1.5][1.0]**.
- E. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width in accordance with AMCA 500-L.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change (Range): **[120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces]<Insert temperature range>**.
- G. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal Nondrainable-Blade Louver, Extruded Aluminum :
 - 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Air Balance; MESTEK, Inc.]**
 - b. **[Air Flow Company, Inc.]**
 - c. **[Aire Technologies, Inc.; DMI Companies]**
 - d. **[Airline Louvers; Mestek, Inc.]**
 - e. **[Airolite Company, LLC (The)]**
 - f. **[All-Lite Architectural Products]**
 - g. **[American Warming and Ventilating (AWV); Mestek, Inc.]**
 - h. **[Architectural Louvers Co.; Harray, LLC]**
 - i. **[Arrow United Industries; Mestek, Inc.]**
 - j. **[Carnes Company]**

- k. [Cesco Products; MESTEK, Inc.]
 - l. [Construction Specialties, Inc.]
 - m. [Greenheck Fan Corporation]
 - n. [Industrial Louvers Inc.]
 - o. [Louvers & Dampers, Inc.; Mestek, Inc.]
 - p. [Metal Form Manufacturing LLC; United Enertech Corp.]
 - q. [NCA Manufacturing, Inc.; Metal Industries, Inc.]
 - r. [Pottorff]
 - s. [Reliable Products, Inc.]
 - t. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
 - u. [Safe Air - Dowco]
 - v. [United Enertech Corp.]
 - w. [Vent Products Co., Inc]
 - x. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Air Balance; MESTEK, Inc.]
 - b. [Air Flow Company, Inc.]
 - c. [Aire Technologies, Inc.; DMI Companies]
 - d. [Airline Louvers; Mestek, Inc.]
 - e. [Airolite Company, LLC (The)]
 - f. [All-Lite Architectural Products]
 - g. [American Warming and Ventilating (AWV); Mestek, Inc.]
 - h. [Architectural Louvers Co.; Harray, LLC]
 - i. [Arrow United Industries; Mestek, Inc.]
 - j. [Carnes Company]
 - k. [Cesco Products; MESTEK, Inc.]
 - l. [Construction Specialties, Inc.]
 - m. [Greenheck Fan Corporation]
 - n. [Industrial Louvers Inc.]
 - o. [Louvers & Dampers, Inc.; Mestek, Inc.]
 - p. [Metal Form Manufacturing LLC; United Enertech Corp.]
 - q. [NCA Manufacturing, Inc.; Metal Industries, Inc.]
 - r. [Pottorff]
 - s. [Reliable Products, Inc.]
 - t. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
 - u. [Safe Air - Dowco]
 - v. [United Enertech Corp.]
 - w. [Vent Products Co., Inc]
 - x. <Insert manufacturer's name>
3. Louver Depth: [2 inches (50 mm)][4 inches (100 mm)][6 inches (150 mm)]<Insert dimension>.
4. Blade Profile: [Plain blade without][Blade with] center baffle.
5. Frame and Blade Nominal Thickness: Not less than [0.080 inch (2.03 mm)][0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames].
6. Mullion Type: [Exposed][Semirecessed][Fully recessed].
7. Louver Performance Ratings:
 - a. Free Area: Not less than [7.5 sq. ft. (0.70 sq. m)][8.0 sq. ft. (0.74 sq. m)][8.5 sq. ft. (0.79 sq. m)]<Insert value> for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - b. Point of Beginning Water Penetration: Not less than [700 fpm (3.6 m/s)][750 fpm (3.8 m/s)][800 fpm (4.1 m/s)][850 fpm (4.3 m/s)][900 fpm (4.6 m/s)][950 fpm (4.8 m/s)]<Insert value>.

- c. Air Performance: Not more than [0.10-inch wg (25-Pa)]<Insert value> static pressure drop at [650-fpm (3.3-m/s)][700-fpm (3.6-m/s)][750-fpm (3.8-m/s)]<Insert value> free-area [exhaust][intake] velocity.

8. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

B. Horizontal Drainable-Blade Louver, Extruded Aluminum :

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Air Balance; MESTEK, Inc.]
 - b. [Air Flow Company, Inc.]
 - c. [Aire Technologies, Inc.; DMI Companies]
 - d. [Airline Louvers; Mestek, Inc.]
 - e. [Airolite Company, LLC (The)]
 - f. [All-Lite Architectural Products]
 - g. [American Warming and Ventilating (AWV); Mestek, Inc.]
 - h. [Architectural Louvers Co.; Harray, LLC]
 - i. [Arrow United Industries; Mestek, Inc.]
 - j. [Carnes Company]
 - k. [Cesco Products; MESTEK, Inc.]
 - l. [Construction Specialties, Inc.]
 - m. [DAMS Incorporated; D. Architectural Metal Solutions Incorporated]
 - n. [Greenheck Fan Corporation]
 - o. [Industrial Louvers Inc.]
 - p. [Louvers & Dampers, Inc.; Mestek, Inc.]
 - q. [Metal Form Manufacturing LLC; United Enertech Corp.]
 - r. [NCA Manufacturing, Inc.; Metal Industries, Inc.]
 - s. [Pottorff]
 - t. [Reliable Products, Inc.]
 - u. [Ross Technology Company]
 - v. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
 - w. [Safe Air - Dowco]
 - x. [United Enertech Corp.]
 - y. [Vent Products Co., Inc]
 - z. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Air Balance; MESTEK, Inc.]
 - b. [Air Flow Company, Inc.]
 - c. [Aire Technologies, Inc.; DMI Companies]
 - d. [Airline Louvers; Mestek, Inc.]
 - e. [Airolite Company, LLC (The)]
 - f. [All-Lite Architectural Products]
 - g. [American Warming and Ventilating (AWV); Mestek, Inc.]
 - h. [Architectural Louvers Co.; Harray, LLC]
 - i. [Arrow United Industries; Mestek, Inc.]
 - j. [Carnes Company]
 - k. [Cesco Products; MESTEK, Inc.]

- l. [Construction Specialties, Inc.]
 - m. [DAMS Incorporated; D. Architectural Metal Solutions Incorporated]
 - n. [Greenheck Fan Corporation]
 - o. [Industrial Louvers Inc.]
 - p. [Louvers & Dampers, Inc.; Mestek, Inc.]
 - q. [Metal Form Manufacturing LLC; United Enertech Corp.]
 - r. [NCA Manufacturing, Inc.; Metal Industries, Inc.]
 - s. [Pottorff]
 - t. [Reliable Products, Inc.]
 - u. [Ross Technology Company]
 - v. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
 - w. [Safe Air - Dowco]
 - x. [United Enertech Corp.]
 - y. [Vent Products Co., Inc]
 - z. <Insert manufacturer's name>
3. Louver Depth: [4 inches (100 mm)][6 inches (150 mm)]<Insert dimension>.
 4. Frame and Blade Nominal Thickness: Not less than [0.080 inch (2.03 mm)][0.060 inch (1.52 mm)] **for blades and 0.080 inch (2.03 mm) for frames**.
 5. Mullion Type: Exposed.
 6. Louver Performance Ratings:
 - a. Free Area: Not less than [7.0 sq. ft. (0.65 sq. m)][7.5 sq. ft. (0.70 sq. m)][8.0 sq. ft. (0.74 sq. m)][8.5 sq. ft. (0.79 sq. m)]<Insert value> for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - b. Point of Beginning Water Penetration: Not less than [900 fpm (4.6 m/s)][950 fpm (4.8 m/s)][1000 fpm (5.1 m/s)][1050 fpm (5.3 m/s)][1100 fpm (5.6 m/s)]<Insert value>.
 - c. Air Performance:
 - 1) Not more than [0.10-inch wg (25-Pa)]<Insert value> static pressure drop at [700-fpm (3.6-m/s)][750-fpm (3.8-m/s)][800-fpm (4.1-m/s)][850-fpm (4.3-m/s)]<Insert value> free-area [exhaust][intake] velocity.
 - 2) Not more than [0.15-inch wg (37-Pa)]<Insert value> static pressure drop at [900-fpm (4.6-m/s)][950-fpm (4.8-m/s)][1000-fpm (5.1-m/s)]<Insert value> free-area [exhaust][intake] velocity.
 7. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
- C. Horizontal, Continuous-Line, Drainable-Blade Louver, Extruded Aluminum : Drainable-blade louver with blade gutters (drains) in rear two-thirds of blades only.
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Airline Louvers; Mestek, Inc.]
 - b. [Airolite Company, LLC (The)]
 - c. [All-Lite Architectural Products]
 - d. [Architectural Louvers Co.; Harray, LLC]
 - e. [Arrow United Industries; Mestek, Inc.]
 - f. [Construction Specialties, Inc.]
 - g. [Greenheck Fan Corporation]
 - h. [Industrial Louvers Inc.]
 - i. [Pottorff]
 - j. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]

- k. [Safe Air - Dowco]
- l. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Airline Louvers; Mestek, Inc.]
- b. [Airolite Company, LLC (The)]
- c. [All-Lite Architectural Products]
- d. [Architectural Louvers Co.; Harray, LLC]
- e. [Arrow United Industries; Mestek, Inc.]
- f. [Construction Specialties, Inc.]
- g. [Greenheck Fan Corporation]
- h. [Industrial Louvers Inc.]
- i. [Pottorff]
- j. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
- k. [Safe Air - Dowco]
- l. <Insert manufacturer's name>

3. Louver Depth: [6 inches (150 mm)]<Insert dimension>.
4. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm).
5. Mullion Type: Semirecessed.
6. Louver Performance Ratings:
 - a. Free Area: Not less than [7.8 sq. ft. (0.72 sq. m)]<Insert value> for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - b. Point of Beginning Water Penetration: Not less than [850 fpm (4.3 m/s)]<Insert value>.
 - c. Air Performance: Not more than [0.10-inch wg (25-Pa)]<Insert value> static pressure drop at [800-fpm (4.1-m/s)]<Insert value> free-area [exhaust][intake] velocity.
7. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

D. Horizontal, Wind-Driven-Rain-Resistant Louver, Extruded Aluminum :

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Air Balance; MESTEK, Inc.]
 - b. [Air Flow Company, Inc.]
 - c. [Airline Louvers; Mestek, Inc.]
 - d. [Airolite Company, LLC (The)]
 - e. [All-Lite Architectural Products]
 - f. [American Warming and Ventilating (AWV); Mestek, Inc.]
 - g. [Architectural Louvers Co.; Harray, LLC]
 - h. [Arrow United Industries; Mestek, Inc.]
 - i. [Construction Specialties, Inc.]
 - j. [Greenheck Fan Corporation]
 - k. [Industrial Louvers Inc.]
 - l. [NCA Manufacturing, Inc.; Metal Industries, Inc.]
 - m. [Pottorff]
 - n. [Reliable Products, Inc.]
 - o. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]

- p. [Safe Air - Dowco]
 - q. [United Enertech Corp.]
 - r. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Air Balance; MESTEK, Inc.]
 - b. [Air Flow Company, Inc.]
 - c. [Airline Louvers; Mestek, Inc.]
 - d. [Airolite Company, LLC (The)]
 - e. [All-Lite Architectural Products]
 - f. [American Warming and Ventilating (AWV); Mestek, Inc.]
 - g. [Architectural Louvers Co.; Harray, LLC]
 - h. [Arrow United Industries; Mestek, Inc.]
 - i. [Construction Specialties, Inc.]
 - j. [Greenheck Fan Corporation]
 - k. [Industrial Louvers Inc.]
 - l. [NCA Manufacturing, Inc.; Metal Industries, Inc.]
 - m. [Pottorff]
 - n. [Reliable Products, Inc.]
 - o. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
 - p. [Safe Air - Dowco]
 - q. [United Enertech Corp.]
 - r. <Insert manufacturer's name>
 3. Louver Depth: [4 inches (100 mm)][5 inches (127 mm)][7 inches (175 mm)][8 inches (200 mm)][9 inches (225 mm)]<Insert dimension>.
 4. Frame and Blade Nominal Thickness: Not less than [0.080 inch (2.03 mm)][0.060 inch (1.52 mm)] **for blades and 0.080 inch (2.03 mm) for frames**.
 5. Louver Performance Ratings:
 - a. Free Area: Not less than [5.0 sq. ft. (0.46 sq. m)][6.0 sq. ft. (0.56 sq. m)][7.0 sq. ft. (0.65 sq. m)]<Insert value> for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - b. Air Performance: Not more than [0.10-inch wg (25-Pa)]<Insert value> static pressure drop at [600-fpm (3.0-m/s)][700-fpm (3.6-m/s)][800-fpm (4.1-m/s)]<Insert value> free-area [exhaust][intake] velocity.
 - c. Wind-Driven Rain Performance: Not less than [99][95][80]<Insert number> percent effectiveness when subjected to a rainfall rate of [3 inches (75 mm) per hour and a wind speed of 29 mph (13 m/s)][8 inches (200 mm) per hour and a wind speed of 50 mph (22.4 m/s)] at a core-area intake velocity of [300 fpm (1.5 m/s)][400 fpm (2.0 m/s)][500 fpm (2.5 m/s)]<Insert value>.
 6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
- E. Vertical, Wind-Driven-Rain-Resistant Louver, Extruded Aluminum :
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Air Balance; MESTEK, Inc.]
 - b. [Air Flow Company, Inc.]
 - c. [Aire Technologies, Inc.; DMI Companies]

- d. [Airline Louvers; Mestek, Inc.]
 - e. [Airolite Company, LLC (The)]
 - f. [All-Lite Architectural Products]
 - g. [American Warming and Ventilating (AWV); Mestek, Inc.]
 - h. [Arrow United Industries; Mestek, Inc.]
 - i. [Cesco Products; MESTEK, Inc.]
 - j. [Construction Specialties, Inc.]
 - k. [Greenheck Fan Corporation]
 - l. [Industrial Louvers Inc.]
 - m. [Louvers & Dampers, Inc.; Mestek, Inc.]
 - n. [NCA Manufacturing, Inc.; Metal Industries, Inc.]
 - o. [Pottorff]
 - p. [Reliable Products, Inc.]
 - q. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
 - r. [United Enertech Corp.]
 - s. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Air Balance; MESTEK, Inc.]
 - b. [Air Flow Company, Inc.]
 - c. [Aire Technologies, Inc.; DMI Companies]
 - d. [Airline Louvers; Mestek, Inc.]
 - e. [Airolite Company, LLC (The)]
 - f. [All-Lite Architectural Products]
 - g. [American Warming and Ventilating (AWV); Mestek, Inc.]
 - h. [Arrow United Industries; Mestek, Inc.]
 - i. [Cesco Products; MESTEK, Inc.]
 - j. [Construction Specialties, Inc.]
 - k. [Greenheck Fan Corporation]
 - l. [Industrial Louvers Inc.]
 - m. [Louvers & Dampers, Inc.; Mestek, Inc.]
 - n. [NCA Manufacturing, Inc.; Metal Industries, Inc.]
 - o. [Pottorff]
 - p. [Reliable Products, Inc.]
 - q. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
 - r. [United Enertech Corp.]
 - s. <Insert manufacturer's name>
3. Louver Depth: [4 inches (100 mm)][6 inches (150 mm)][8 inches (200 mm)][9 inches (225 mm)][12 inches (300 mm)]<Insert dimension>.
4. Frame and Blade Nominal Thickness: Not less than [0.080 inch (2.03 mm)][0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames].
5. Louver Performance Ratings:
- a. Free Area: Not less than [5.0 sq. ft. (0.46 sq. m)][6.0 sq. ft. (0.56 sq. m)][7.0 sq. ft. (0.65 sq. m)]<Insert value> for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - b. Air Performance: Not more than [0.10-inch wg (25-Pa)]<Insert value> static pressure drop at [600-fpm (3.0-m/s)][700-fpm (3.6-m/s)][800-fpm (4.1-m/s)]<Insert value> free-area [exhaust][intake] velocity.
 - c. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of [3 inches (75 mm) per hour and a wind speed of 29 mph (13 m/s)][8 inches (200 mm) per hour and a wind speed of 50 mph (22.4 m/s)] at a core-area

intake velocity of [300 fpm (1.5 m/s)][400 fpm (2.0 m/s)][500 fpm (2.5 m/s)]<Insert value>.

6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
- F. Horizontal, Drainable-Blade, Windborne-Debris-Impact-Resistant Louver, Extruded Aluminum :
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Aire Technologies, Inc.; DMI Companies]
 - b. [Airolite Company, LLC (The)]
 - c. [Greenheck Fan Corporation]
 - d. [Reliable Products, Inc.]
 - e. <Insert manufacturer's name>
 2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Aire Technologies, Inc.; DMI Companies]
 - b. [Airolite Company, LLC (The)]
 - c. [Greenheck Fan Corporation]
 - d. [Reliable Products, Inc.]
 - e. <Insert manufacturer's name>
 3. Louver Depth: [4 inches (100 mm)][6 inches (150 mm)]<Insert dimension>.
 4. Frame and Blade Nominal Thickness: Not less than [0.080 inch (2.03 mm)]<Insert dimension>.
 5. Mullion Type: Exposed.
 6. Louver Performance Ratings:
 - a. Free Area: Not less than [8.5 sq. ft. (0.79 sq. m)][9.0 sq. ft. (0.84 sq. m)]<Insert value> for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - b. Point of Beginning Water Penetration: Not less than [1077 fpm (5.5 m/s)][1100 fpm (5.6 m/s)]<Insert value>.
 - c. Air Performance:
 - 1) Not more than [0.16-inch wg (40-Pa)]<Insert value> static pressure drop at [989-fpm (5.0-m/s)]<Insert value> free-area [exhaust][intake] velocity.
 - 2) Not more than [0.15-inch wg (37-Pa)]<Insert value> static pressure drop at [1077-fpm (5.5-m/s)]<Insert value> free-area [exhaust][intake] velocity.
 7. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
 8. AMCA Rating: AMCA 540.
- G. Vertical, Wind-Driven-Rain-Resistant, Windborne-Debris-Impact-Resistant Louver, Extruded Aluminum :
1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. [Airolite Company, LLC (The)]
 - b. [All-Lite Architectural Products]

- c. **[Greenheck Fan Corporation]**
 - d. **[Pottorff]**
 - e. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[Airolite Company, LLC (The)]**
 - b. **[All-Lite Architectural Products]**
 - c. **[Greenheck Fan Corporation]**
 - d. **[Pottorff]**
 - e. **<Insert manufacturer's name>**
3. Louver Depth: **[5 inches (127 mm)][6 inches (150 mm)]<Insert dimension>**.
4. Frame and Blade Nominal Thickness: Not less than **[0.080 inch (2.03 mm)][0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames][0.060 inch (1.52 mm) for blades and 0.095 inch (2.41 mm) for frames]**.
5. Louver Performance Ratings:
- a. Free Area: Not less than **[7.0 sq. ft. (0.65 sq. m)][8.5 sq. ft. (0.79 sq. m)]<Insert value>** for **48-inch- (1220-mm-)** wide by **48-inch- (1220-mm-)** high louver.
 - b. Air Performance: Not more than **[0.18-inch wg (40-Pa)]<Insert value>** static pressure drop at **[1250-fpm (6.35-m/s)]<Insert value>** free-area **[exhaust][intake]** velocity.
 - c. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of **[3 inches (75 mm) per hour and a wind speed of 29 mph (13 m/s)][8 inches (200 mm) per hour and a wind speed of 50 mph (22.4 m/s)]** at a core-area intake velocity of **[782 fpm (4.0 m/s)][875 fpm (4.4 m/s)][989 fpm (5.0 m/s)]<Insert value>**.
6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
7. AMCA Rating: AMCA 540, AMCA 550.
- H. Horizontal, Sightproof, Drainable-Blade Louver, Extruded Aluminum :
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
- a. **[Air Balance; MESTEK, Inc.]**
 - b. **[Air Flow Company, Inc.]**
 - c. **[Airline Louvers; Mestek, Inc.]**
 - d. **[Airolite Company, LLC (The)]**
 - e. **[All-Lite Architectural Products]**
 - f. **[American Warming and Ventilating (AWV); Mestek, Inc.]**
 - g. **[Arrow United Industries; Mestek, Inc.]**
 - h. **[Construction Specialties, Inc.]**
 - i. **[Greenheck Fan Corporation]**
 - j. **[Industrial Louvers Inc.]**
 - k. **[Louvers & Dampers, Inc.; Mestek, Inc.]**
 - l. **[NCA Manufacturing, Inc.; Metal Industries, Inc.]**
 - m. **[Pottorff]**
 - n. **[Reliable Products, Inc.]**
 - o. **[Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]**

- p. **[Safe Air - Dowco]**
 - q. **[United Enertech Corp.]**
 - r. **<Insert manufacturer's name>**
2. Basis-of-Design Product: Subject to compliance with requirements, provide **<Insert manufacturer's name; product name or designation>** or comparable product by one of the following:
- a. **[Air Balance; MESTEK, Inc.]**
 - b. **[Air Flow Company, Inc.]**
 - c. **[Airline Louvers; Mestek, Inc.]**
 - d. **[Airolite Company, LLC (The)]**
 - e. **[All-Lite Architectural Products]**
 - f. **[American Warming and Ventilating (AWV); Mestek, Inc.]**
 - g. **[Arrow United Industries; Mestek, Inc.]**
 - h. **[Construction Specialties, Inc.]**
 - i. **[Greenheck Fan Corporation]**
 - j. **[Industrial Louvers Inc.]**
 - k. **[Louvers & Dampers, Inc.; Mestek, Inc.]**
 - l. **[NCA Manufacturing, Inc.; Metal Industries, Inc.]**
 - m. **[Pottorff]**
 - n. **[Reliable Products, Inc.]**
 - o. **[Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]**
 - p. **[Safe Air - Dowco]**
 - q. **[United Enertech Corp.]**
 - r. **<Insert manufacturer's name>**
3. Louver Depth: **[5 inches (127 mm)]<Insert dimension>**.
4. Frame and Blade Nominal Thickness: Not less than **[0.080 inch (2.03 mm)][0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames]**.
5. Mullion Type: Exposed.
6. Louver Performance Ratings:
- a. Free Area: Not less than **[8.3 sq. ft. (0.77 sq. m)]<Insert value>** for **48-inch- (1220-mm-)** wide by **48-inch- (1220-mm-)** high louver.
 - b. Point of Beginning Water Penetration: Not less than **[750 fpm (3.8 m/s)][950 fpm (4.8 m/s)]<Insert value>**.
 - c. Air Performance: Not more than **[0.10-inch wg (25-Pa)]<Insert value>** static pressure drop at **[550-fpm (2.8-m/s)]<Insert value>** free-area **[exhaust][intake]** velocity.
7. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
- I. Vertical Sightproof Louver, Extruded Aluminum :
1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
- a. **[Air Balance; MESTEK, Inc.]**
 - b. **[Air Flow Company, Inc.]**
 - c. **[Airline Louvers; Mestek, Inc.]**
 - d. **[Airolite Company, LLC (The)]**
 - e. **[All-Lite Architectural Products]**
 - f. **[American Warming and Ventilating (AWV); Mestek, Inc.]**
 - g. **[Arrow United Industries; Mestek, Inc.]**

- h. [Cesco Products; MESTEK, Inc.]
 - i. [Construction Specialties, Inc.]
 - j. [Greenheck Fan Corporation]
 - k. [Industrial Louvers Inc.]
 - l. [Pottorff]
 - m. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
 - n. [Safe Air - Dowco]
 - o. [United Enertech Corp.]
 - p. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Air Balance; MESTEK, Inc.]
 - b. [Air Flow Company, Inc.]
 - c. [Airline Louvers; Mestek, Inc.]
 - d. [Airolite Company, LLC (The)]
 - e. [All-Lite Architectural Products]
 - f. [American Warming and Ventilating (AWV); Mestek, Inc.]
 - g. [Arrow United Industries; Mestek, Inc.]
 - h. [Cesco Products; MESTEK, Inc.]
 - i. [Construction Specialties, Inc.]
 - j. [Greenheck Fan Corporation]
 - k. [Industrial Louvers Inc.]
 - l. [Pottorff]
 - m. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
 - n. [Safe Air - Dowco]
 - o. [United Enertech Corp.]
 - p. <Insert manufacturer's name>
3. Louver Depth: [4 inches (100 mm)]<Insert dimension>.
4. Blade Profile: [Chevron][Y][Labyrinth]-shaped blade.
5. Frame and Blade Nominal Thickness: Not less than [0.080 inch (2.03 mm)][0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames].
6. Blade Spacing: [2 inches (50 mm)][4 inches (100 mm)]<Insert dimension> o.c.
7. Mullion Type: [Exposed][Semirecessed][Fully recessed].

2.4 FIXED FORMED-METAL LOUVERS

A. Horizontal Nondrainable-Blade Louver, Formed Metal :

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
- a. [Air Balance; MESTEK, Inc.]
 - b. [Air Flow Company, Inc.]
 - c. [Airline Louvers; Mestek, Inc.]
 - d. [Airolite Company, LLC (The)]
 - e. [All-Lite Architectural Products]
 - f. [American Warming and Ventilating (AWV); Mestek, Inc.]
 - g. [Arrow United Industries; Mestek, Inc.]

- h. [Cesco Products; MESTEK, Inc.]
 - i. [Construction Specialties, Inc.]
 - j. [Greenheck Fan Corporation]
 - k. [Industrial Louvers Inc.]
 - l. [Metal Form Manufacturing LLC; United Enertech Corp.]
 - m. [NCA Manufacturing, Inc.; Metal Industries, Inc.]
 - n. [Pottorff]
 - o. [Ross Technology Company]
 - p. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
 - q. [Safe Air - Dowco]
 - r. [United Enertech Corp.]
 - s. [Vent Products Co., Inc]
 - t. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
 - a. [Air Balance; MESTEK, Inc.]
 - b. [Air Flow Company, Inc.]
 - c. [Airline Louvers; Mestek, Inc.]
 - d. [Airolite Company, LLC (The)]
 - e. [All-Lite Architectural Products]
 - f. [American Warming and Ventilating (AWV); Mestek, Inc.]
 - g. [Arrow United Industries; Mestek, Inc.]
 - h. [Cesco Products; MESTEK, Inc.]
 - i. [Construction Specialties, Inc.]
 - j. [Greenheck Fan Corporation]
 - k. [Industrial Louvers Inc.]
 - l. [Metal Form Manufacturing LLC; United Enertech Corp.]
 - m. [NCA Manufacturing, Inc.; Metal Industries, Inc.]
 - n. [Pottorff]
 - o. [Ross Technology Company]
 - p. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
 - q. [Safe Air - Dowco]
 - r. [United Enertech Corp.]
 - s. [Vent Products Co., Inc]
 - t. <Insert manufacturer's name>
3. Louver Depth: [4 inches (100 mm)][6 inches (150 mm)]<Insert dimension>.
4. Blade Profile: [Plain blade without][Blade with] center baffle.
5. Frame and Blade Material and Nominal Thickness:
 - a. Galvanized-steel sheet, not less than [0.052 inch (1.32 mm) for frames and 0.040 inch (1.02 mm) for blades][0.052 inch (1.32 mm)][0.064 inch (1.63 mm)].
 - b. Stainless steel sheet, not less than [0.050 inch (1.27 mm)][0.062 inch (1.59 mm)].
6. Mullion Type: [Exposed][Semirecessed][Fully recessed].
7. Louver Performance Ratings:
 - a. Free Area: Not less than [6.5 sq. ft. (0.60 sq. m)][7.0 sq. ft. (0.65 sq. m)][7.5 sq. ft. (0.70 sq. m)][8.0 sq. ft. (0.74 sq. m)]<Insert value> for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - b. Point of Beginning Water Penetration: Not less than [550 fpm (2.8 m/s)][600 fpm (3.0 m/s)][650 fpm (3.3 m/s)][700 fpm (3.6 m/s)]<Insert value>.
 - c. Air Performance: Not more than [0.10-inch wg (25-Pa)]<Insert value> static pressure

drop at [550-fpm (2.8-m/s)][600-fpm (3.0-m/s)][650-fpm (3.3-m/s)][700-fpm (3.6-m/s)]<Insert value> free-area [exhaust][intake] velocity.

8. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

B. Horizontal Drainable-Blade Louver, Formed Metal :

1. Manufacturers: Subject to compliance with requirements, [provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- a. [Air Balance; MESTEK, Inc.]
- b. [Air Flow Company, Inc.]
- c. [Airolite Company, LLC (The)]
- d. [All-Lite Architectural Products]
- e. [American Warming and Ventilating (AWV); Mestek, Inc.]
- f. [Arrow United Industries; Mestek, Inc.]
- g. [Cesco Products; MESTEK, Inc.]
- h. [Construction Specialties, Inc.]
- i. [Greenheck Fan Corporation]
- j. [Industrial Louvers Inc.]
- k. [Metal Form Manufacturing LLC; United Enertech Corp.]
- l. [NCA Manufacturing, Inc.; Metal Industries, Inc.]
- m. [Pottorff]
- n. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
- o. [Safe Air - Dowco]
- p. [United Enertech Corp.]
- q. [Vent Products Co., Inc]
- r. <Insert manufacturer's name>

2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

- a. [Air Balance; MESTEK, Inc.]
- b. [Air Flow Company, Inc.]
- c. [Airolite Company, LLC (The)]
- d. [All-Lite Architectural Products]
- e. [American Warming and Ventilating (AWV); Mestek, Inc.]
- f. [Arrow United Industries; Mestek, Inc.]
- g. [Cesco Products; MESTEK, Inc.]
- h. [Construction Specialties, Inc.]
- i. [Greenheck Fan Corporation]
- j. [Industrial Louvers Inc.]
- k. [Metal Form Manufacturing LLC; United Enertech Corp.]
- l. [NCA Manufacturing, Inc.; Metal Industries, Inc.]
- m. [Pottorff]
- n. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
- o. [Safe Air - Dowco]
- p. [United Enertech Corp.]
- q. [Vent Products Co., Inc]
- r. <Insert manufacturer's name>

3. Louver Depth: [4 inches (100 mm)][6 inches (150 mm)]<Insert dimension>.

4. Frame and Blade Material and Nominal Thickness:
 - a. Galvanized-steel sheet, not less than **[0.052 inch (1.32 mm) for frames and 0.040 inch (1.02 mm) for blades][0.052 inch (1.32 mm)][0.064 inch (1.63 mm)]**.
 - b. Stainless steel sheet, not less than **[0.050 inch (1.27 mm)][0.062 inch (1.59 mm)]**.
5. Mullion Type: Exposed.
6. Louver Performance Ratings:
 - a. Free Area: Not less than **[7.0 sq. ft. (0.65 sq. m)][7.5 sq. ft. (0.70 sq. m)][8.0 sq. ft. (0.74 sq. m)][8.5 sq. ft. (0.79 sq. m)]<Insert value>** for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
 - b. Point of Beginning Water Penetration: Not less than **[800 fpm (4.1 m/s)][850 fpm (4.3 m/s)][900 fpm (4.6 m/s)][950 fpm (4.8 m/s)][1000 fpm (5.1 m/s)]<Insert value>**.
 - c. Air Performance:
 - 1) Not more than **[0.10-inch wg (25-Pa)]<Insert value>** static pressure drop at **[700-fpm (3.6-m/s)][750-fpm (3.8-m/s)][800-fpm (4.1-m/s)][850-fpm (4.3-m/s)]<Insert value>** free-area **[exhaust][intake]** velocity.
 - 2) Not more than **[0.15-inch wg (37-Pa)]<Insert value>** static pressure drop at **[900-fpm (4.6-m/s)][950-fpm (4.8-m/s)][1000-fpm (5.1-m/s)]<Insert value>** free-area velocity.
7. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.5 FIXED ACOUSTICAL LOUVERS

- A. Acoustic Performance: Provide acoustical louvers complying with ratings specified, as demonstrated by testing manufacturer's stock units identical to those specified, except for length and width for **[airborne sound-transmission loss in accordance with ASTM E90][outdoor-indoor, sound-transmission loss in accordance with ASTM E966]**.
- B. Fixed, Acoustical Louver, Formed Metal : Louver with formed-metal blades filled on interior with mineral-fiber, rigid-board, acoustical insulation retained by perforated metal sheet of same material and finish as blade.
 1. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
 - a. **[Air Balance; MESTEK, Inc.]**
 - b. **[Air Flow Company, Inc.]**
 - c. **[Airline Louvers; Mestek, Inc.]**
 - d. **[Airolite Company, LLC (The)]**
 - e. **[All-Lite Architectural Products]**
 - f. **[American Warming and Ventilating (AWV); Mestek, Inc.]**
 - g. **[Arrow United Industries; Mestek, Inc.]**
 - h. **[Construction Specialties, Inc.]**
 - i. **[Greenheck Fan Corporation]**
 - j. **[Louvers & Dampers, Inc.; Mestek, Inc.]**
 - k. **[Metal Form Manufacturing LLC; United Enertech Corp.]**
 - l. **[NCA Manufacturing, Inc.; Metal Industries, Inc.]**
 - m. **[North East Louvers, Inc.]**
 - n. **[Pottorff]**

- o. [Reliable Products, Inc.]
 - p. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
 - q. [Safe Air - Dowco]
 - r. [United Enertech Corp.]
 - s. <Insert manufacturer's name>
2. Basis-of-Design Product: Subject to compliance with requirements, provide <Insert manufacturer's name; product name or designation> or comparable product by one of the following:
- a. [Air Balance; MESTEK, Inc.]
 - b. [Air Flow Company, Inc.]
 - c. [Airline Louvers; Mestek, Inc.]
 - d. [Airolite Company, LLC (The)]
 - e. [All-Lite Architectural Products]
 - f. [American Warming and Ventilating (AWV); Mestek, Inc.]
 - g. [Arrow United Industries; Mestek, Inc.]
 - h. [Construction Specialties, Inc.]
 - i. [Greenheck Fan Corporation]
 - j. [Louvers & Dampers, Inc.; Mestek, Inc.]
 - k. [Metal Form Manufacturing LLC; United Enertech Corp.]
 - l. [NCA Manufacturing, Inc.; Metal Industries, Inc.]
 - m. [North East Louvers, Inc.]
 - n. [Pottorff]
 - o. [Reliable Products, Inc.]
 - p. [Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.]
 - q. [Safe Air - Dowco]
 - r. [United Enertech Corp.]
 - s. <Insert manufacturer's name>
3. Louver Depth: [6 inches (150 mm)][8 inches (200 mm)][12 inches (300 mm)]<Insert dimension>.
4. Frame Material:
- a. Extruded aluminum or aluminum sheet, not less than 0.080-inch (2.03-mm) nominal thickness.
 - b. Galvanized-steel sheet, not less than [0.052-inch (1.32-mm)][0.064-inch (1.63-mm)] nominal thickness.
5. Blade Material:
- a. Aluminum sheet, not less than [0.063-inch (1.60-mm)][0.080-inch (2.03-mm)] nominal thickness.
 - b. Galvanized-steel sheet, not less than [0.034-inch (0.86-mm)][0.040-inch (1.02-mm)][0.052-inch (1.32-mm)] nominal thickness.
6. Blade Shape: [Straight][Airfoil][Chevron].
7. Blade Angle: 45 degrees unless otherwise indicated.
8. Blade Spacing:
- a. 6 inches (150 mm) o.c. for 6-inch- (150-mm-) deep louvers.
 - b. [6 inches (150 mm)][8 inches (200 mm)] o.c. for 8-inch- (200-mm-) deep louvers.
 - c. [9 inches (225 mm)][12 inches (300 mm)] o.c. for 12-inch- (300-mm-) deep louvers.
9. Free Area: Not less than 4 sq. ft. (0.37 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-

- mm-) high louver.
- 10. Airborne Sound-Transmission Loss: **[STC 10]<Insert STC value>** in accordance with ASTM E413, determined by testing in accordance with ASTM E90.
- 11. Outdoor-Indoor, Sound-Transmission Loss: **[OITC 10]<Insert OITC value>** in accordance with ASTM E1332, determined by testing in accordance with ASTM E966.

2.6 LOUVER SCREENS

- A. General: Provide screen at **[each exterior louver][louvers indicated]**.
 - 1. Screen Location for Fixed Louvers: Interior face.
 - 2. Screening Type: **[Bird screening][Bird screening, except where insect screening is indicated][Insect screening]**.
- B. Secure screen frames to louver frames with **[stainless steel machine screws][machine screws with heads finished to match louver]**, spaced a maximum of **6 inches (150 mm)** from each corner and at **12 inches (300 mm) o.c.**
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 - 1. Metal: Same type and form of metal as indicated for louver to which screens are attached.**[Reinforce extruded-aluminum screen frames at corners with clips.]**
 - 2. Finish: **[Same finish as louver frames to which louver screens are attached][Mill finish unless otherwise indicated]**.
 - 3. Type: **[Rewirable frames with a driven spline or insert][Non-rewirable, U-shaped frames]**.
- D. Louver Screening for Aluminum Louvers:
 - 1. Bird Screening, Aluminum: **1/2-inch- (13-mm-)** square mesh, **0.063-inch (1.60-mm)** wire.
 - 2. Bird Screening, Stainless Steel: **1/2-inch- (13-mm-)** square mesh, **0.047-inch (1.19-mm)** wire.
 - 3. Bird Screening, Flattened, Expanded Aluminum: **3/4 by 0.050 inch (19 by 1.27 mm)** thick.
 - 4. Insect Screening, Aluminum: **18-by-16 (1.4-by-1.6-mm)** mesh, **0.012-inch (0.30-mm)** wire.
 - 5. Insect Screening, Stainless Steel: **18-by-18 (1.4-by-1.4-mm)** mesh, **0.009-inch (0.23-mm)** wire.
- E. Louver Screening for Galvanized-Steel Louvers:
 - 1. Bird Screening, Galvanized Steel: **1/2-inch- (13-mm-)** square mesh, **0.041-inch (1.04-mm)** wire.
 - 2. Bird Screening, Stainless Steel: **1/2-inch- (13-mm-)** square mesh, **0.047-inch (1.19-mm)** wire.
 - 3. Insect Screening, Galvanized Steel: **18-by-14 (1.4-by-1.8-mm)** mesh, **0.011-inch (0.28-mm)** wire.
 - 4. Insect Screening, Stainless Steel: **18-by-18 (1.4-by-1.4-mm)** mesh, **0.009-inch (0.23-mm)** wire.
- F. Louver Screening for Stainless Steel Louvers:
 - 1. Bird Screening, Stainless Steel: **1/2-inch- (13-mm-)** square mesh, **0.047-inch (1.19-mm)** wire.
 - 2. Insect Screening, Stainless Steel: **18-by-18 (1.4-by-1.4-mm)** mesh, **0.009-inch (0.23-mm)** wire.

2.7 BLANK-OFF PANELS

- A. Uninsulated Blank-Off Panels: Metal sheet attached to back of louver.
 - 1. Aluminum sheet for aluminum louvers, not less than **0.050-inch (1.27-mm)** nominal thickness.
 - 2. Galvanized-steel sheet for galvanized-steel louvers, not less than **[0.040-inch (1.02-mm)][0.052-**

- inch (1.32-mm)] nominal thickness.
3. Stainless steel sheet for stainless steel louvers, not less than [0.038-inch (0.95-mm)][0.050-inch (1.27-mm)] nominal thickness, with grain running in same direction as grain of louver blades.
4. Panel Finish: [Same finish applied to louvers][Same finish type applied to louvers, but black color].
5. Attach blank-off panels with [clips][sheet metal screws]<Insert method>.

B. Insulated Blank-Off Panels: Laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver.

1. Thickness: [1 inch (25 mm)][2 inches (50 mm)].
2. Metal Facing Sheets, Aluminum: Not less than 0.032-inch (0.81-mm) nominal thickness.
3. Metal Facing Sheets, Galvanized Steel: Not less than 0.028-inch (0.71-mm) nominal thickness.
4. Metal Facing Sheets, Stainless Steel: Not less than 0.031-inch (0.79-mm) nominal thickness.
5. Insulating Core: [Rigid, glass-fiber-board insulation][or][extruded-polystyrene foam]<Insert insulation material>.
6. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard [extruded-aluminum-channel frames, not less than 0.080-inch (2.03-mm) nominal thickness][channel frames], with corners mitered and with same finish as panels.
7. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
8. Panel Finish: [Same finish applied to louvers][Same type of finish applied to louvers, but black color].
9. Attach blank-off panels with [clips][sheet metal screws]<Insert method>.

2.8 MATERIALS

- A. Aluminum Extrusions: **ASTM B221 (ASTM B221M)**, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: **ASTM B209 (ASTM B209M)**, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Galvanized-Steel Sheet: ASTM A653/A653M, [G60 (Z180)][G90 (Z275)] zinc coating, mill phosphatized.
- D. Stainless Steel Sheet: ASTM A240/A240M, Type 304, [No. 2B finish][No. 2D finish][No. 4 finish, with grain running parallel to length of blades and frame members][No. 4 finish, with grain running perpendicular to length of blades and frame members][No. 4 finish, with grain running perpendicular to length of blades and parallel to length of frame members][No. 6 finish].
- E. Fasteners: Use types and sizes to suit unit installation conditions.
 1. Use [Phillips flat-head][hex-head or Phillips pan-head][tamper-resistant] screws for exposed fasteners unless otherwise indicated.
 2. For fastening aluminum, use aluminum or 300 series stainless steel fasteners.
 3. For fastening galvanized steel, use hot-dip-galvanized-steel or 300 series stainless steel fasteners.
 4. For fastening stainless steel, use 300 series stainless steel fasteners.
 5. For color-finished louvers, use fasteners with heads that match color of louvers.
- F. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless steel components, with allowable load or strength design capacities calculated in accordance with ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing in accordance with ASTM E488/E488M conducted by a qualified testing agency.
- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

- H. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25]<Insert value>** percent.
- I. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **[25][50]<Insert value>** percent.
- J. Regional Materials: Products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- K. Regional Materials: Products shall be manufactured within **500 miles (800 km)** of Project site.
- L. Regional Materials: Products shall be manufactured within **100 miles (160 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **100 miles (160 km)** of Project site.
- M. Indigenous Materials: Products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.
- N. Regional Materials: Products shall be manufactured within **500 miles (800 km)** of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site. If materials are transported by rail or water, the distance transported by rail or water shall be multiplied by 0.25 to determine the distance to Project site.

2.9 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
 - 1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern **[unless horizontal mullions are indicated][where indicated]**.
 - 2. Horizontal Mullions: Provide horizontal mullions at joints **[unless continuous vertical assemblies are indicated][where indicated]**.
- C. Maintain equal louver blade spacing[, **including separation between blades and frames at head and sill,**] to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
 - 1. Frame Type: **[Channel][Exterior flange][Interior flange]** unless otherwise indicated.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or **72 inches (1830 mm)** o.c., whichever is less.
 - 1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades.

Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.

2. Semirecessed Mullions: Where indicated, provide mullions partly recessed behind louver blades, so louver blades appear continuous. Where length of louver exceeds fabrication and handling limitations, fabricate with interlocking split mullions and close-fitting blade splices designed to permit expansion and contraction.
3. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
4. Exterior Corners: Prefabricated corner units with mitered **[and welded blades][blades with concealed close-fitting splices]** and with **[fully recessed][semirecessed]** mullions at corners.

G. Provide **[subsills made of same material as louvers][or][extended sills]** for recessed louvers.

H. Join frame members to each other and to fixed louver blades with fillet welds **[concealed from view][, threaded fasteners, or both, as standard with louver manufacturer]** unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.10 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. Clear Anodic Finish: AAMA 611, **[AA-M12C22A41, Class I, 0.018 mm][AA-M12C22A31, Class II, 0.010 mm]** or thicker.

C. Color Anodic Finish: AAMA 611, **[AA-M12C22A42/A44, Class I, 0.018 mm][AA-M12C22A32/A34, Class II, 0.010 mm]** or thicker.

1. Color: **[Champagne][Light bronze][Medium bronze][Dark bronze][Black][Match Architect's sample][As selected by Architect from full range of industry colors and color densities]<Insert color>**.

D. Conversion-Coated Finish: AA-C12C42, nonetched, cleaned with inhibited chemicals, and chemical conversion coated with acid chromate-fluoride-phosphate.

E. Factory-Primed Finish: AA-C12C42R1x with air-dried primer of not less than **2-mil (0.05-mm)** dry film thickness.

F. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.

G. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with **[AAMA 2604][AAMA 2605]** and containing not less than **[50][70]** percent PVDF resin by weight in color coat.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.

H. Superior-Performance Organic Finish, Three-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- I. Superior-Performance Organic Finish, Four-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.
1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions **[for seacoast and severe environments]**.
 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- J. Superior-Performance Organic Finish, Single-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.
- K. Superior-Performance Organic Finish, Two-Coat FEVE: Fluoropolymer finish complying with AAMA 2605.
1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
 2. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.

2.11 GALVANIZED-STEEL SHEET FINISHES

- A. Finish louvers after assembly.
 - B. Surface Preparation: Clean surfaces with nonpetroleum solvent, so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair in accordance with ASTM A780/A780M.
 - C. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of **2 mils (0.05 mm)**.
1. Color and Gloss: **[As indicated by manufacturer's designations][Match Architect's sample][As selected by Architect from manufacturer's full range]<Insert color and gloss>**.

2.12 STAINLESS STEEL SHEET FINISHES

- A. Repair sheet finish by grinding and polishing irregularities, weld spatter, scratches, and forming marks to match surrounding finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.



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Task	Specification	Specification Description
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08 95 13 00	01 11 19 00	No Specification Required



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